

## **Regular Board template**

Wednesday, May 2, 2012 7:00 PM

Board of Education Auditorium, 129 Church Street, Bristol, CT 06010

**1. Call to Order, Pledge of Allegiance, Moment of Silence**

**2. Student Recognition**

2.1. Penny Wars - Ben Carmelich - Greene Hills

2.2. CABE Student Achievement Awards

2.3. CREC - Outward Bound Program - Corinne Malley -  
Bristol Eastern High School

2.4. Spirit of Life Award

**3. Staff Achievement Award Recipients - 2012**

**4. Approval of Minutes - April 4, 2012 Regular Meeting and April 11, 2012 Special Meeting**

**5. Committee Reports**

**6. Consent Agenda**

6.1. Personnel

6.1.a. Coaching Appointments

6.2. Grants

6.2.a. Immigrant Children and Youth Education  
Grant Application

**7. Public Comment**

**8. Deliberated Items**

8.1. Donation for South Side School Library

8.2. Enrollment Update

8.3. Teacher Evaluation Report

8.4. 2012-2013 Bristol Public School Budget

8.5. Curriculum Adoption

8.5.a. Grades 1,3,5 Mathematics Curriculum -  
Second Reading

**9. Policy Revision**

9.1. Policy 3541 - Student Transportation - First  
Reading

**10. Old Business**

**11. New Business**

12. **Building Committee Reports**

13. **Information**

14. **Adjournment**

**BOARD OF EDUCATION**  
**Bristol, Connecticut**  
**SPECIAL BOARD OF EDUCATION MEETING**  
**Wednesday, April 11, 2012**

A special meeting of the Bristol Board of Education was held on Wednesday, April 11, 2012 at 6:15 pm at Bristol Eastern High School Library, 632 King Street.

**Present:** Commissioners: Lawrence Amara, Karen Bourassa, Genard Dolan, Jill Fitzgerald, Karen Hintz, Jeffrey Morgan, Thomas O'Brien, Karen Vibert, Christopher Wilson; Dr. Philip Streifer, Superintendent of Schools, Dr. Susan Kalt Moreau, Deputy Superintendent of Schools, Dennis Bieu, Director of Human Resources and Denise Carabetta, Director of Teaching & Learning.

**Call to order**

Chairman Wilson called the meeting to order at 6:27 pm.

**1. Re-affirm the appointment of Dr. Ellen Solek as Superintendent of Schools beginning July 1, 2012.**

*On a motion by Christopher Wilson and seconded by Thomas O'Brien, it was unanimously Voted: to re-affirm the appointment of Dr. Ellen Solek as Bristol Superintendent of Schools beginning July 1, 2012.*

**2. Re-affirm the appointment of Dr. Susan Kalt Moreau as Acting Superintendent of Schools beginning May 1, 2012 to June 30, 2012.**

*On a motion by Christopher Wilson and seconded by Karen Vibert, it was unanimously Voted: to re-affirm the appointment of Dr. Susan Kalt Moreau as Acting Superintendent of Schools beginning May 1, 2012 to June 30, 2012.*

**3. Approval of Central Office Administrative Contracts.**

It was decided to discuss these at the next Personnel Committee meeting.

**4. Sidewalk Waiver at 733 Hill Street.**

No other parcels on this street have sidewalks and it is unlikely to ever be an area where students would be walkers.

*On a motion by Genard Dolan and seconded by Thomas O'Brien, it was unanimously Voted: to approve the sidewalk waiver at 733 Hill Street to be in force as long as there are no adjacent sidewalks.*

**5. Request to Purchase Land Abutting Stafford School and Patricia Drive.**

This property was being held for possible expansion of Stafford School. Philip Streifer and Peter Fusco walked the property. The land is approximately 30 feet higher than the Stafford School property. It would require extensive excavation and expense to make this property usable for Stafford School. With the two new K-8 schools and the expense that would be involved in making the property usable, they recommended approval to sell the property.

*On a motion by Karen Vibert and seconded by Karen Hintz, it was unanimously*

**Voted: to approve the request to purchase the land abutting Stafford School and Patricia Drive.**

**Adjournment**

*On a motion by Karen Hintz and seconded by Karen Vibert, the meeting was adjourned at 6:55 pm.*

Respectfully Submitted,

*Nancy Fandozzi*

Nancy Fandozzi

**BOARD OF EDUCATION**  
Bristol, Connecticut  
**Regular Meeting – April 4, 2012**

The regular monthly meeting of the Bristol Board of Education was held on Wednesday, April 4, 2012 at 7:00 p.m., at Bristol Eastern High School, 632 King Street, Bristol, Connecticut.

**PRESENT:** Commissioners: Lawrence Amara, Karen Bourassa, Genard Dolan, Jill Fitzgerald, Karen Hintz, Jeffrey Morgan, Thomas O'Brien, Karen Vibert, Christopher Wilson; Philip Streifer, Superintendent of School, Susan Kalt Moreau, Deputy Superintendent of Schools, Dennis Bieu, Director of Human Resources and David Mills, City Council Liaison

**CALL TO ORDER, PLEDGE OF ALLEGIANCE, MOMENT OF SILENCE**

Chairman Wilson called the meeting to order at 7:15 p.m. and invited the audience to join him in reciting the Pledge of Allegiance. A moment of silence was observed for Frances Borrelli Colucia a Head Chef at Bristol Eastern High School.

Chairman Wilson made note of the meeting location change in anticipation of a larger crowd due to the redistricting agenda item; as well as the elevator at the Board of Education building is being repaired, which resulted in no handicap accessibility. Due to the location change, the meeting is now titled a "Special Meeting", however we will be adding items to tonight's agenda that would have been done as our normal board process. We will re-ratify these items at a meeting next week.

**APPROVAL OF MINUTES**

On motion of Commissioner Dolan, seconded by Commissioner Morgan, it was unanimously

***VOTED: That the minutes of the March 7, 2012 Regular Meeting be approved as written.***

**COMMITTEE REPORTS**

**Finance**

Commissioner Vibert reported that this past Thursday she and Dr. Streifer attended the Board of Finance meeting and presented the 2012-2013 proposed school budget. Commissioner Vibert wanted to thank the board members who attended that meeting. The committee met earlier this evening to review the current year's budget and everything seems to be going along fine, we are still in the black.

**Personnel**

Commissioner O'Brien asked that the Appointment of a new Superintendent be placed on the agenda for a vote.

On motion of Commissioner O'Brien, seconded by Commissioner Dolan, it was unanimously

***VOTED: To add the Appointment of Superintendent of Schools to the agenda for a vote.***

**Appointment of Superintendent of Schools**

On motion of Commissioner O'Brien, seconded by Commissioner Morgan, it was unanimously

***VOTED: That the Board of Education appoint Dr. Ellen Solek as Superintendent of Schools, effective July 1, 2012.***

### **Appointment of Superintendent of Schools – con't**

Following a roll call vote Chairman Wilson declared the motion **PASSED** with unanimous approval.

Commissioner O'Brien congratulated Dr. Solek on her appointment and asked her to stand; the board will be releasing a copy of her resume to the press at the end of the meeting. Chairman Wilson added that he spent the day with Dr. Solek and he is excited to have her join our district. She has a great amount of energy; she is enthusiastic about education and is a great communicator. He is looking forward to her leadership in the district. Dr. Solek spoke briefly. She is honored to be here, and thanked the Board for their support; she thanked Dr. Streifer, members of Central Office and the staff for a delightful day. She is excited to join the community and the Bristol School district.

Dr. Streifer spoke briefly. He is delighted that Dr. Solek has joined us; she is highly regarded in their field. Bristol is in great hands. She will be here over the next several months getting oriented and he offered Dr. Solek a warm welcome to the district. He also announced that he will be leaving the district effective May 1<sup>st</sup>. He has accepted a position at the University of North Carolina – Fayetteville as a Professor and Chair of the Department of Educational Leadership; he also has a book he is working on prior to the start of his new position. He thanked the Board, the community for all of their support over the years. The district will be in a transition period now and until his departure May 1<sup>st</sup>.

### **Appointment of Acting Superintendent of Schools**

On motion of Commissioner O'Brien, seconded by Commissioner Morgan, it was unanimously

***VOTED: To add the Appointment of Acting Superintendent of Schools to the agenda for a vote.***

On motion of Commissioner O'Brien, seconded by Commissioner Dolan, it was unanimously

***VOTED: That the Board of Education Appointment Dr. Susan Moreau as Acting Superintendent of Schools for the period of May 1, 2012 to June 30, 2012.***

Following a roll call vote Chairman Wilson declared the motion **PASSED** with unanimous approval.

Chairman Wilson thanked Dr. Moreau for stepping up and accepting the Board's offer to be Acting Superintendent, we are looking forward to her leadership in the next two critical months.

### **CONSENT AGENDA**

#### **Personnel**

#### **Administrator Retirement – Effective June 30, 2012**

On motion of Commissioner O'Brien, seconded by Commissioner Vibert, it was unanimously

***VOTED: That the Board of Education approve the following Administrator Retirement – Effective June 30, 2012:***

***Gary Maynard – Principal – South Side School***

**Teacher Resignation From an Unpaid Leave of Absence - Effective June 30, 2012**

On motion of Commissioner O'Brien, seconded by Commissioner Vibert, it was unanimously

***VOTED: That the Board of Education approve the following Teacher Resignation From an Unpaid Leave of Absence - Effective June 30, 2012:***

***Mary Klimas - Grade 3 – South Side School***

**A-1 Teacher Appointment - Effective March 22, 2012**

On motion of Commissioner O'Brien, seconded by Commissioner Vibert, it was unanimously

***VOTED: That the Board of Education approve the following A-1 Teacher Appointment - Effective March 22, 2012:***

***Sharon Jacques - BEHS - Dept. Head of Business, Family & Consumer Science and Business***

**Coaching Resignations**

On motion of Commissioner O'Brien, seconded by Commissioner Vibert, it was unanimously

***VOTED: That the Board of Education approve the following Coaching Resignations:***

***Michael Drury - Assistant Track and Field Coach - BCHS - Effective 2/7/12***

***Brian Archibald - Wrestling Coach - MBMS - Effective 3/8/12***

**Coaching Appointment**

On motion of Commissioner O'Brien, seconded by Commissioner Vibert, it was unanimously

***VOTED: That the Board of Education approve the following Coaching Appointment:***

***Michael Archangelo - Assistant Track and Field Coach - BEHS - Effective 3/8/12***

**Grants**

On motion of Commissioner O'Brien, seconded by Commissioner Vibert, it was unanimously

***VOTED: That the Board of Education approve the following Grants:***

***Open Choice Grant - July 1, 2011- June 30, 2012***

***Program Improvement Project (PIP) - Federal Grant to Supplement Adult Basic Education***

Dr. Streifer commented on the Administrator Retirement of Gary Maynard. Mr. Maynard was not present in the audience, but Dr. Streifer wanted to publically thank Mr. Maynard for his many years of outstanding service as a Principal and Educator in the City of Bristol. We owe him a great deal of gratitude, and wish him well on his retirement.

Dr. Streifer asked that Steve Woznicki, who was present in the audience to stand up. Mr. Woznicki is the Principal at Jennings School, tomorrow he will be appointed as the Principal at South Side School.

## **PUBLIC COMMENT**

David Rackliff – 730 Lake Avenue - addressed the Board regarding lacrosse and ensuring its addition along with music into the Board of Education budget.

Susan Steele – 4 Garden Terrace - addressed the Board regarding K-8 busing. She has no stake in this decision, but she does not agree with the idea of busing the younger students with the middle school students.

Hannah Lemick – 51 Payton Terrace - addressed the Board regarding lacrosse and the positive effects it has had for her and other participants.

Eric Bell – 280 Morris Avenue - addressed the Board regarding lacrosse.

Dillion Cushing – 214 Brentwood Drive – addressed the board regarding cutting music in the middle schools and its effect on the students.

Will Cushing – 214 Brentwood Drive – addressed the board regarding the revised middle school music program.

Tamara Roy – Waterbury Road – addressed the board regarding O’Connell School and the 44 students that are not being moved to the West Bristol School. She knows that there are several students who have decided to go to magnet schools, so there should be room for these students to attend.

## **Deliberated Items**

### **Consideration of Proposed Redistricting Plans**

Over the past couple months the board of education has held informational forums on the proposed redistricting plans being developed by the administration and consultants, Milone & McBroom. The board was to consider the final plan in its entirety this evening.

On motion of Commissioner O’Brien, seconded by Commissioner Morgan, it was unanimously

***VOTED: That the Board of Education approve the redistricting of K-8 school attendance areas identified as "Scenarios F and H" as proposed by the central office administration at the March 22, 2012 Redistricting Workshop.***

Commissioner Dolan offered an amendment to approve Alternative #1 to the Redistricting Plan which is the Boardman and Collins area.

On motion of Commissioner O’Brien, seconded by Commissioner Fitzgerald, it was unanimously

***VOTED: That the Board of Education accept the amendment to approve Alternative #1 to the Redistricting Plan which is the Boardman and Collins area.***

Commissioner Vibert asked if we have looked at every possibility for the students that were mentioned during public comment. Dr. Moreau said that the consultants have looked at many scenarios and moving other neighborhoods around, however the problem is that there is a large population bubble in grades 4 and 8 and there just is not enough room at West Bristol to accommodate these 44 students. Commissioner Fitzgerald asked if the information that was just given regarding 13 middle school students not attending West Bristol would change anything. The Board does not have this information; we usually do not get the

**Consideration of Proposed Redistricting Plans – con't**

magnet school letters until the summer. Commissioner Amara asked in light of the any changes in the coming months, can the administration make adjustments as we see fit. Dr. Moreau stated that we will look at our October 1 number as we usually do, and may make adjustments then, and families still have the option of utilizing the Out of Area policy, and once Mr. Bieu reviews numbers in August and ensure that all of the in district students have been placed, slots may open that can be filled with out of area students.

Following a roll call vote Chairman Wilson declared the motion **PASSED** with unanimous approval.

Dr. Moreau wanted to thank Mike Zuba and Rebecca Auber for the amount of work they put in to make this redistricting plan happen for us.

**Certification of Phase III of the West Bristol School Building Project**

Susan Moreau presented the Certification of Phase III of the West Bristol School Building Project. The Phase III of the building project is the design and installation of playground equipment. This is the final phase of the West Bristol Building Project. The Board must approve the plans and project manual prior to review by the School Facilities Bureau.

On motion of Commissioner Vibert, seconded by Commissioner Morgan, it was unanimously

***VOTED: That the Bristol Board of Education certifies that these final plans and project manual for Phase III of the West Bristol School, as prepared for bidding and dated March 27, 2012 and the professional cost estimate dated March 27, 2012 for this project, have been reviewed and approved on the date listed in this motion.***

**Bristol Eastern Field Trip To Greece**

Pam Brisson and Gary Fleming presented the Bristol Eastern Trip To Greece. Normally according to board policy travel outside of the continental United States requires approval six months in advance. The trip was brought to our attention in advance of the six months, but there was some confusion as to whether it was an outside trip, meaning we just needed to be notified of the trip. However upon further review, we found that the trip is in fact a school trip, and will require board approval. We have expedited the approval and the students will depart in four and half months.

The trip allows Bristol students interested in classical history to travel to Greece for three weeks in the summer to explore the remains of an ancient civilization whose political and cultural contributions continue to shape societies two millennium after their birth. Prior to the trip, students have taken classes to learn about the ideas of Pericles, Socrates, Plato, Aristotle, Alexander the Great, Aristophanes, and Phidias. During the trip, they take note of the sites that inspired not only these Greek geniuses but also the likes of William Shakespeare and Thomas Jefferson. Upon their return, students have written a paper and earned ¼ course credit. He does works with the UCONN Center of Hellenic Studies, and two other school districts in Connecticut.

On motion of Commissioner Hintz seconded by Commissioner Morgan, it was unanimously

***VOTED: That the Board of Education approve the Bristol Eastern High School Trip to Greece.***

**BEHS Acceptance of Mission/Core Values Statement and Academic, Social, and Civic Expectations**

Dr. Wysowski, Principal of Bristol Eastern High School presented the BEHS Acceptance of Mission/Core Values Statement and Academic, Social, and Civic Expectations. Staff came together under the leadership of

a special committee to create and have staff accept a statement of Mission and Core Values as well as Academic, Social, and Civic Expectations. The expectations are measured by a series of school-wide rubrics yet to be adopted.

On motion of Commissioner Hintz, seconded by Commissioner Morgan it was unanimously

***VOTED: That the Board of Education approve the BEHS Acceptance of Mission/Core Values Statement and Academic, Social, and Civic Expectations.***

### **Elementary and Secondary Summer School Offerings**

Bristol offers a variety of Summer School programming for students in kindergarten through grade 12.

#### ***Elementary:***

**Enrichment:** These courses provide enrichment activities for elementary students. This program will be held at Ivy Drive School.

#### ***Middle School:***

**District Program:** This program offers the opportunity for students to make up courses for which they did not receive a passing grade. Grade 6-7-8 students required to make-up courses attend on a non-tuition paying basis. This program will be held at Bristol Central High School.

#### ***High School:***

**District Program:** Courses offered in this program allow students to obtain credit for courses not successfully completed during the academic year. Grade 9 and 10 students required to make-up courses attend on a non-tuition paying basis. Students pay tuition for grade 11 and 12 classes. This program will be held at Bristol Central High School.

#### ***Costs:***

For the Elementary Enrichment program, it is recommended that tuition be raised in order for this program to be self-supporting. In past years, the BOE budget funded the salaries for the director and secretary. It is recommended that tuition be raised from \$25 per class to \$35 per class so that all costs for the program are covered through tuition payments.

For the Middle School and High School Programs, it is recommended that tuition be raised. The Board of Education policy on summer school states that Bristol students in grades 6, 7, 8, 9, and 10, who are making up failed courses, will not be charged tuition. Bristol students making up failed courses from grades 11 and 12 and non-Bristol residents will be charged tuition. In past years, the costs for the director, secretary, book custodian, and security worker were paid through the Board of Education budget. This year, it is recommended that tuition be raised to cover these costs. Tuition would be raised from \$110 to \$175 for Bristol students taking grade 11 and 12 courses and from \$150 to \$225 for non-Bristol students taking high school courses. For non-Bristol residents taking middle school courses, the tuition will increase from \$125 to \$225 per course. The BOE budget will continue to fund the teaching positions for make-up of failed middle school and failed courses in grades 9 and 10 as per the BOE policy.

On motion of Commissioner Bourassa, seconded by Commissioner Fitzgerald, it was unanimously

***VOTED: That the Board of Education approve the Elementary and Secondary Summer School Offerings.***

**High School Graduation Date and End of Year Closing Date**

Dennis Bieu presented the High School Graduation Date and End of Year Closing Date. Traditionally the closing day of school has been set at the April meeting along with the high school graduation date.

Promotional exercises at the middle schools take place in the morning of the last day of school, Thursday, June 21, 2012.

High school graduation will be scheduled for the evening of Thursday, June 21, 2012.

Summary of Closing Information to Date

School Closed: 9/1 & 9/2 CTO only, 10/31, 11/1, 11/2, 11/3, 11/4

Late Openings: 1/17

Early Dismissals: 9/8 CTO only, 2/29

On motion of Commissioner Dolan, seconded by Commissioner Morgan it was unanimously

***VOTED: That the Board of Education approve that the high school graduation be scheduled for the evening of Thursday, June 21, 2012, following completion of the 181th day of school. The closing date for K-5, middle, and high schools be scheduled at the end of the school session on Thursday, June 21, 2012 with the exception of O'Connell School. O'Connell Schools last day will be Friday, June 22, 2012. This date will be subject to change in the event additional emergency closing days are required in the interim to the end of the school year.***

**Municipal Corporate Credit Card Resolution**

We need to update the documentation as to responsible individuals for use of the Board credit cards. With Gretel Cote retiring and the impending departure of Dr. Streifer, we recommend naming Dr. Susan Moreau and Mr. Dennis Bieu.

Following discussion, and

On motion of Commissioner Fitzgerald, seconded by Commissioner Morgan, it was unanimously

***VOTED: That the Board of Education approve the Municipal Corporate Credit Card Resolution naming Dr. Susan Moreau and Mr. Dennis Bieu as signatories.***

**OLD BUSINESS**

There was no Old Business to come before the board.

**NEW BUSINESS**

There was no New Business to come before the board.

## **BUILDING COMMITTEE REPORTS**

### **Forestville and West Bristol Building Committees**

Dr. Moreau reported that both building reports will be similar in that they were consumed by approving contracts for the bids that were accepted for the furniture, fixtures and equipment. They have toured the buildings, and committee members are getting more excited each month as they see the progress we are making on the schools.

## **INFORMATION**

Commissioner Dolan wanted to commend the students and the parents who appeared this evening regarding lacrosse. They have operated within the systems, and have persevered for years and he gives them credit. He hopes it will come to fruition for them; he has his fingers crossed for them.

Commissioner Vibert reported that the Bristol Veterans Council has offered to fund the cost of providing special tassels for high school graduating seniors who will be going into the Armed Forces to wear at graduation.

## **CONVENE INTO EXECUTIVE SESSION**

There being no further business to come before the Board and

It was unanimously

***VOTED: That the Board of Education convene into Executive Session for the purpose of discussing Student Expulsions and Non-Renewal for Reduction in Force. (8:17 p.m.)***

## **EXECUTIVE SESSION**

**PRESENT:** Commissioners: Lawrence Amara, Karen Bourassa, Genard Dolan, Jill Fitzgerald, Karen Hintz, Jeffrey Morgan, Thomas O'Brien, Karen Vibert, Christopher Wilson; Philip Streifer, Superintendent of School, Susan Kalt Moreau, Deputy Superintendent of Schools, Dennis Bieu, Director of Human Resources, Denise Carabetta, Director of Teacher and Learning, Kim Hapken, Director of Special Services, and David Mills, City Council Liaison

The Board of Education convened into Executive Session and the meeting was called to order ***(8:20 p.m.)***

## **DISCUSSION**

Dr. Moreau gave a report on Student Expulsions; there were three middle school expulsion and one high school expulsion.

Mr. Bieu presented the Reduction in Force information and provided the Board with the names of staff affected, and the rationale.

## **RECONVENE INTO PUBLIC SESSION**

On motion of Commissioner O'Brien seconded by Commissioner Dolan it was unanimously

***VOTED: That the Board of Education reconvene into Public Session to take any necessary votes from Executive Session (8:40 p.m.)***

**ADJOURNMENT:**

On motion of Commissioner Morgan seconded by Commissioner O'Brien it was unanimously

***VOTED: That the Board of Education meeting be adjourned. (8:45 p.m.)***

Respectfully Submitted:

*Susan P. Everett*

Susan P. Everett  
Executive Secretary  
Bristol Board of Education

**COACHES GOING BEFORE THE BOARD OF EDUCATION FOR APPROVAL**

<b>Name:</b> Mario Marrero		<b>Address:</b> 42 Trelli Lane	
<b>City:</b> Bristol		<b>State:</b> CT	<b>Zip:</b> 06010
<b>Current Occupation:</b> Senior Transportation Planner -CREC			
<b>Position Desired:</b>			
<b>Sport</b> Assistant Track Coach	<b>School</b> Bristol Central High School	<b>Level</b> 9-12	
<b>Coaching/Playing Experience:</b>		<b>Level</b>	<b># Years</b>
<b>In Sport Applying for:</b>			
Private Throwing Coach		High School Athletes	4
Player Football and Track Holds the BEHS shot put record and CT State indoor record		High School and College	8
<b>Date Paperwork Completed for Human Resources:</b> April 12, 2012			
<b>Certifications Required:</b> yes			
<b>Coaching Permit Current</b> YES		<b>Dates Valid From:</b> pending	
<b>First Aid Current</b> YES		<b>Dates Valid From:</b> 3/12/12-3/12/14	
<b>CPR Current</b> YES		<b>Dates Valid From:</b> 3/12/12-3/12/14	
<b>Recommend To Hire Date:</b> April 16, 2102		<b>By:</b> Ellen Benham <b>Title:</b> Supervisor of Athletics	

**COACHES GOING BEFORE THE BOARD OF EDUCATION FOR APPROVAL**

<b>Name:</b> Kevin Taylor		<b>Address:</b> 101 Stearns Street	
<b>City:</b> Bristol		<b>State:</b> CT	<b>Zip:</b> 06010
<b>Current Occupation:</b> Youth Development Specialist- Boys and Girls Club			
<b>Position Desired:</b>			
<b>Sport</b> Assistant Track Coach	<b>School</b> Bristol Central High School	<b>Level</b> 9-12	
<b>Coaching/Playing Experience:</b>		<b>Level</b>	<b># Years</b>
<b>In Sport Applying for:</b>			
As a Player Football, Basketball and Track Holds the school record in long jump and 4X100 meters All American in College in Track		High School and College	8
Some recreational coaching with the B&G Club		Elem, middle	4
<b>Date Paperwork Completed for Human Resources:</b> April 16, 2012			
<b>Certifications Required:</b> yes			
<b>Coaching Permit Current</b> YES		<b>Dates Valid From:</b> pending	
<b>First Aid Current</b> YES		<b>Dates Valid From:</b> 3/12/12-3/12/14	
<b>CPR Current</b> YES		<b>Dates Valid From:</b> 3/12/12-3/12/14	
<b>Recommend To Hire Date:</b> April 16, 2102		<b>By:</b> Ellen Benham <b>Title:</b> Supervisor of Athletics	



**STATE OF CONNECTICUT**  
**DEPARTMENT OF EDUCATION**



**GRANT AWARD NOTIFICATION**

**1 Grant Recipient**

BRISTOL PUBLIC SCHOOLS  
 129 CHURCH STREET PO BOX 450  
 BRISTOL, CT 06011-0450

**4 Award Information**

Grant Type: FEDERAL  
 Statute: P.L. 107-110  
 CFDA #: 84.365A  
 SDE Project Code: SDE0000000000002

Grant Number: 017-000 12060-20868-2012-82076-170002

**2 Grant Title**

IMMIGRANT & YOUTH EDUCATION PROGRAM

**5 Award Period**

7/1/2011 - 6/30/2013

**3 Education Staff**

Program Manager:  
 William Howe 860-807-2031

Payment & Expenditure Inquiries:  
 Eugene Croce (860) 713-6470

**6 Authorized Funding**

Grant Amount: \$11,402

Funding Status: Final

**7 Terms and Conditions of Award**

This grant is contingent upon the continuing availability of funds from the grant's funding source and the continuing eligibility of the State of Connecticut and your town/agency to receive such funds.

Fiscal and other reports relating to this grant must be submitted as required by the granting agency. Written requests for budget revisions for expenditures made between July 1, 2011 and June 30, 2012 must be received at least 60 days prior to the expiration of the grant period but no later than May 1, 2012. For grants awarded for two-year periods beginning July 1, 2011, final second-year budget revision requests covering the entire two-year period must be received at least 60 days prior to the expiration of the grant period but no later than February 1, 2013. The grantee shall provide for an audit acceptable to the granting agency in accordance with the provisions of Sections 7-394a and 7-396a of the Connecticut General Statutes. The following attachment(s) are incorporated by reference: ED114.

The grant may be terminated upon 30 days written notice by either party. In the event of such action, all remaining funds shall be returned in a timely fashion to the granting agency.

This grant has been approved.

3/12/2012

Marion Martinez  
 Associate Commissioner  
 Div of Teach & Learn & Instr Leadership

# BUDGET FORM

Created On: 3/12/2012

## ED 114

**Fiscal Year:** 2012 **Funding Status:** Final  
**Grantee Name:** BRISTOL **Grantee:** 017-000 **Vendor ID:** 00017  
**Grant Title:** IMMIGRANT & YOUTH EDUCATION PROGRAM  
**Project Title:**  
**Fund:** 12060 **SPID:** 20868 **Year:** 2012 **PROG:** 82076 **CF1:** 170002 **CF2:**  
**Grant Period:** 7/1/2011 - 6/30/2013 **Authorized Amount:** \$11,402  
**SDE Project Code:** SDE000000000002

### AUTHORIZED AMOUNT BY SOURCE:

LOCAL BALANCE:

CARRYOVER DUE:

CURRENT DUE: \$11,402

CODES	DESCRIPTIONS	PUB BUD	NPUB BUD
111A	ADMINISTRATOR/SUPERVISOR SALARIES		
111B	TEACHERS	1,342	
112A	EDUCATION AIDES		
112B	CLERICAL		
119	OTHER		
200	PERSONAL SERVICES-EMPLOYEE BENEFITS		
321	TUTORS		
322	IN SERVICE	2,500	
323	PUPIL SERVICES		
324	FIELD TRIPS		
325	PARENT ACTIVITIES		
330	OTHER PROFESSIONAL TECHNICAL SERVICES	1,000	
331	AUDIT		
400	PURCHASED PROPERTY SERVICES		
510	PUPIL TRANSPORTATION		
530	COMMUNICATIONS		
560	TUITION		
580	TRAVEL		
590	OTHER PURCHASED SERVICES		
611	INSTRUCTIONAL SUPPLIES	6,560	
641	TEXTBOOKS		
642	LIBRARY BOOKS		
690	OTHER SUPPLIES		
700	PROPERTY		
940	INDIRECT COSTS		
	<b>TOTAL</b>	<b>\$11,402</b>	

Original Request Date: 11/21/2011

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This budget was approved by William Howe on 3/8/2012.

## BRISTOL PUBLIC SCHOOLS

ENROLLMENT FIGURES  
Quarterly Report May 2012

As of April 19, 2012

Elem.School	Pre-K	Kgn.	1	2	3	4	5	Total	Total Prev. Yr.	DIFF.
Edgewood		14	17	20	18	19	20			
		16	16	21	21	21	18			
		16	20	21	19	19	20			
		15	18		21					
<b>Total</b>	<b>0</b>	<b>61</b>	<b>71</b>	<b>62</b>	<b>79</b>	<b>59</b>	<b>58</b>	<b>390</b>	<b>395</b>	<b>-5</b>
Greene-Hills	15	15	21	18	26	22	19			
	15	17	20	18	24	21	20			
		17	20	17			21			
<b>Total</b>	<b>30</b>	<b>49</b>	<b>61</b>	<b>53</b>	<b>50</b>	<b>43</b>	<b>60</b>	<b>346</b>	<b>354</b>	<b>-8</b>
Hubbell	9	19	20	16	21	24	21			
	11	19	20	17	21	25	23			
	15	18	21	17	22	24	23			
	12	19	21	19	23		23			
	12	18								
	13									
<b>Total</b>	<b>72</b>	<b>93</b>	<b>82</b>	<b>69</b>	<b>87</b>	<b>73</b>	<b>90</b>	<b>566</b>	<b>521</b>	<b>45</b>
Ivy Drive	39	18	17	17	24	21	20			
individuals		13	18	17	24	20	22			
		18	18	18	23	21	21			
		16	18	17						
<b>Total</b>	<b>39</b>	<b>65</b>	<b>71</b>	<b>69</b>	<b>71</b>	<b>62</b>	<b>63</b>	<b>440</b>	<b>422</b>	<b>18</b>
Jennings		19	17	19	22	20	21			
		18	18	20	23	19	24			
		18	19	20	24	19	23			
			19							
<b>Total</b>	<b>0</b>	<b>55</b>	<b>73</b>	<b>59</b>	<b>69</b>	<b>58</b>	<b>68</b>	<b>382</b>	<b>366</b>	<b>16</b>
Mt. View	15	20	19	17	17	24	23			
	15	20	20	19	17	24	24			
	15	19	21	19	17					
	15									
<b>Total</b>	<b>60</b>	<b>59</b>	<b>60</b>	<b>55</b>	<b>51</b>	<b>48</b>	<b>47</b>	<b>380</b>	<b>380</b>	<b>0</b>

BRISTOL PUBLIC SCHOOLS

ENROLLMENT FIGURES  
Quarterly Report May 2012

Elem.School	Pre-K	Kgn.	1	2	3	4	5	Total	Total Prev. Yr.	DIFF.
O'Connell	12	15	16	17	15	17	17			
	14	17	16	18	17	19	17			
		18	16	18	17	21	18			
			18							
<b>Total</b>	<b>26</b>	<b>50</b>	<b>66</b>	<b>53</b>	<b>49</b>	<b>57</b>	<b>52</b>	<b>353</b>	<b>345</b>	<b>8</b>
South Side	15	19	18	21	23	24	23			
	14	19	18	20	22	24	22			
		18	18	19	24	23	21			
		17	18	19	23	23	24			
			17	21			22			
<b>Total</b>	<b>29</b>	<b>73</b>	<b>89</b>	<b>100</b>	<b>92</b>	<b>94</b>	<b>112</b>	<b>589</b>	<b>609</b>	<b>-20</b>
Stafford	4	19	19	20	25	21	22			
	11	19	18	21	25	22	24			
	13	19	18	20	25	24	25			
	10	15	20	20						
	12									
	12									
<b>Total</b>	<b>62</b>	<b>72</b>	<b>75</b>	<b>81</b>	<b>75</b>	<b>67</b>	<b>71</b>	<b>503</b>	<b>543</b>	<b>-40</b>
<b>TOTALS</b>	<b>318</b>	<b>577</b>	<b>648</b>	<b>601</b>	<b>623</b>	<b>561</b>	<b>621</b>	<b>3949</b>	<b>3935</b>	<b>14</b>
<b>Total K - 5</b>		<b>577</b>	<b>648</b>	<b>601</b>	<b>623</b>	<b>561</b>	<b>621</b>	<b>3631</b>	<b>3626</b>	<b>5</b>

<b>NESDEC</b>		587	667	577	621	541	623	<b>3616</b>		<b>15</b>
<b>PROWDA</b>		588	665	570	625	543	634	<b>3625</b>		<b>6</b>

Elementary Class Size Averages

Pre-K	Kgn.	1	2	3	4	5
14.5	17.5	18.5	18.8	21.5	21.6	21.4

<b>Range</b>	4-15	13-20	16-21	16-21	15-26	17-25	17-25
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BRISTOL PUBLIC SCHOOLS

ENROLLMENT FIGURES  
Quarterly Report May 2012

Mid. School	6	7	8			Total	Total Prev. Yr.	DIFF.
Chippens Hill	247	301	295			843	882	-39
Mem. Blvd.	170	165	175			510	515	-5
Northeast	177	185	194			556	563	-7
<b>Total</b>	<b>594</b>	<b>651</b>	<b>664</b>			<b>1909</b>	<b>1960</b>	<b>-51</b>

NESDEC	593	636	660			1889		20
PROWDA	605	641	664			1910		-1

High School	9	10	11	12	Total	Total Prev. Yr.	DIFF.
BCHS	356	320	296	299	1271	1277	-6
BEHS	362	339	281	281	1263	1314	-51
<b>Total</b>	<b>718</b>	<b>659</b>	<b>577</b>	<b>580</b>	<b>2534</b>	<b>2591</b>	<b>-57</b>
<b>Community/Vocational Program (in HS numbers last year)</b>					15	0	15
					2549	2591	-42

West Woods Academy included in high school numbers.

NESDEC	761	680	614	586	2641		-92
PROWDA	762	654	601	574	2591		-42

Number Attending	Total to Date	Total Prev. Yr.	DIFF.
<b>Total PreK-5</b>	<b>3949</b>	<b>3935</b>	<b>14</b>
<b>Total Gr. 6-8</b>	<b>1909</b>	<b>1960</b>	<b>-51</b>
<b>Total Gr. 9-12</b>	<b>2549</b>	<b>2591</b>	<b>-42</b>
<b>Sub Total</b>	<b>8407</b>	<b>8486</b>	<b>-79</b>
<b>Special Education Program: Citywide</b>	<b>ASEP</b>	<b>29</b>	<b>25</b>
	<b>Sub Total</b>	<b>8436</b>	<b>8511</b>
<b>Bristol Students Enrolled But Not Attending A Bristol Public School: And Counted in the State Report</b>	<b>Special Ed. Out Pl.</b>	<b>71</b>	<b>61</b>
	<b>BTEC</b>	<b>27</b>	<b>39</b>
	<b>Sub Total</b>	<b>98</b>	<b>100</b>
	<b>Gr. Total Enrolled</b>	<b>8534</b>	<b>8611</b>

**MEMORANDUM**

TO: Dr. Philip Streifer, Superintendent of Schools  
FROM: Dennis Bieu, Director of Human Resources  
SUBJECT: Annual Teacher Evaluation Report for the 2011-2012 School Year

**Sec. 10-151b. Evaluation by superintendents of certain educational personnel.** (a) The superintendent of each local or regional board of education shall, in accordance with guidelines established by the State Board of Education for the development of evaluation programs and such other guidelines as may be established by mutual agreement between the local or regional board of education and the teachers' representative chosen pursuant to section 10-153b, continuously evaluate or cause to be evaluated each teacher. An evaluation pursuant to this subsection shall include, but need not be limited to, strengths, areas needing improvement and strategies for improvement. The superintendent shall report the status of teacher evaluations to the local or regional board of education on or before June first of each year. For purposes of this section, the term "teacher" shall include each professional employee of a board of education, below the rank of superintendent, who holds a certificate or permit issued by the State Board of Education.

The teacher evaluation program was revised in 2001-2002. The program has a process for non-tenured and tenured teachers. The non-tenured process is an intensive observation and evaluation schedule (Professional Performance Instrument, PPI) that takes place from the start of the school year through February 15<sup>th</sup> of the school year. The tenured process is a six-year cycle including one year of intense observation (PPI) and evaluation and five years of professional growth plans (Professional Growth Plan, PGP).

During this school year the number of teachers involved in each phase is as follows:

PPI Non-Tenured	97
PPI Tenured	77
PGP 1	96
PGP 2	112
PGP 3	100
PGP 4	89
PGP 5	<u>91</u>
TOTAL	662

Professional Growth Plans (PGP's) submitted by teachers establish goals that will have a positive impact on student achievement. The goals are aimed at teacher's expanding their skills to improve their students' achievement. A sample of PGP's include using literacy circles at the high school, developing a new lab course and increase knowledge in skills related to improving reading, writing, and math skills of students. All PGP's are measurable.

The teacher evaluation process continues to assist in promoting improvement in teacher performance. It also continues to assist in the decision making process of non-renewal or resignation of teachers who do not meet the standards set by the Bristol Public Schools.

Administrators are also evaluated yearly. As you know, the evaluation for administrators was revised in January 2004. The total number of administrators evaluated was 37.

# Bristol Mathematics Curriculum Grades 1, 3 and 5



Marlene M. Lovanio  
Supervisor of Mathematics  
April 11, 2012

# Bristol's Implementation Timeline

## Math Curriculum Development 2010- 2015

2014-2015 First Year of  
New Assessment

M = New Materials To  
Purchase

D = Development

I = Implementation

	2010 -2011	2011-2012	2012-2013***	2013-2014	2014-2015
<b>Kindergarten</b>	D	IM	I	I	I
<b>Grade 1</b>		D	IM	I	I
<b>Grade 2</b>	D	IM	I	I	I
<b>Grade 3</b>	M	D	I	I	I
<b>Grade 4</b>	D	IM	I	I	I
<b>Grade 5</b>		D	IM	I	I
<b>Grade 6</b>		D	I	I	I



# **Jumping in: the Common Core State Standards (CCSS)**

# Common Core State Standards for Mathematics

## K-8 Mathematics Content

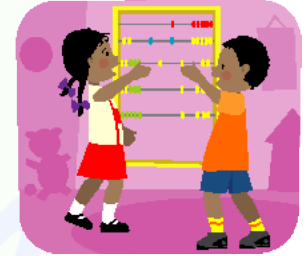
DOMAINS	Counting & Cardinality	Operations & Algebraic Thinking	Number & Operations in Base Ten	Measurement & Data	Geometry	Number & Operations: Fractions	Ratios & Proportional Relationships	The Number System	Expressions & Equations	Statistics & Probability	Functions
K	X	X	X	X	X						
1		X	X	X	X						
2		X	X	X	X						
3		X	X	X	X	X					
4		X	X	X	X	X					
5		X	X	X	X	X					
6					X		X	X	X	X	
7					X		X	X	X	X	
8					X			X	X	X	X

# CCSS Organization

- **Critical Areas by Grade ( K– 8)**
- **Domains:** large groupings of related standards
  - Counting and Cardinality (K)
  - Operations and Algebraic Thinking
  - Number and Operations in Base-Ten
  - Number and Operations – Fractions (3–5)
  - Measurement and Data
  - Geometry

Refer to Bristol Curriculum p. 1 and 5

# Eight Standards for Mathematical Practice



1. Make sense of problems and persevere in solving them.
2. *Reason abstractly and quantitatively.*
3. *Construct viable arguments and critique the reasoning of others.*
4. Model with mathematics.
5. Use appropriate tools strategically.
6. *Attend to precision.*
7. **Look for and make use of structure (patterns).**
8. **Look for and express regularity in repeated reasoning.**

(plain text: problem solving, *italicized–reasoning and precision,*  
–habits of mind)

**bold**

Refer to p. 3

# Shift in Content Focus


## Reduce Time Spent on:

- ▶ Data, graphing
- ▶ Probability
- ▶ Fractions prior to grade 3
- ▶ Time, money, calendar
- ▶ Sorting, classifying
- ▶ Patterns
- ▶ Ratios and proportions
- ▶ Coordinate grids

## Spend More Time on:

- ▶ Counting
- ▶ Number sense
- ▶ Meaning of operations
- ▶ Computation
- ▶ Place value
- ▶ Reasoning about fractions (after grade 3)
- ▶ Reasoning about shapes

# Developing Understanding

From  $4 \times 3 =$  

To ...Solve  $4 \times \frac{1}{3} =$  

To ...Donna needs  $\frac{3}{4}$  of a yard of fabric to

make a skirt. She needs to make 3 skirts.  
How much fabric will she need to buy?

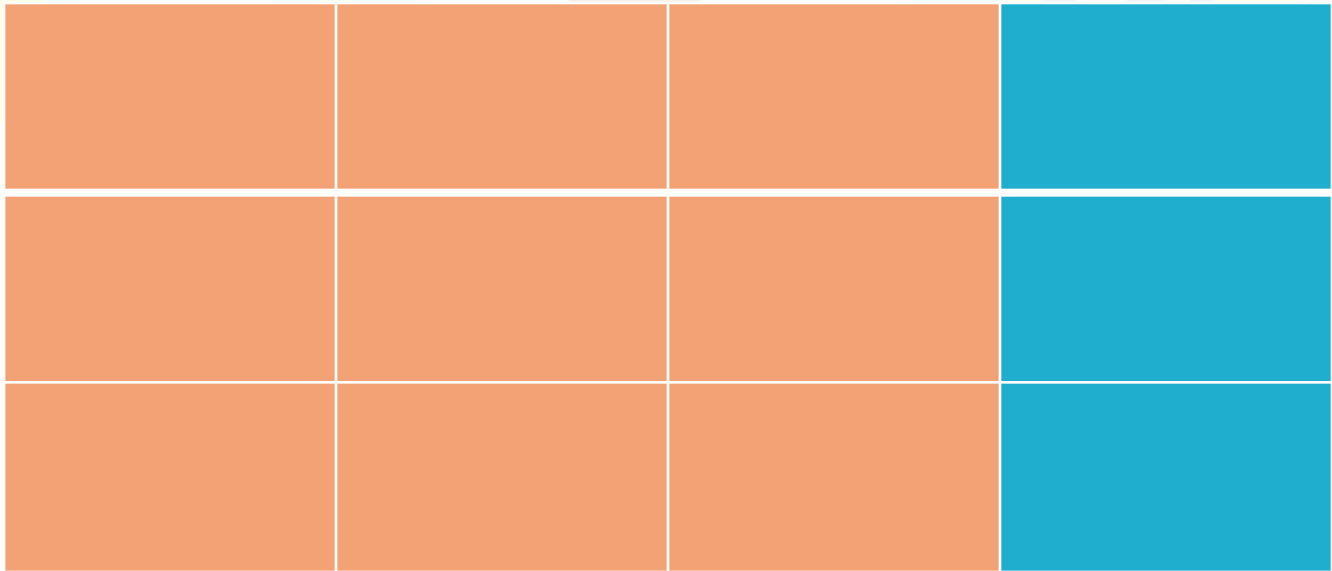
Visual  
Models

Word  
Problems

Related  
Sentence

$\frac{3}{4}$  of a yard

3  
skirts



$$3 * \frac{3}{4} = \frac{3}{4} + \frac{3}{4} + \frac{3}{4} = \frac{9}{4} \text{ or } 2 \frac{1}{4} \text{ yards of fabric}$$

# Curriculum Format

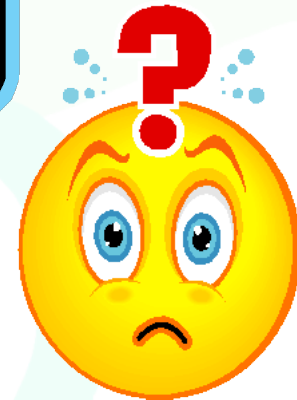
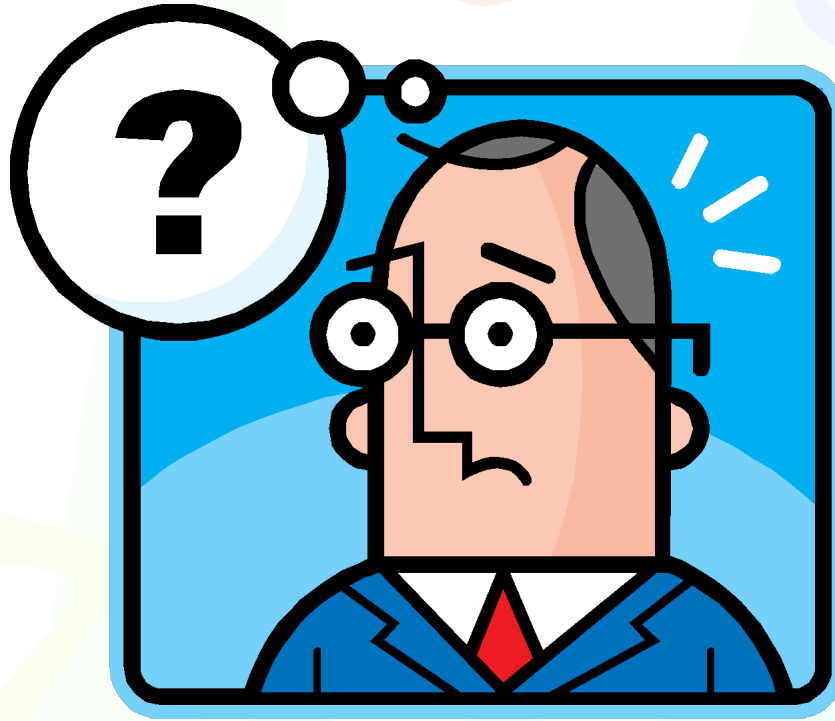
- ▶ CCSS and Explanations and Examples
- ▶ Unwrapped Standards
- ▶ Big Ideas & Essential Questions
- ▶ Learning Objectives
- ▶ Instructional Strategies
- ▶ Assessments/Common Learning Experiences



# Next Steps...

- ▶ Textbook Adoption for Grades 1 and 5
- ▶ Implementation 2012–2013 for 1,3, 5
- ▶ Professional Development
  - Principal training
  - Math Leadership Academy
  - District PD
  - Grade level planning meetings
  - Job embedded coaching

# Questions





**Bristol Public Schools  
 Office of Teaching & Learning**

**DEPARTMENT:** Elementary Mathematics

**COURSE:** Grade 1 Mathematics

**COURSE DESCRIPTION**

<b>Mathematical topics include:</b>	<b>Instruction focuses on four critical areas:</b>
<ul style="list-style-type: none"> <li>• whole numbers to 120</li> <li>• place value to 100</li> <li>• addition and subtraction</li> <li>• linear measurement</li> <li>• time</li> <li>• coin identification</li> <li>• data displays</li> <li>• 2-dimensional shapes</li> </ul>	<p><b>Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20.</b>            Students develop strategies for adding and subtracting whole numbers based on their prior work with small numbers. They use a variety of models, including discrete objects and length-based models (e.g., cubes connected to form lengths), to model add-to, take-from, put-together, take-apart, and compare situations to develop meaning for the operations of addition and subtraction, and to develop strategies to solve arithmetic problems with these operations. Students understand connections between counting and addition and subtraction (e.g., adding two is the same as counting on two). They use properties of addition to add whole numbers and to create and use increasingly sophisticated strategies based on these properties (e.g., “making tens”) to solve addition and subtraction problems within 20. By comparing a variety of solution strategies, children build their understanding of the relationship between addition and subtraction.</p> <p><b>Developing understanding of whole number relationships and place value, including grouping in tens and ones.</b>            Students develop, discuss, and use efficient, accurate, and generalizable methods to add within 100 and subtract multiples of 10. They compare whole numbers (at least to 100) to develop understanding of and solve problems involving their relative sizes. They think of whole numbers between 10 and 100 in terms of tens and ones (especially recognizing the numbers 11 to 19 as composed of a ten and some ones). Through activities that build number sense, they understand the order of the counting numbers and their relative magnitudes.</p> <p><b>Developing understanding of linear measurement and measuring lengths as iterating length units.</b>            Students develop an understanding of the meaning and processes of measurement, including underlying concepts such as iterating (the mental activity of building up the length of an object with equal-sized units) and the transitivity principle for indirect measurement.<sup>1</sup></p> <p><b>Reasoning about attributes of, and composing and decomposing geometric shapes.</b>            Students compose and decompose plane or solid figures (e.g., put two triangles together to make a quadrilateral) and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, and determine how they are alike and different, to develop the background for measurement and for initial understandings of properties such as congruence and symmetry.</p> <p><sup>1</sup> Students should apply this principle, but need not use the term.</p>

## **DEPARTMENT PHILOSOPHY**

The philosophy of the elementary mathematics department is to develop mathematically literate and productive students who can effectively and efficiently apply mathematics in their lives to make informed decisions about the world around them. To be mathematically literate, one must understand major mathematics concepts, possess computational facility and have the ability to apply these understandings to situations in daily life. Making connections between mathematics and other disciplines is key to the appropriate application of mathematics skills and concepts to solve problems. The ability to read, discuss and write within the discipline of mathematics is an integral skill that supports mathematical understanding, reasoning and communication. The opportunity to think critically and creatively to solve problems is important to deepen mathematical knowledge and foster innovation. A rich mathematical experience in the elementary grades is essential to provide the foundational knowledge and skills that prepare students to be mathematically literate, productive citizens.

The Bristol elementary mathematics curriculum focuses on high expectations for **all** students and provides a balanced approach to mathematics education, placing equal importance on conceptual understanding, computational and procedural fluency and problem solving through the use of a variety of strategies, tools and technologies. The mathematics curriculum is responsive to the individual needs of students. While providing a structure tied to the Common Core State Standards in Connecticut, it allows for classroom experiences, additional supports and enrichment ensuring students' access to the content at an appropriate level of challenge.

## **DEPARTMENT GOALS**

Through a planned, sequential curriculum, Bristol Public schools strives to educate each student in conjunction with the Common Core State Standards in Connecticut. As a result, students will be able to demonstrate knowledge and skills in each of the following:

- ◆ Operations and Algebraic Thinking
- ◆ Number and Operations in Base Ten
- ◆ Measurement and Data
- ◆ Geometry

In addition, teachers will support students in developing the following mathematical practices aligned to those found in the Common Core State Standards in Connecticut.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

## **PHILOSOPHY OF INSTRUCTION**

Based on our department philosophy and goals, elementary math teachers will:

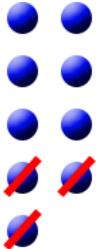
- ensure a minimum of one hour of daily instructional time for mathematics (kindergarten – 30 minutes);
- provide a safe, supportive and respectful classroom environment conducive to learning, where students are encouraged to take risks and share ideas;
- have a deep understanding of the mathematical concepts and skills in the curriculum and strong pedagogical content knowledge;
- use the BOE approved textbook and a variety of resources to have students read about, explore and reinforce curriculum concepts and skills;
- build upon students' prior knowledge and experience, and real-world events, to foster connections and make learning relevant and meaningful;
- provide students with developmentally appropriate opportunities to question, explore, observe, synthesize and draw conclusions based on their mathematics understanding;
- use high-level questions and rich tasks to facilitate classroom discourse, both oral and written, to encourage student-student, student-teacher and teacher-student communication;
- incorporate and highlight key mathematical vocabulary during instruction and require students to use this vocabulary appropriately in their communications;
- model and have students use manipulatives, tools and technology to actively explore and build understanding of mathematical concepts;
- structure learning experiences that utilize a variety of grouping strategies to encourage collaborative problem solving; and
- differentiate instruction to meet the needs of a variety of learners based on student readiness, interest, and learning style and provide supplemental mathematics intervention or enrichment as needed.

**Note: The instructional strategies recommended in our resource document are specific examples of these expectations in practice. They serve as a starting point for planning and implementing instruction that will develop our students as thinkers. Teachers may create new instructional strategies and activities as they continue to grow professionally and as they develop an understanding of each student's unique strengths, weaknesses, and interests.**

## **PHILOSOPHY OF ASSESSMENT**

Based on our department philosophy and goals, elementary math teachers will:

- align assessments with instruction;
- use a variety of formative and summative assessment throughout each unit of instruction;
- design and use assessments that include questions at varied levels of cognitive demand;
- analyze results and plan or modify instruction based on the results;
- provide specific, constructive feedback for students;
- support students in goal setting and the monitoring and evaluation of their progress; and
- collaborate with colleagues and use scoring rubrics to evaluate student work as appropriate.

Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING	
Common Core State Standards in Connecticut	Explanations and Examples*
<p><b>Represent and solve problems involving addition and subtraction.</b></p> <p>1.OA.1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. (See Table 1.)</p>	<p>Contextual problems that are closely connected to students' lives should be used to develop fluency with addition and subtraction. Table 1 describes the four different addition and subtraction situations and their relationship to the position of the unknown. Students use objects or drawings to represent the different situations.</p> <ul style="list-style-type: none"> <li>Take From example: Abel has 9 balls. He gave 3 to Susan. How many balls does Abel have now?   </li> <li>Compare example: Abel has 9 balls. Susan has 3 balls. How many more balls does Abel have than Susan? A student will use 9 objects to represent Abel's 9 balls and 3 objects to represent Susan's 3 balls. Then they will compare the 2 sets of objects.</li> </ul> <p>Note that even though the modeling of the two problems above is different, the equation, <math>9 - 3 = ?</math>, can represent both situations yet the compare example can also be represented by <math>3 + ? = 9</math> (How many more do I need to make 9?)</p>

## Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

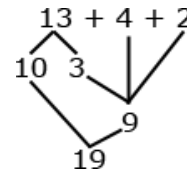
1.OA.2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

It is important to attend to the difficulty level of the problem situations in relation to the position of the unknown.

- Result Unknown, Total Unknown, and Both Addends Unknown problems are the least complex for students.
- The next level of difficulty includes Change Unknown, Addend Unknown, and Difference Unknown
- The most difficult are Start Unknown and versions of Bigger and Smaller Unknown (compare problems).

To further students' understanding of the concept of addition, students create word problems with three addends. They can also increase their estimation skills by creating problems in which the sum is less than 5, 10 or 20. They use properties of operations and different strategies to find the sum of three whole numbers such as:

- Counting on and counting on again (e.g., to add  $3 + 2 + 4$  a student writes  $3 + 2 + 4 = ?$  and thinks, "3, 4, 5, that's 2 more, 6, 7, 8, 9 that's 4 more so  $3 + 2 + 4 = 9$ ."
- Making tens (e.g.,  $4 + 8 + 6 = 4 + 6 + 8 = 10 + 8 = 18$ )
- Using "plus 10, minus 1" to add 9 (e.g.,  $3 + 9 + 6$  A student thinks, "9 is close to 10 so I am going to add 10 plus 3 plus 6 which gives me 19. Since I added 1 too many, I need to take 1 away so the answer is 18.)
- Decomposing numbers between 10 and 20 into 1 ten plus some ones to facilitate adding the ones



## Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Understand and apply properties of operations and the relationship between addition and subtraction.

1.OA.3. Apply properties of operations as strategies to add and subtract. *Examples: If  $8 + 3 = 11$  is known, then  $3 + 8 = 11$  is also known. (Commutative property of addition.) To add  $2 + 6 + 4$ , the second two numbers can be added to make a ten, so  $2 + 6 + 4 = 2 + 10 = 12$ . (Associative property of addition.)* (Students need not use formal terms for these properties.)

- Using doubles

$$\begin{array}{r} 3 + 8 + 3 \\ \swarrow \quad \downarrow \quad \searrow \\ \quad 6 \quad \quad \quad \\ \quad \quad \downarrow \\ \quad \quad 14 \end{array}$$

Students will use different strategies to add the 6 and 8.

- Using near doubles (e.g.,  $5 + 6 + 3 = 5 + 5 + 1 + 3 = 10 + 4 = 14$ )

Students should understand the important ideas of the following properties:

- Identity property of addition (e.g.,  $6 = 6 + 0$ )
- Identity property of subtraction (e.g.,  $9 - 0 = 9$ )
- Commutative property of addition (e.g.,  $4 + 5 = 5 + 4$ )
- Associative property of addition (e.g.,  $3 + 9 + 1 = 3 + 10 = 13$ )

Students need several experiences investigating whether the commutative property works with subtraction. The intent is not for students to experiment with negative numbers but only to recognize that taking 5 from 8 is not the same as taking 8 from 5. Students should recognize that they will be working with numbers later on that will allow them to subtract larger numbers from smaller numbers. However, in first grade we do not work with negative numbers.

**Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING**

1.OA.4. Understand subtraction as an unknown-addend problem. *For example, subtract  $10 - 8$  by finding the number that makes 10 when added to 8.*

**Add and subtract within 20.**

1.OA.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).

1.OA.6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g.,  $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$ ); decomposing a number leading to a ten (e.g.,  $13 - 4 = 13 - 3 - 1 = 10 - 1 = 9$ ); using the relationship between addition and subtraction (e.g., knowing that  $8 + 4 = 12$ , one knows  $12 - 8 = 4$ ); and creating equivalent but easier or known sums (e.g., adding  $6 + 7$  by creating the known equivalent  $6 + 6 + 1 = 12 + 1 = 13$ ).

When determining the answer to a subtraction problem,  $12 - 5$ , students think, “If I have 5, how many more do I need to make 12?” Encouraging students to record this symbolically,  $5 + ? = 12$ , will develop their understanding of the relationship between addition and subtraction. Some strategies they may use are counting objects, creating drawings, counting up, using number lines or 10 frames to determine an answer.

Students’ multiple experiences with counting may hinder their understanding of counting on and counting back as connected to addition and subtraction. To help them make these connections when students count on 3 from 4, they should write this as  $4 + 3 = 7$ . When students count back (3) from 7, they should connect this to  $7 - 3 = 4$ . Students often have difficulty knowing where to begin their count when counting backward.

This standard is strongly connected to all the standards in this domain. It focuses on students being able to fluently add and subtract numbers to 10 and having experiences adding and subtracting within 20. By studying patterns and relationships in addition facts and relating addition and subtraction, students build a foundation for fluency with addition and subtraction facts. Adding and subtracting fluently refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. The use of objects, diagrams, or interactive whiteboards and various strategies will help students develop fluency.

## Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Work with addition and subtraction equations.

1.OA.7. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. *For example, which of the following equations are true and which are false?  $6 = 6$ ,  $7 = 8 - 1$ ,  $5 + 2 = 2 + 5$ ,  $4 + 1 = 5 + 2$ .*

Interchanging the language of “equal to” and “the same as” as well as “not equal to” and “not the same as” will help students grasp the meaning of the equal sign. Students should understand that “equality” means “the same quantity as”. In order for students to avoid the common pitfall that the equal sign means “to do something” or that the equal sign means “the answer is,” they need to be able to:

- Express their understanding of the meaning of the equal sign
- Accept sentences other than  $a + b = c$  as true ( $a = a$ ,  $c = a + b$ ,  $a = a + 0$ ,  $a + b = b + a$ )
- Know that the equal sign represents a relationship between two equal quantities
- Compare expressions without calculating

These key skills are hierarchical in nature and need to be developed over time. Experiences determining if equations are true or false help student develop these skills. Initially, students develop an understanding of the meaning of equality using models. However, the goal is for students to reason at a more abstract level. At all times students should justify their answers, make conjectures (e.g., if you add a number and then subtract that same number, you always get zero), and make estimations.

Once students have a solid foundation of the key skills listed above, they can begin to rewrite true/false statements using the symbols,  $<$  and  $>$ .

Examples of true and false statements:

- $7 = 8 - 1$
- $8 = 8$
- $1 + 1 + 3 = 7$

## Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

1.OA.8. Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations:  $8 + ? = 11$ ,  $5 = \square - 3$ ,  $6 + 6 = \square$ .*

- $4 + 3 = 3 + 4$
- $6 - 1 = 1 - 6$
- $12 + 2 - 2 = 12$
- $9 + 3 = 10$
- $5 + 3 = 10 - 2$
- $3 + 4 + 5 = 3 + 5 + 4$
- $3 + 4 + 5 = 7 + 5$
- $13 = 10 + 4$
- $10 + 9 + 1 = 19$

Students need to understand the meaning of the equal sign and know that the quantity on one side of the equal sign must be the same quantity on the other side of the equal sign. They should be exposed to problems with the unknown in different positions. Having students create word problems for given equations will help them make sense of the equation and develop strategic thinking.

Examples of possible student “think-throughs”:

- $8 + ? = 11$ : “8 and some number is the same as 11. 8 and 2 is 10 and 1 more makes 11. So the answer is 3.”
- $5 = \square - 3$ : “This equation means I had some cookies and I ate 3 of them. Now I have 5. How many cookies did I have to start with? Since I have 5 left and I ate 3, I know I started with 8 because I count on from 5. . . 6, 7, 8.”

**Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING**

**Unwrapped Standards**

<b>Concepts:</b> Need to know about:	<b>Skills:</b> Need to be able to:
<p>Addition and Subtraction</p> <ul style="list-style-type: none"> <li>• strategies           <ul style="list-style-type: none"> <li>- properties of operations               <ul style="list-style-type: none"> <li>○ commutative</li> <li>○ associative</li> <li>○ identity</li> </ul> </li> <li>- inverse relationship</li> <li>- counting on, counting back</li> <li>- making ten</li> <li>- decomposing numbers to make a ten</li> <li>- known sums to find unknown sums</li> </ul> </li>   <li>• equations           <ul style="list-style-type: none"> <li>- equal sign</li> <li>- equivalent expressions</li> </ul> </li>   <li>• problem solving           <ul style="list-style-type: none"> <li>- adding to, taking from, putting together, taking apart, comparing, three whole number addends               <ul style="list-style-type: none"> <li>○ unknowns in all positions                   <ul style="list-style-type: none"> <li>◆ symbols</li> </ul> </li> <li>○ objects, drawings, equations</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ Apply (properties of operations) to add and subtract</li> <li>➤ Relate (counting) to addition and subtraction</li> <li>➤ Add and subtract (within 20)           <ul style="list-style-type: none"> <li>○ using (strategies)</li> </ul> </li> <li>➤ Fluently add and subtract (within 10)</li>   <li>➤ Determine whether (equations) are true or false</li>   <li>➤ Solve (addition and subtraction word problems within 20)           <ul style="list-style-type: none"> <li>○ using (objects, drawings, equations with a symbol for the unknown)</li> </ul> </li> <li>➤ Determine (unknown in equations)           <ul style="list-style-type: none"> <li>○ by relating (the three whole numbers)</li> </ul> </li> </ul>

## Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Big Ideas

Student's statements of enduring ideas

1. Recognizing how a real-world situation fits into a common operation category helps to solve the problem.
2. We can show mathematical situations in word problem using objects, drawings, and equations.
3. Subtraction is the opposite of or “undoes” addition.
4. The equal sign tells us that the quantities on either side have the same value or balance.
5. Properties of operations allow us to reorder, decompose and/or compose numbers in order to make computation simpler.

### Essential Questions

Teacher's guiding questions

1. How do we decide what operation to use when solving a real-world problem?
2. How can we show mathematical situations in word problems?
3. How is subtraction related to addition?
4. What does the equal sign mean in a number sentence?
5. How do the properties of operations help us add and subtract?

### Learning Objectives

The students will be able to:

- a. Solve addition and subtraction word problems within 20 with unknowns in all positions.
- b. Solve word problems involving addition of three whole numbers where the sum is less than 20.
- c. Represent and justify solutions to word problems using objects, drawings, and equations.
- d. Fluently add and subtract within 10.
- e. Add and subtract within 20 using properties of operations and strategies, such as counting on, making 10, the inverse relationship between the operations, and known facts.
- f. Determine if addition and subtraction equations are true or false.
- g. Find the unknown in an addition or subtraction equation by relating the three whole numbers.

## Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate addition and subtraction involving whole numbers.
- facilitate classroom discussions focused on composing and decomposing numbers in a variety of ways to develop number sense and mental computation.
- make connections among mathematical computation and real-world situations and use real-world situations as a springboard for learning.
- encourage the use of multiple representations for problem situations (e.g., bar diagrams, numbers, words, pictures, objects, acting out, making a chart, list, graph, creating equations) and explain the connections among the representations.
- present equations in a variety of ways ( e.g.  $10 = 3 + 7$ ,  $7 + 3 = 10$ ,  $2 + 8 = 5 + 5$ ) to develop the idea of equivalence.
- incorporate the use of a student math journal and/or class posters in order for students to record strategies for building basic fact fluency for addition and subtraction.
- model the use of strategies, such as counting on, making ten, decomposing a number leading to a ten, known sums, and the relationship between addition and subtraction to build fluency with basic facts.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- encourage the use of fact fluency games for practice in school and at home.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

## **Grade 1 Mathematics – OPERATIONS AND ALGEBRAIC THINKING**

### **Assessments/Common Learning Experiences**

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.  
Teachers will assess and provide feedback to students about the following:

- Fact Fluency Games
- Performance Task: write and illustrate story problems representing addition and subtraction situations for a given fact
- Equation Truth Detectives
- “How Many Ways Can You Make My Number?” activity
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

Grade 1 Mathematics – Number and Operations in Base Ten

Common Core State Standards in Connecticut

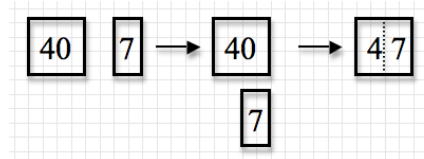
Explanations and Examples\*

**Extend the counting sequence.**

1.NBT.1. Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.

Students use objects, words, and/or symbols to express their understanding of numbers. They extend their counting beyond 100 to count up to 120 by counting by 1s. Some students may begin to count in groups of 10 (while other students may use groups of 2s or 5s to count). Counting in groups of 10 as well as grouping objects into 10 groups of 10 will develop students understanding of place value concepts.

Students extend reading and writing numerals beyond 20 to 120. After counting objects, students write the numeral or use numeral cards to represent the number. Given a numeral, students read the numeral, identify the quantity that each digit represents using numeral cards, and count out the given number of objects.



Students should experience counting from different starting points (e.g., start at 83; count to 120). To extend students' understanding of counting, they should be given opportunities to count backwards by ones and tens. They should also investigate patterns in the base 10 system.

## Grade 1 Mathematics – Number and Operations in Base Ten

### Understand place value.

1.NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:

- a. 10 can be thought of as a bundle of ten ones — called a “ten.”
- b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
- c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).

1.NBT.3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols  $>$ ,  $=$ , and  $<$ .

Understanding the concept of 10 is fundamental to children’s mathematical development. Students need multiple opportunities counting 10 objects and “bundling” them into one group of ten. They count between 10 and 20 objects and make a bundle of 10 with or without some left over (this will help students who find it difficult to write teen numbers). Finally, students count any number of objects up to 99, making bundles of 10s with or without leftovers.

As students are representing the various amounts, it is important that an emphasis is placed on the language associated with the quantity. For example, 53 should be expressed in multiple ways such as 53 ones or 5 groups of ten with 3 ones leftover. When students read numbers, they read them in standard form as well as using place value concepts. For example, 53 should be read as “fifty-three” as well as five tens, 3 ones. Reading 10, 20, 30, 40, 50 as “one ten, 2 tens, 3 tens, etc.” helps students see the patterns in the number system.

Students use models that represent two sets of numbers. To compare, students first attend to the number of tens, then, if necessary, to the number of ones. Students may also use pictures, number lines, and spoken or written words to compare two numbers. Comparative language includes but is not limited to more than, less than, greater than, most, greatest, least, same as, equal to and not equal to.

## Grade 1 Mathematics – Number and Operations in Base Ten

### Use place value understanding and properties of operations to add and subtract.

1.NBT.4. Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.

Students extend their number fact and place value strategies to add within 100. They represent a problem situation using any combination of words, numbers, pictures, physical objects, or symbols. It is important for students to understand if they are adding a number that has 10s to a number with 10s, they will have more tens than they started with; the same applies to the ones. Also, students should be able to apply their place value skills to decompose numbers. For example,  $17 + 12$  can be thought of 1 ten and 7 ones plus 1 ten and 2 ones. Numeral cards may help students decompose the numbers into 10s and 1s.

Students should be exposed to problems both in and out of context and presented in horizontal and vertical forms. As students are solving problems, it is important that they use language associated with proper place value (see example). They should always explain and justify their mathematical thinking both verbally and in a written format. Estimating the solution prior to finding the answer focuses students on the meaning of the operation and helps them attend to the actual quantities. This standard focuses on developing addition - the intent is not to introduce traditional algorithms or rules.

Examples:

- $43 + 36$   
Student counts the 10s (10, 20, 30...70 or 1, 2, 3...7 tens) and then the 1s.



Grade 1 Mathematics – Number and Operations in Base Ten

- $$\begin{array}{r} 28 \\ +34 \\ \hline \end{array}$$

Student thinks: 2 tens plus 3 tens is 5 tens or 50. S/he counts the ones and notices there is another 10 plus 2 more. 50 and 10 is 60 plus 2 more or 62.



- $45 + 18$

Student thinks: Four 10s and one 10 are 5 tens or 50. Then 5 and 8 is  $5 + 5 + 3$  (or  $8 + 2 + 3$ ) or 13. 50 and 13 is 6 tens plus 3 more or 63.



- $$\begin{array}{r} 29 \\ +14 \\ \hline \end{array}$$

Student thinks: “29 is almost 30. I added one to 29 to get to 30. 30 and 14 is 44. Since I added one to 29, I have to subtract one so the answer is 43.”

## Grade 1 Mathematics – Number and Operations in Base Ten

1.NBT.5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.

This standard requires students to understand and apply the concept of 10 which leads to future place value concepts. It is critical for students to do this without counting. Prior use of models such as base ten blocks, number lines, and 100s charts helps facilitate this understanding. It also helps students see the pattern involved when adding or subtracting 10.

Examples:

- 10 more than 43 is 53 because 53 is one more 10 than 43
- 10 less than 43 is 33 because 33 is one 10 less than 43

1.NBT.6. Subtract multiples of 10 in the range 10–90 from multiples of 10 in the range 10–90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

This standard is foundational for future work in subtraction with more complex numbers. Students should have multiple experiences representing numbers that are multiples of 10 (e.g. 90) with models or drawings. Then they subtract multiples of 10 (e.g. 20) using these representations or strategies based on place value. These opportunities develop fluency of addition and subtraction facts and reinforce counting up and back by 10s.

Examples:

- 70 - 30: Seven 10s take away three 10s is four 10s
- 80 - 50: 80, 70 (one 10), 60 (two 10s), 50 (three 10s), 40 (four 10s), 30 (five 10s)
- 60 - 40: I know that  $4 + 2$  is 6 so four 10s + two 10s is six 10s so  $60 - 40$  is 20

Grade 1 Mathematics – Number and Operations in Base Ten

Unwrapped Performance Standards

**Concepts:** Need to know about:

**Skills:** Need to be able to:

Whole Numbers up to 120

- counting
  - forward from any number
- numerals
  - reading and writing
  - representing a number of objects
- place value
  - ten ones as one ten
  - two-digit numbers
    - tens and ones
    - 10, 20, 30, etc. as 1 ten, 2 tens, 3 tens, etc.
  - comparison of two-digit numbers
    - symbols  $<$ ,  $=$ ,  $>$

- Count
  - starting at (any number)
- Read and write (numerals)
- Represent (a number of objects)
  - using (written numeral)
- Compare (two-digit numbers)
  - using (symbols)
  
- Add (within 100)
  - using (concrete models, drawings, and strategies)
    - relate strategies to a (written method)
    - explain reasoning
- Mentally find (10 more or 10 less than a number)
  - without counting
  - explain reasoning

Addition within 100

- concrete models or drawings, written method
- strategies
  - place value
  - properties of operations
  - inverse relationship between addition and subtraction
- two-digit number and a one digit number
- two-digit number and multiple of ten
- ten more/ten less than a two-digit number

Grade 1 Mathematics – Number and Operations in Base Ten	
<p>Subtraction within 100</p> <ul style="list-style-type: none"> <li>• multiplies of 10 from multiples 10-90</li> <li>• concrete models or drawings, written method</li> <li>• strategies               <ul style="list-style-type: none"> <li>○ place value</li> <li>○ properties of operations</li> <li>○ inverse relationship between addition and subtraction</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ Subtract (multiples of 10) within 100               <ul style="list-style-type: none"> <li>○ using (concrete models, drawings, and strategies)                   <ul style="list-style-type: none"> <li>▪ relate strategies to a (written method)</li> <li>▪ explain reasoning</li> </ul> </li> </ul> </li> </ul>
<p><b>Big Ideas</b>            Student’s statements of enduring ideas</p>	
<ol style="list-style-type: none"> <li>1. Our number system is a base-ten system. Any group of 10 in a given place value can be represented as one in the next greater place value (10 ones is 1 ten).</li> <li>2. Understanding place value enables us to represent, compare and order numbers and perform computations.</li> <li>3. Properties of operations allow us to reorder, decompose and/or compose numbers in order to make computation simpler.</li> </ol>	
<p><b>Essential Questions</b>            Teacher’s guiding questions</p>	
<ol style="list-style-type: none"> <li>1. How is our number system organized?</li> <li>2. How can understanding place value help us?</li> <li>3. How do the properties of operations make computation simpler?</li> </ol>	

## Grade 1 Mathematics – Number and Operations in Base Ten

### Learning Objectives

The students will be able to:

- a. Count to 120, starting at any number.
- b. Read and write numerals to 120.
- c. Represent a number of objects less than 120 with a written numeral.
- d. Express two-digit numbers in a variety of ways, e.g., 80 as 8 tens; 47 as 4 tens and 7 ones, 12 as 1 ten and 2 ones.
- e. Compare two two-digit numbers using  $<$ ,  $=$ , and  $>$ .
- f. Add a two-digit number and a one-digit number using concrete models or drawings and strategies.
- g. Add a two-digit number and a multiple of 10 within 100, using concrete models or drawings and strategies.
- h. Relate strategies used to solve addition problems to a written method and explain reasoning used.
- i. Mentally find 10 more or 10 less than a given two-digit number and explain reasoning used.
- j. Subtract multiples of 10 within 100 from multiples of 10 within 100 using concrete models or drawings and strategies.
- k. Relate strategies used to solve subtraction problems to a written method and explain reasoning used.

## Grade 1 Mathematics – Number and Operations in Base Ten

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate number concepts involving whole numbers.
- facilitate classroom discussions focused on the variety of strategies students use to add and subtract whole numbers to make connections to place value, the relationship between addition and subtraction and the properties of operations.
- incorporate the use of hundred charts and/or place-value charts to support students in developing an understanding of 10 more or less than a given number.
- model and have students use number lines to compare and add or subtract whole numbers.
- guide students to make connections among representations of numbers, e.g., number names, standard and expanded forms, and visual models.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students experience and observations of numbers in their world.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

## Grade 1 Mathematics – Number and Operations in Base Ten

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Double Compare Game
- Performance Task: Connect addition or subtraction strategy to a written method
- Ten More/Ten Less Game
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

Grade 1 Mathematics – Measurement and Data	
Common Core State Standards in Connecticut	Explanations and Examples*
<p><b>Measure lengths indirectly and by iterating length units.</b></p> <p>1.MD.1. Order three objects by length; compare the lengths of two objects indirectly by using a third object.</p>	<p>In order for students to be able to compare objects, students need to understand that length is measured from one end point to another end point. They determine which of two objects is longer, by physically aligning the objects. Typical language of length includes taller, shorter, longer, and higher. When students use bigger or smaller as a comparison, they should explain what they mean by the word. Some objects may have more than one measurement of length, so students identify the length they are measuring. Both the length and the width of an object are measurements of length.</p> <p>Examples for ordering:</p> <ul style="list-style-type: none"> <li>• Order three students by their height</li> <li>• Order pencils, crayons, and/or markers by length</li> <li>• Build three towers (with cubes) and order them from shortest to tallest</li> <li>• Three students each draw one line, then order the lines from longest to shortest</li> </ul> <p>Example for comparing indirectly:</p> <ul style="list-style-type: none"> <li>• Two students each make a dough “snake.” Given a tower of cubes, each student compares his/her snake to the tower. Then students make statements such as, “My snake is longer than the cube tower and your snake is shorter than the cube tower. So, my snake is longer than your snake.”</li> </ul>

## Grade 1 Mathematics – Measurement and Data

1.MD.2. Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.*

### Tell and write time.

1.MD.3. Tell and write time in hours and half-hours using analog and digital clocks.

Students use their counting skills while measuring with non-standard units. While this standard limits measurement to whole numbers of length, in a natural environment, not all objects will measure to an exact whole unit. When students determine that the length of a pencil is six to seven paperclips long, they can state that it is about six paperclips long.

Example:

- Ask students to use multiple units of the same object to measure the length of a pencil.  
(How many paper clips will it take to measure how long the pencil is?)



Ideas to support telling time:

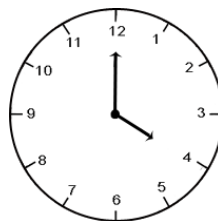
- within a day, the hour hand goes around a clock twice (the hand moves only in one direction)
- when the hour hand points exactly to a number, the time is exactly on the hour
- time on the hour is written in the same manner as it appears on a digital clock
- the hour hand moves as time passes, so when it is half way between two numbers it is at the half hour
- there are 60 minutes in one hour; so halfway between an hour, 30 minutes have passed, half hour is written with “30” after the colon

## Grade 1 Mathematics – Measurement and Data

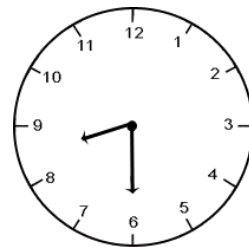
### Represent and interpret data.

1.MD.4. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

“It is 4 o’clock”



“It is halfway between 8 o’clock and 9 o’clock. It is 8:30.”



The idea of 30 being “halfway” is difficult for students to grasp. Students can write the numbers from 0 - 60 counting by tens on a sentence strip. Fold the paper in half and determine that halfway between 0 and 60 is 30. A number line on an interactive whiteboard may also be used to demonstrate this.

Students create object graphs and tally charts using data relevant to their lives (e.g., favorite ice cream, eye color, pets, etc.). Graphs may be constructed by groups of students as well as by individual students.

Counting objects should be reinforced when collecting, representing, and interpreting data. Students describe the object graphs and tally charts they create. They should also ask and answer questions based on these charts or graphs that reinforce

Grade 1 Mathematics – Measurement and Data	
<p><b>Recognize and identify coins.</b>            1.MD.5.(Additional Bristol Standard) Recognize and identify names and values of coins, including pennies, nickels, dimes and quarters.</p>	<p>other mathematics concepts such as sorting and comparing. The data chosen or questions asked give students opportunities to reinforce their understanding of place value, identifying ten more and ten less, relating counting to addition and subtraction and using comparative language and symbols.</p>
Unwrapped Performance Standards	
<u>Concepts:</u> Need to know about:	<u>Skills:</u> Need to be able to:
<p><b>Length</b></p> <ul style="list-style-type: none"> <li>• whole number, non-standard length units               <ul style="list-style-type: none"> <li>- same-size</li> <li>- laid end-to-end</li> <li>- no gaps</li> <li>- no overlaps</li> </ul> </li> <li>• ordering three objects               <ul style="list-style-type: none"> <li>- indirect measurement of two objects at a time to a third</li> </ul> </li> </ul> <p><b>Time</b></p> <ul style="list-style-type: none"> <li>• hours and half-hours               <ul style="list-style-type: none"> <li>- analog clock</li> <li>- digital clock</li> </ul> </li> </ul> <p><b>Data</b></p> <ul style="list-style-type: none"> <li>• organizing and representing               <ul style="list-style-type: none"> <li>- up to three categories</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ Measure (length of object)               <ul style="list-style-type: none"> <li>○ using (whole number, non-standard length units)</li> </ul> </li> <li>➤ Order (three objects) by length               <ul style="list-style-type: none"> <li>○ using (indirect comparison)</li> </ul> </li> <li>➤ Tell and write (time)               <ul style="list-style-type: none"> <li>○ using (clocks)</li> </ul> </li> <li>➤ Organize, represent and interpret (data)</li> </ul>

Grade 1 Mathematics – Measurement and Data	
<ul style="list-style-type: none"> <li>• interpreting               <ul style="list-style-type: none"> <li>- How many in each category?</li> <li>- How many in all?</li> <li>- How many more or less in one category than in another?</li> </ul> </li> </ul> <p>Coins</p> <ul style="list-style-type: none"> <li>• pennies</li> <li>• nickels</li> <li>• dimes</li> <li>• quarters</li> </ul>	<ul style="list-style-type: none"> <li>➤ Recognize and identify (coins)</li> </ul>
<p><b>Big Ideas</b>            Student’s statements of enduring ideas</p>	
<ol style="list-style-type: none"> <li>1. Measuring length is the process of counting the number of same-sized units, placed end-to-end without gaps or overlaps, that match the length of the object being measured.</li> <li>2. Clocks help us keep track of time and plan and sequence events.</li> <li>3. Specific coins have a unique value that is determined by their markings. The size and color do not indicate a coin’s value.</li> <li>4. We collect, organize, represent, and analyze data in order to answer a question or solve a problem.</li> </ol>	
<p><b>Essential Questions</b>            Teacher’s guiding questions</p>	
<ol style="list-style-type: none"> <li>1. How can you measure the length of an object?</li> <li>2. How are clocks useful?</li> <li>3. How can we determine the value of coins?</li> <li>4. Why do we collect, organize, represent and analyze data?</li> </ol>	

## Grade 1 Mathematics – Measurement and Data

### Learning Objectives

The students will be able to:

- a. Order three objects by length.
- b. Compare the lengths of two objects indirectly to the length of a third object, using specific vocabulary such as taller, shorter, etc.
- c. Measure the length of an object using non-standard units.
- d. Tell and write time in hours and half-hours, using analog and digital clocks.
- e. Name and identify the value of pennies, nickels, dimes and quarters.
- f. Organize and represent data with up to three categories, using object, picture or bar graphs and tally charts.
- g. Ask and answer questions about data represented in graphs or charts.

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives, tools and/or technology to model and have students investigate measurement and data concepts.
- provide students multiple opportunities to engage in hands-on measurement explorations involving length using various non-standard units.
- facilitate opportunities to have students notice and represent time at different points throughout the day.
- have students engage in small group activities to investigate coins based on students' prior knowledge and experiences.
- incorporate the use of data collected from classroom routines, such as lunch count, to provide opportunities for students to ask and answer questions about the data.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students experience and observations of measurement in their world.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.


## Grade 1 Mathematics – Measurement and Data

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Clock Match Game
- Measurement Scavenger Hunt
- Coin Riddles
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

Grade 1 Mathematics – Geometry	
Common Core State Standards in Connecticut	Explanations and Examples*
<p><b>Reason with shapes and their attributes.</b></p> <p>1.G.1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.</p>	<p>Attributes refer to any characteristic of a shape. Students use attribute language to describe a given two-dimensional shape: number of sides, number of vertices/points, straight sides, closed. A child might describe a triangle as “right side up” or “red.” These attributes are not defining because they are not relevant to whether a shape is a triangle or not. Students should articulate ideas such as, “A triangle is a triangle because it has three straight sides and is closed.” It is important that students are exposed to both regular and irregular shapes so that they can communicate defining attributes. Students should use attribute language to describe why these shapes are not triangles.</p> <div style="text-align: center;">  </div> <p>Students should also use appropriate language to describe a given three-dimensional shape: number of faces, number of vertices/points, number of edges.</p> <p>Example: A cylinder may be described as a solid that has two circular faces connected by a curved surface (which is not considered a face). Students may say, “It looks like a can.”</p> <p>Students should compare and contrast two-and three-dimensional figures using defining attributes.</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• List two things that are the same and two things that are different between a triangle and a cube.</li> <li>• Given a circle and a sphere, students identify the sphere as being three-dimensional but both are round.</li> <li>• Given a trapezoid, find another two-dimensional shape that has two things that are the same.</li> </ul>

## Grade 1 Mathematics – Geometry

1.G.2. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape. (Students do not need to learn formal names such as “right rectangular prism.”)

1.G.3. Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves*, *fourths*, and *quarters*, and use the phrases *half of*, *fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.

The ability to describe, use and visualize the effect of composing and decomposing shapes is an important mathematical skill. It is not only relevant to geometry, but is related to children’s ability to compose and decompose numbers. Students may use pattern blocks, plastic shapes, tangrams, or computer environments to make new shapes. The teacher can provide students with cutouts of shapes and ask them to combine them to make a particular shape.

Example:

- What shapes can be made from four squares?



Students can make three-dimensional shapes with clay or dough, slice into two pieces (not necessarily congruent) and describe the two resulting shapes. For example, slicing a cylinder will result in two smaller cylinders.

Students need experiences with different sized circles and rectangles to recognize that when they cut something into two equal pieces, each piece will equal one half of its original whole. Children should recognize that halves of two different wholes are not necessarily the same size. Also they should reason that decomposing equal shares into more equal shares results in smaller equal shares.

Examples:

- Student partitions a rectangular candy bar to share equally with one friend and thinks “I cut the rectangle into two equal parts. When I put the two parts back together, they equal the whole candy bar. One half of the candy bar is smaller than the whole candy bar.”

## Grade 1 Mathematics – Geometry



- Student partitions an identical rectangular candy bar to share equally with 3 friends and thinks “I cut the rectangle into four equal parts. Each piece is one fourth of or one quarter of the whole candy bar. When I put the four parts back together, they equal the whole candy bar. I can compare the pieces (one half and one fourth) by placing them side-by-side. One fourth of the candy bar is smaller than one half of the candy bar.



- Students partition a pizza to share equally with three friends. They recognize that they now have four equal pieces and each will receive a fourth or quarter of the whole pizza.



Grade 1 Mathematics – Geometry	
Unwrapped Performance Standards	
<u>Concepts:</u> Need to know about:	<u>Skills:</u> Need to be able to:
<p>Shapes and Their Defining Attributes</p> <ul style="list-style-type: none"> <li>• 2-dimensional           <ul style="list-style-type: none"> <li>- rectangles</li> <li>- squares</li> <li>- trapezoids</li> <li>- triangles</li> <li>- half-circles</li> <li>- quarter-circles</li> </ul> </li> <li>• 3-dimensional           <ul style="list-style-type: none"> <li>- cubes</li> <li>- right rectangular prisms</li> <li>- right circular cones</li> <li>- right circular cylinders</li> </ul> </li> <li>• composite shapes</li> </ul> <p>Partitioning Shapes</p> <ul style="list-style-type: none"> <li>• equal shares (two or four)           <ul style="list-style-type: none"> <li>- circles and rectangles               <ul style="list-style-type: none"> <li>○ halves, half of</li> <li>○ fourths, fourth of, quarters, quarter of</li> <li>○ the whole                   <ul style="list-style-type: none"> <li>▪ two of the shares</li> <li>▪ four of the shares</li> </ul> </li> </ul> </li> <li>- decomposing results in smaller shares</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ Build and draw (shapes)           <ul style="list-style-type: none"> <li>○ possessing (defining attributes)</li> </ul> </li> <li>➤ Distinguish between (defining and non-defining attributes)</li> <li>➤ Create (composite shapes)           <ul style="list-style-type: none"> <li>○ using (2- or 3-dimensional shapes)</li> <li>○ using (composite shapes)</li> </ul> </li> <li>➤ partition (circles and rectangles)           <ul style="list-style-type: none"> <li>○ two or four equal shares</li> </ul> </li> <li>➤ describe (equal shares)           <ul style="list-style-type: none"> <li>○ using (fractional language)</li> </ul> </li> <li>➤ describe (the whole as two of or four of the shares)</li> </ul>

## Grade 1 Mathematics – Geometry

### Big Ideas

Student's statements of enduring ideas

1. Two- and three-dimensional shapes can be named, described and analyzed using attributes, such as number and lengths of sides and number of angles/vertices. Naming shapes is not dependent on their color, orientation or size.
2. New shapes can be created by putting together existing shapes.
3. Partitioning a shape into smaller parts allows us to describe the shape in different ways.

### Essential Questions

Teacher's guiding questions

1. How can we name, describe, and analyze two-and three-dimensional shapes?
2. How can we create new shapes using existing shapes?
3. How does partitioning help us reason about shapes?

### Learning Objectives

The students will be able to:

- a. Build and draw shapes based on given attributes.
- b. Describe two-and three-dimensional shapes.
- c. Compare and contrast two- and three-dimensional shapes.
- d. Compose two-and three-dimensional shapes to create a composite shape.
- e. Create new shapes using composite shapes.
- f. Partition circles and rectangles into two and four equal shares.
- g. Compare the size of halves and fourths given same-sized wholes.
- h. Identify equal shares of partitioned figures as halves or fourths and quarters.
- i. Describe a partitioned whole in terms of the number of equal shares.

## Grade 1 Mathematics – Geometry

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate 2- and 3-dimensional figures and build composite shapes.
- use examples and non-examples of specific 2- and 3- dimensional figures to develop students' understanding of defining attributes.
- provide opportunities for students to explore the partitioning of different-sized rectangles and circles into the same number of equal pieces and discuss whether halves or fourths from different wholes are the same size.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students' experience and observations of geometry in their world.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *sol/ve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Who Am I? game
- Composite Shape Build
- Equal Share Performance Task
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets)
- Topic assessments
- District benchmark assessments

**Appendix**

Table 1: Common Addition and Subtraction Situations<sup>1</sup>

	Result Unknown	Change Unknown	Start Unknown
<b>Add to</b>	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? $2 + 3 = ?$	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two? $2 + ? = 5$	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before? $? + 3 = 5$
<b>Take from</b>	Five apples were on the table. I ate two apples. How many apples are on the table now? $5 - 2 = ?$	Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat? $5 - ? = 3$	Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before? $? - 2 = 3$
	Total Unknown	Addend Unknown	Both Addends Unknown <sup>1</sup>
<b>Put Together/ Take Apart<sup>2</sup></b>	Three red apples and two green apples are on the table. How many apples are on the table? $3 + 2 = ?$	Five apples are on the table. Three are red and the rest are green. How many apples are green? $3 + ? = 5, 5 - 3 = ?$	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? $5 = 0 + 5, 5 = 5 + 0$ $5 = 1 + 4, 5 = 4 + 1$ $5 = 2 + 3, 5 = 3 + 2$
	Difference Unknown	Bigger Unknown	Smaller Unknown
<b>Compare<sup>3</sup></b>	<p>("How many more?" version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy?</p> <p>("How many fewer?" version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? <math>2 + ? = 5, 5 - 2 = ?</math></p>	<p>(Version with "more"): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have?</p> <p>(Version with "fewer"): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? <math>2 + 3 = ?, 3 + 2 = ?</math></p>	<p>(Version with "more"): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have?</p> <p>(Version with "fewer"): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? <math>5 - 3 = ?, ? + 3 = 5</math></p>

<sup>1</sup>These Take Apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help children understand that the = sign does not always mean makes or results in but always does mean is the same number as.

<sup>2</sup>Either addend can be unknown, so there are three variations of these problem situations. Both Addends Unknown is a productive extension of this basic situation, especially for small numbers less than or equal to 10.

<sup>3</sup>For the Bigger Unknown or Smaller Unknown situations, one version directs the correct operation (the version using more for the bigger unknown and using less for the smaller unknown). The other versions are more difficult.

1. Common Core State Standards for Mathematics (2010, p. 88).



**Bristol Public Schools  
 Office of Teaching & Learning**

**DEPARTMENT:** Elementary Mathematics

**COURSE:** Grade 3 Mathematics

**COURSE DESCRIPTION**

<b>Mathematical topics include:</b>	<b>Instruction focuses on four critical areas:</b>
<ul style="list-style-type: none"> <li>• whole numbers to 1000</li> <li>• addition and subtraction within 1000</li> <li>• multiplication and division within 100</li> <li>• arithmetic patterns</li> <li>• fractions</li> <li>• time</li> <li>• liquid volume and mass</li> <li>• scaled graphs and line plots</li> <li>• area and perimeter</li> <li>• 2-dimensional shapes</li> </ul>	<p><b>Developing understanding of multiplication and division and strategies for multiplication and division within 100.</b>            Students develop an understanding of the meanings of multiplication and division of whole numbers through activities and problems involving equal-sized groups, arrays, and area models; multiplication is finding an unknown product, and division is finding an unknown factor in these situations. For equal-sized group situations, division can require finding the unknown number of groups or the unknown group size. Students use properties of operations to calculate products of whole numbers, using increasingly sophisticated strategies based on these properties to solve multiplication and division problems involving single-digit factors. By comparing a variety of solution strategies, students learn the relationship between multiplication and division.</p> <p><b>Understanding of fractions, especially unit fractions (fractions with numerator 1).</b>            Students develop an understanding of fractions, beginning with unit fractions. Students view fractions in general as being built out of unit fractions, and they use fractions along with visual fraction models to represent parts of a whole. Students understand that the size of a fractional part is relative to the size of the whole. For example, <math>\frac{1}{2}</math> of the paint in a small bucket could be less paint than <math>\frac{1}{3}</math> of the paint in a larger bucket, but <math>\frac{1}{3}</math> of a ribbon is longer than <math>\frac{1}{5}</math> of the same ribbon because when the ribbon is divided into 3 equal parts, the parts are longer than when the ribbon is divided into 5 equal parts. Students are able to use fractions to represent numbers equal to, less than, and greater than one. They solve problems that involve comparing fractions by using visual fraction models and strategies based on noticing equal numerators or denominators.</p> <p><b>Developing understanding of the structure of rectangular arrays and of area.</b>            Students recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-size units of area required to cover the shape without gaps or overlaps, a square with sides of unit length being the standard unit for measuring area. Students understand that rectangular arrays can be decomposed into identical rows or into identical columns. By decomposing rectangles into rectangular arrays of squares, students connect area to multiplication, and justify using multiplication to determine the area of a rectangle.</p> <p><b>Describing and analyzing two-dimensional shapes.</b>            Students describe, analyze, and compare properties of two-dimensional shapes. They compare and classify shapes by their sides and angles, and connect these with definitions of shapes. Students also relate their fraction work to geometry by expressing the area of part of a shape as a unit fraction of the whole.</p>

## **DEPARTMENT PHILOSOPHY**

The philosophy of the elementary mathematics department is to develop mathematically literate and productive students who can effectively and efficiently apply mathematics in their lives to make informed decisions about the world around them. To be mathematically literate, one must understand major mathematics concepts, possess computational facility and have the ability to apply these understandings to situations in daily life. Making connections between mathematics and other disciplines is key to the appropriate application of mathematics skills and concepts to solve problems. The ability to read, discuss and write within the discipline of mathematics is an integral skill that supports mathematical understanding, reasoning and communication. The opportunity to think critically and creatively to solve problems is important to deepen mathematical knowledge and foster innovation. A rich mathematical experience in the elementary grades is essential to provide the foundational knowledge and skills that prepare students to be mathematically literate, productive citizens.

The Bristol elementary mathematics curriculum focuses on high expectations for **all** students and provides a balanced approach to mathematics education, placing equal importance on conceptual understanding, computational and procedural fluency and problem solving through the use of a variety of strategies, tools and technologies. The mathematics curriculum is responsive to the individual needs of students. While providing a structure tied to the Common Core State Standards in Connecticut, it allows for classroom experiences, additional supports and enrichment ensuring students' access to the content at an appropriate level of challenge.

## **DEPARTMENT GOALS**

Through a planned, sequential curriculum, Bristol Public schools strives to educate each student in conjunction with the Common Core State Standards in Connecticut. As a result, students will be able to demonstrate knowledge and skills in each of the following:

- ◆ Operations and Algebraic Thinking
- ◆ Number and Operations in Base Ten
- ◆ Number and Operations - Fractions
- ◆ Measurement and Data
- ◆ Geometry

In addition, teachers will support students in developing the following mathematical practices aligned to those found in the Common Core State Standards in Connecticut.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

## PHILOSOPHY OF INSTRUCTION

Based on our department philosophy and goals, elementary math teachers will:

- ensure a minimum of one hour of daily instructional time for mathematics (kindergarten – 30 minutes);
- provide a safe, supportive and respectful classroom environment conducive to learning, where students are encouraged to take risks and share ideas;
- have a deep understanding of the mathematical concepts and skills in the curriculum and strong pedagogical content knowledge;
- use the BOE approved textbook and a variety of resources to have students read about, explore and reinforce curriculum concepts and skills;
- build upon students' prior knowledge and experience, and real-world events, to foster connections and make learning relevant and meaningful;
- provide students with developmentally appropriate opportunities to question, explore, observe, synthesize and draw conclusions based on their mathematics understanding;
- use high-level questions and rich tasks to facilitate classroom discourse, both oral and written, to encourage student-student, student-teacher and teacher-student communication;
- incorporate and highlight key mathematical vocabulary during instruction and require students to use this vocabulary appropriately in their communications;
- model and have students use manipulatives, tools and technology to actively explore and build understanding of mathematical concepts;
- structure learning experiences that utilize a variety of grouping strategies to encourage collaborative problem solving; and
- differentiate instruction to meet the needs of a variety of learners based on student readiness, interest, and learning style and provide supplemental mathematics intervention or enrichment as needed.

**Note: The instructional strategies recommended in our resource document are specific examples of these expectations in practice. They serve as a starting point for planning and implementing instruction that will develop our students as thinkers. Teachers may create new instructional strategies and activities as they continue to grow professionally and as they develop an understanding of each student's unique strengths, weaknesses, and interests.**

## **PHILOSOPHY OF ASSESSMENT**

Based on our department philosophy and goals, elementary math teachers will:

- align assessments with instruction;
- use a variety of formative and summative assessment throughout each unit of instruction;
- design and use assessments that include questions at varied levels of cognitive demand;
- analyze results and plan or modify instruction based on the results;
- provide specific, constructive feedback for students;
- support students in goal setting and the monitoring and evaluation of their progress; and
- collaborate with colleagues and use scoring rubrics to evaluate student work as appropriate.

Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

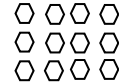
Common Core State Standards in Connecticut	Explanations and Examples*
<p><b>Represent and solve problems involving multiplication and division.</b></p> <p>3.OA.1. Interpret products of whole numbers, e.g., interpret <math>5 \times 7</math> as the total number of objects in 5 groups of 7 objects each. <i>For example, describe a context in which a total number of objects can be expressed as <math>5 \times 7</math>.</i></p> <p>3.OA.2. Interpret whole-number quotients of whole numbers, e.g., interpret <math>56 \div 8</math> as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. <i>For example, describe a context in which a number of shares or a number of groups can be expressed as <math>56 \div 8</math>.</i></p> <p>3.OA.3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. (See Appendix, Table 1)</p>	<p>Students recognize multiplication as a means to determine the total number of objects when there are a specific number of groups with the same number of objects in each group. Multiplication requires students to think in terms of groups of things rather than individual things. Students learn that the multiplication symbol ‘x’ means “groups of” and problems such as <math>5 \times 7</math> refer to 5 groups of 7.</p> <p>To further develop this understanding, students interpret a problem situation requiring multiplication using pictures, objects, words, numbers, and equations. Then, given a multiplication expression (e.g., <math>5 \times 6</math>) students interpret the expression using a multiplication context. (See Appendix, Table 1) They should begin to use the terms, <i>factor</i> and <i>product</i>, as they describe multiplication.</p> <p>Students recognize the operation of division in two different types of situations. One situation requires determining how many groups and the other situation requires sharing (determining how many in each group). Students should be exposed to appropriate terminology (quotient, dividend, divisor, and factor).</p> <p>To develop this understanding, students interpret a problem situation requiring division using pictures, objects, words, numbers, and equations. Given a division expression (e.g., <math>24 \div 6</math>) students interpret the expression in contexts that require both interpretations of division. (See Appendix, Table 1)</p> <p>Students use a variety of representations for creating and solving one-step word problems, i.e., numbers, words, pictures, physical objects, or equations. They use multiplication and division of whole numbers up to <math>10 \times 10</math>. Students explain their thinking, show their work by using at least one representation, and verify that their answer is reasonable.</p>

Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

Word problems may be represented in multiple ways:

- Equations:  $3 \times 4 = ?$ ,  $4 \times 3 = ?$ ,  $12 \div 4 = ?$  and  $12 \div 3 = ?$

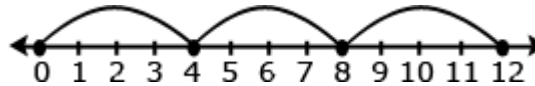
- Array:



- Equal groups

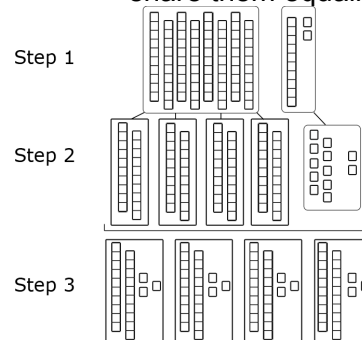


- Repeated addition:  $4 + 4 + 4$  or repeated subtraction
- Three equal jumps forward from 0 on the number line to 12 or three equal jumps backwards from 12 to 0



Examples of division problems:

- Determining the number of objects in each share (partitive division, where the size of the groups is unknown):
  - The bag has 92 hair clips, and Laura and her three friends want to share them equally. How many hair clips will each person receive?



Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

3.OA.4. Determine the unknown whole number in a multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations  $8 \times ? = 48$ ,  $5 = \square \div 3$ ,  $6 \times 6 = ?$ .*

- Determining the number of shares (measurement division, where the number of groups is unknown)  
 Max the monkey loves bananas. Molly, his trainer, has 24 bananas. If she gives Max 4 bananas each day, how many days will the bananas last?

Starting	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
24	$24-4=20$	$20-4=16$	$16-4=12$	$12-4=8$	$8-4=4$	$4-4=0$

Solution: The bananas will last for 6 days.

This standard is strongly connected to 3.AO.3 when students solve problems and determine unknowns in equations. Students should also experience creating story problems for given equations. When crafting story problems, they should carefully consider the question(s) to be asked and answered to write an appropriate equation. Students may approach the same story problem differently and write either a multiplication equation or division equation

Students apply their understanding of the meaning of the equal sign as "the same as" to interpret an equation with an unknown. When given  $4 \times ? = 40$ , they might think:

- 4 groups of some number is the same as 40
- 4 times some number is the same as 40
- I know that 4 groups of 10 is 40 so the unknown number is 10
- The missing factor is 10 because 4 times 10 equals 40.

Equations in the form of  $a \times b = c$  and  $c = a \times b$  should be used interchangeably, with the unknown in different positions.

Examples:

- Solve the equations below:  
 $24 = ? \times 6$   
 $72 \div \Delta = 9$
- Rachel has 3 bags. There are 4 marbles in each bag. How many marbles does Rachel have altogether?  $3 \times 4 = m$

Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

**Understand properties of multiplication and the relationship between multiplication and division.**

3.OA.5. Apply properties of operations as strategies to multiply and divide. (Students need not use formal terms for these properties.) *Examples: If  $6 \times 4 = 24$  is known, then  $4 \times 6 = 24$  is also known. (Commutative Property of Multiplication.)  $3 \times 5 \times 2$  can be found by  $3 \times 5 = 15$ , then  $15 \times 2 = 30$ , or by  $5 \times 2 = 10$ , then  $3 \times 10 = 30$ . (Associative Property of Multiplication.) Knowing that  $8 \times 5 = 40$  and  $8 \times 2 = 16$ , one can find  $8 \times 7$  as  $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$ . (Distributive Property.)*

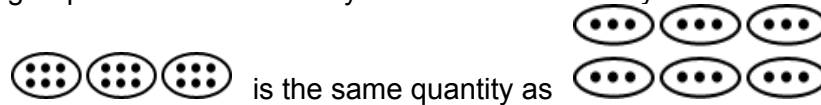
Note: Students need not use formal terms for these properties.

Students represent expressions using various objects, pictures, words and symbols in order to develop their understanding of properties. They multiply by 1 and 0 and divide by 1. They change the order of numbers to determine that the order of numbers does not make a difference in multiplication (but does make a difference in division). Given three factors, they investigate changing the order of how they multiply the numbers to determine that changing the order does not change the product. They also decompose numbers to build fluency with multiplication.

Models help build understanding of the Commutative Property:

Example:  $3 \times 6 = 6 \times 3$

In the following diagram it may not be obvious that 3 groups of 6 is the same as 6 groups of 3. A student may need to count to verify this.



Example:  $4 \times 3 = 3 \times 4$

An array explicitly demonstrates the concept of the Commutative Property.



4 rows of 3 or  $4 \times 3$

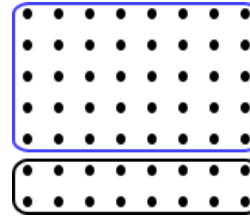


3 rows of 4 or  $3 \times 4$

Students are introduced to the Distributive Property of Multiplication over addition as a strategy for using products they know to solve products they don't know. For example, if students are asked to find the product of  $7 \times 8$ , they might decompose 7 into 5 and 2 and then multiply  $5 \times 8$  and  $2 \times 8$  to arrive at  $40 + 16$  or 56. Students should learn that they can decompose either of the factors. It is important to note that the students may record their thinking in different ways.

Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

$$\begin{array}{r} 5 \times 8 = 40 \\ 2 \times 8 = \underline{16} \\ 56 \end{array}$$



$5 \times 8 = 40$

$2 \times 8 = 16$

$$\begin{array}{r} 7 \times 4 = 28 \\ 7 \times 4 = \underline{28} \\ 56 \end{array}$$

3.OA.6. Understand division as an unknown-factor problem. For example, find  $32 \div 8$  by finding the number that makes 32 when multiplied by 8.

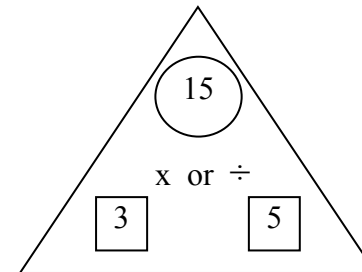
To further develop understanding of properties related to multiplication and division, students use different representations and their understanding of the relationship between multiplication and division to determine if the following types of equations are true or false.

- $0 \times 7 = 7 \times 0 = 0$  (Zero Property of Multiplication)
- $1 \times 9 = 9 \times 1 = 9$  (Multiplicative Identity Property of 1)
- $3 \times 6 = 6 \times 3$  (Commutative Property)
- $8 \div 2 = 2 \div 8$  (Students are only to determine that these are not equal)
- $2 \times 3 \times 5 = 6 \times 5$
- $10 \times 2 < 5 \times 2 \times 2$
- $2 \times 3 \times 5 = 10 \times 3$
- $0 \times 6 > 3 \times 0 \times 2$

Multiplication and division are inverse operations and that understanding can be used to find the unknown. Fact family triangles demonstrate the inverse operations of multiplication and division by showing the two factors and how those factors relate to the product and/or quotient.

Examples:

- $3 \times 5 = 15$      $5 \times 3 = 15$
- $15 \div 3 = 5$      $15 \div 5 = 3$



## Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Multiply and divide within 100

3.OA.7. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that  $8 \times 5 = 40$ , one knows  $40 \div 5 = 8$ ) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.

Students use their understanding of the meaning of the equal sign as “the same as” to interpret an equation with an unknown. When given  $32 \div \square = 4$ , students may think:

- 4 groups of some number is the same as 32
- 4 times some number is the same as 32
- I know that 4 groups of 8 is 32 so the unknown number is 8
- The missing factor is 8 because 4 times 8 is 32.

Equations in the form of  $a \div b = c$  and  $c = a \div b$  need to be used interchangeably, with the unknown in different positions.

By studying patterns and relationships in multiplication facts and relating multiplication and division, students build a foundation for fluency with multiplication and division facts. Students demonstrate fluency with multiplication facts through 10 and the related division facts. Multiplying and dividing fluently refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently.

Strategies students may use to attain fluency include:

- Multiplication by zeros and ones
- Doubles (2s facts), Doubling twice (4s), Doubling three times (8s)
- Tens facts (relating to place value,  $5 \times 10$  is 5 tens or 50)
- Five facts (half of tens)
- Skip counting (counting groups of \_\_\_ and knowing how many groups have been counted)
- Square numbers (ex:  $3 \times 3$ )
- Nines (10 groups less one group, e.g.,  $9 \times 3$  is 10 groups of 3 minus one group of 3)
- Decomposing into known facts ( $6 \times 7$  is  $6 \times 6$  plus one more group of 6)
- Turn-around facts (Commutative Property)
- Fact families (Ex:  $6 \times 4 = 24$ ;  $24 \div 6 = 4$ ;  $24 \div 4 = 6$ ;  $4 \times 6 = 24$ )
- Missing factors

General Note: Students should have exposure to multiplication and division problems presented in both vertical and horizontal forms.

Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

**Solve problems involving the four operations, and identify and explain patterns in arithmetic**

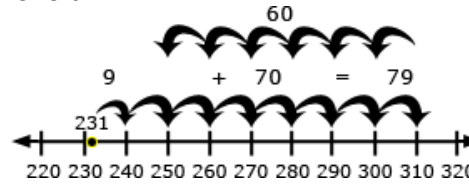
3.OA.8. Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Note: This standard is limited to problems posed with whole numbers and having whole-number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

Students should be exposed to multiple problem-solving strategies (using any combination of words, numbers, diagrams, physical objects or symbols) and be able to choose which ones to use.

Examples:

- Jerry earned 231 points at school last week. This week he earned 79 points. If he uses 60 points to earn free time on a computer, how many points will he have left?



A student may use the number line above to describe his/her thinking, “231 + 9 = 240 so now I need to add 70 more. 240, 250 (10 more), 260 (20 more), 270, 280, 290, 300, 310 (70 more). Now I need to count back 60. 310, 300 (back 10), 290 (back 20), 280, 270, 260, 250 (back 60).”

A student writes the equation,  $231 + 79 - 60 = m$  and uses rounding ( $230 + 80 - 60$ ) to estimate.

A student writes the equation,  $231 + 79 - 60 = m$  and calculates  $79 - 60 = 19$  and then calculates  $231 + 19 = m$ .

- The soccer club is going on a trip to the water park. The cost of attending the trip is \$63. Included in that price is \$13 for lunch and the cost of 2 wristbands, one for the morning and one for the afternoon. Write an equation representing the cost of the field trip and determine the price of one wristband.

w	w	13
63		

## Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

3.OA.9. Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. *For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.*

The diagram on the previous page helps the student write the equation,  $w + w + 13 = 63$ . Using the diagram, a student might think, "I know that the two wristbands cost \$50 ( $\$63 - \$13$ ) so one wristband costs \$25." To check for reasonableness, a student might use front end estimation and say  $60 - 10 = 50$  and  $50 \div 2 = 25$ .

When students solve word problems, they use various estimation skills which include identifying when estimation is appropriate, determining the level of accuracy needed, selecting the appropriate method of estimation, and verifying solutions or determining the reasonableness of solutions.

Estimation strategies include, but are not limited to:

- using benchmark numbers that are easy to compute
- front-end estimation with adjusting (using the highest place value and estimating from the front end making adjustments to the estimate by taking into account the remaining amounts)
- rounding and adjusting (students round down or round up and then adjust their estimate depending on how much the rounding changed the original values)

Students need ample opportunities to observe and identify important numerical patterns related to operations. They should build on their previous experiences with properties related to addition and subtraction. Students investigate addition and multiplication tables in search of patterns and explain why these patterns make sense mathematically. For example:

- Any sum of two even numbers is even.
- Any sum of two odd numbers is even.
- Any sum of an even number and an odd number is odd.
- The multiples of 4, 6, 8, and 10 are all even because they can all be decomposed into two equal groups.
- The doubles (2 addends the same) in an addition table fall on a diagonal while the doubles (multiples of 2) in a multiplication table fall on horizontal and vertical lines.
- The multiples of any number fall on a horizontal and a vertical line due to the commutative property.

**Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING**

- All the multiples of 5 end in a 0 or 5 while all the multiples of 10 end with 0. Every other multiple of 5 is a multiple of 10.

Students also investigate a hundreds chart in search of addition and subtraction patterns. They record and organize all the different possible sums of a number and explain why the pattern makes sense.

**Unwrapped Standards**

**Concepts:** Need to know about:

**Skills:** Need to be able to:

Multiplication and Division

- products
- quotients
  - unknown factor problems
- equal groups(shares), arrays, measurement quantities
  - drawings
  - equations that relate three whole numbers
    - symbol to represent an unknown
- strategies
  - properties of operations
    - Commutative, Associative, Distributive properties
  - inverse relationship ( $\times, \div$ )

Problem solving

- all four operations
- two-step
- letter for an unknown
- reasonableness
  - mental computation
  - estimation
    - rounding

- Interpret (products and quotients of whole numbers)
- Describe (a context)
- Represent (multiplication and division situations)
- Determine (the unknown)
- Multiply and divide (within 100)
  - use (strategies)
  - know (from memory)
  
- Solve (word problems)
  - Represent (with equations)
    - using (a letter for unknown quantities)
  - Assess (reasonableness)

## Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Patterns

- arithmetic
  - sums on an addition table
  - products on a multiplication table

- Identify (arithmetic patterns)
- Explain (patterns)

### Big Ideas

Student's statements of enduring ideas

1. Multiplication and division problems include repeated addition/subtraction of equal groups and array/area problems.
2. Division is the opposite (inverse) operation or “undoes” multiplication and vice versa.
3. Some strategies that help us remember the multiplication and division facts include using patterns, skip counting, known facts to find unknown facts, properties, arrays, fact families, and the inverse relationship between the operations.
4. Recognizing how a real-world situation fits into a common operation category helps to solve the problem.
5. We can show mathematical situations in word problems by making tables or drawings, modeling with number lines or writing equations.

### Essential Questions

Teacher's guiding questions

1. What are the different types of multiplication and division problems?
2. How is division related to multiplication?
3. What are some strategies for helping learn multiplication and division facts?
4. How do we decide what operation to use when solving a real-world problem?
5. How can we show mathematical situations in word problems?

## Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Learning Objectives

The students will be able to:

- a. Represent multiplication and division problems using concrete models, drawings, tables, number lines and equations.
- b. Recognize patterns in addition and multiplication tables and hundreds charts and make connections to multiplication and division facts.
- c. Write a story problem to represent a given multiplication or division fact and vice versa for a variety of types of situations (see table 1).
- d. Solve multiplication and division problems for an unknown in any position.
- e. Describe and apply the inverse relationship between multiplication and division to solve problems.
- f. Explain the strategies used to solve multiplication and division problems.
- g. Apply understanding of properties to justify the solutions to multiplication and division problems.
- h. Fluently multiply and divide within 100.
- i. Identify arithmetic patterns.
- j. Solve two-step word problems involving all four operations.
- k. Represent a word problem using an equation with a letter standing for the unknown.
- l. Justify the reasonableness of solutions using mental computation and estimation.

## Grade 3 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate multiplication and division involving whole numbers.
- make connections among mathematical computation and real-world situations and use real-world situations as a springboard for learning.
- encourage the use of multiple representations for problem situations (e.g., bar diagrams, numbers, words, pictures, objects, acting out, making a chart, list, graph, creating equations) and explain the connections among the representations.
- have students draw pictures, build arrays and create number lines to represent and solve multiplication and division problems
- present equations in a variety of ways ( e.g.  $12 = 3 \times 4$ ,  $3 \times 4 = 12$ ,  $2 \times 6 = 3 \times 4$ ) to develop the idea of equivalence.
- incorporate the use of a student math journal and/or class posters in order for students to record strategies for building basic fact fluency for multiplication and division.
- model the use of strategies, such as using a known fact to find an unknown fact, looking for patterns, inverse operations, and properties of operations to build fluency with basic facts.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- encourage the use of fact fluency games for practice in school and at home.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Build an Array – Multiplication Chart
- Reasoning about equations (true, false, justify)
- Multiplication/Division Problem Sort
- Performance Task: write and illustrate the various types of multiplication and division problems for a given fact
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

Grade 3 Mathematics – Number and Operations in Base Ten

Common Core State Standards in Connecticut

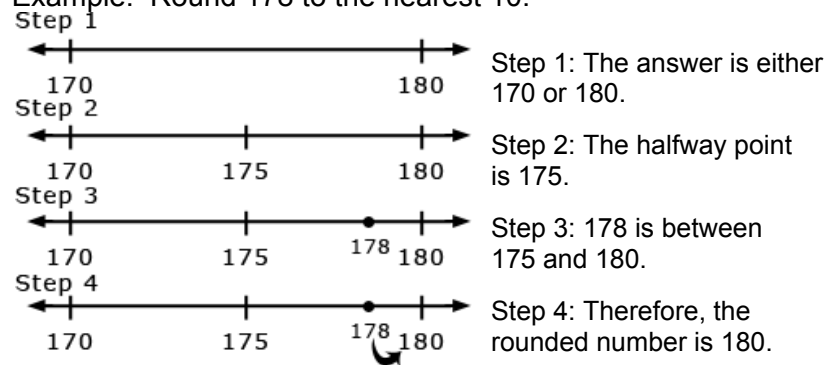
Explanations and Examples\*

**Use place value understanding and properties of operations to perform multi-digit arithmetic. (A range of algorithms may be used.)**

3.NBT.1. Use place value understanding to round whole numbers to the nearest 10 or 100

Students learn when and why to round numbers. They identify possible answers and halfway points. Then they narrow where the given number falls between the possible answers and halfway points. They also understand that by convention if a number is exactly at the halfway point of the two possible answers, the number is rounded up.

Example: Round 178 to the nearest 10.



3.NBT.2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

Problems should include both vertical and horizontal forms, including opportunities for students to apply the commutative and associative properties. Adding and subtracting fluently refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. Students explain their thinking and show their work by using strategies and algorithms, and verify that their answer is reasonable.

## Grade 3 Mathematics – Number and Operations in Base Ten

3.NBT.3. Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g.,  $9 \times 80$ ,  $5 \times 60$ ) using strategies based on place value and properties of operations.

Example:

Mary read 573 pages during her summer reading challenge. She was only required to read 399 pages. How many extra pages did Mary read beyond the challenge requirements?

Students may use several approaches to solve the problem including the traditional algorithm. Examples of other methods students may use are listed below:

- $399 + 1 = 400$ ,  $400 + 100 = 500$ ,  $500 + 73 = 573$ , therefore  $1 + 100 + 73 = 174$  pages (Adding up strategy)
- $400 + 100$  is 500;  $500 + 73$  is 573;  $100 + 73$  is 173 plus 1 (for 399, to 400) is 174 (Compensating strategy)
- Take away 73 from 573 to get to 500, take away 100 to get to 400, and take away 1 to get to 399. Then  $73 + 100 + 1 = 174$  (Subtracting to count down strategy)
- $399 + 1$  is 400, 500 (that's 100 more). 510, 520, 530, 540, 550, 560, 570, (that's 70 more), 571, 572, 573 (that's 3 more) so the total is  $1 + 100 + 70 + 3 = 174$  (Adding by tens or hundreds strategy)

Students use base ten blocks, diagrams, or hundreds charts to multiply one-digit numbers by multiples of 10 from 10-90. They apply their understanding of multiplication and the meaning of the multiples of 10. For example, 30 is 3 tens and 70 is 7 tens. They can interpret  $2 \times 40$  as 2 groups of 4 tens or 8 groups of ten. They understand that  $5 \times 60$  is 5 groups of 6 tens or 30 tens and know that 30 tens is 300. After developing this understanding they begin to recognize the patterns in multiplying by multiples of 10.

Grade 3 Mathematics – Number and Operations in Base Ten	
Unwrapped Performance Standards	
<b>Concepts:</b> Need to know about:	<b>Skills:</b> Need to be able to:
Whole numbers <ul style="list-style-type: none"> <li>• place value               <ul style="list-style-type: none"> <li>- rounding                   <ul style="list-style-type: none"> <li>○ nearest 10</li> <li>○ nearest 100</li> </ul> </li> </ul> </li> <li>• addition and subtraction               <ul style="list-style-type: none"> <li>- strategies and algorithms                   <ul style="list-style-type: none"> <li>○ place value</li> <li>○ properties of operations</li> <li>○ inverse relationship</li> </ul> </li> </ul> </li> <li>• multiplication               <ul style="list-style-type: none"> <li>- one digit by multiples of 10</li> <li>- strategies                   <ul style="list-style-type: none"> <li>○ place value</li> <li>○ properties of operations</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ round (whole numbers)</li>   <li>➤ add and subtract (fluently within 1000)               <ul style="list-style-type: none"> <li>▪ use (strategies and algorithms)</li> </ul> </li>   <li>➤ multiply (one digit whole numbers by multiples of 10)               <ul style="list-style-type: none"> <li>○ using (strategies)</li> </ul> </li> </ul>
Big Ideas	
Student’s statements of enduring ideas	
1. Understanding place value enables us to round numbers and perform computations. 2. Properties of operations allow us to reorder, decompose and/or compose numbers in order to make computation simpler.	
Essential Questions	
Teacher’s guiding questions	
1. How can understanding place value help us? 2. How do the properties of operations make computation simpler?	

## Grade 3 Mathematics – Number and Operations in Base Ten

### Learning Objectives

The students will be able to:

- a. Round whole numbers up to 1000 to the nearest 10 or 100.
- b. Illustrate how to round numbers using a number line.
- c. Justify solutions to rounding and computation problems.
- d. Fluently add and subtract within 1000 using strategies and a variety of algorithms.
- e. Multiply one-digit whole numbers by multiples of 10 (in the range of 10-90).

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use base-ten blocks, drawings and/or technology to model and have students investigate ways to compute with whole numbers.
- facilitate classroom discussions focused on the variety of strategies students use to add, subtract and multiply whole numbers to make connections to place value, the relationships among operations, and the properties of operations.
- model and have students use number lines to round, add and subtract whole numbers.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

## Grade 3 Mathematics – Number and Operations in Base Ten

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Number Line Rounding Game
- Race to 1000 or 0
- Multiplying by 10 Pattern Exploration
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

Grade 3 Mathematics – Number and Operations - Fractions

Common Core State Standards in Connecticut

Explanations and Examples\*

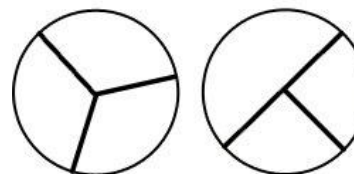
**Develop understanding of fractions as numbers.**  
 3.NF.1. Understand a fraction  $1/b$  as the quantity formed by 1 part when a whole is partitioned into  $b$  equal parts; understand a fraction  $a/b$  as the quantity formed by  $a$  parts of size  $1/b$ .

**Note: Grade 3 expectations in this domain are limited to fractions with denominators 2, 3, 4, 6, and 8.**

Some important concepts related to developing understanding of fractions include:

- Understand fractional parts must be equal-sized

Example      Non-example



These are thirds      These are NOT thirds

- The number of equal parts tell how many make a whole
- As the number of equal pieces in the whole increases, the size of the fractional pieces decreases
- The size of the fractional part is relative to the whole
  - The number of children in one-half of a classroom is different than the number of children in one-half of a school. (the whole in each set is different therefore the half in each set will be different)
- When a whole is cut into equal parts, the denominator represents the number of equal parts
- The numerator of a fraction is the count of the number of equal parts
  - $\frac{3}{4}$  means that there are 3 one-fourths
  - Students can count *one fourth, two fourths, three fourths*

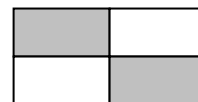
Students express fractions as fair sharing, parts of a whole, and parts of a set. They use various contexts (candy bars, fruit, and cakes) and a variety of models (circles, squares, rectangles, fraction bars, and number lines) to develop understanding of fractions and represent fractions. Students need many opportunities to solve word problems that require fair sharing.

## Grade 3 Mathematics – Number and Operations - Fractions

To develop understanding of fair shares, students first participate in situations where the number of objects is greater than the number of children and then progress into situations where the number of objects is less than the number of children.

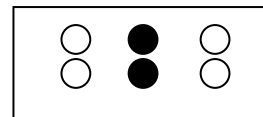
Examples:

- Four children share six brownies so that each child receives a fair share. How many brownies will each child receive?
- Six children share four brownies so that each child receives a fair share. What portion of each brownie will each child receive?
- What fraction of the rectangle is shaded? How might you draw the rectangle in another way but with the same fraction shaded?

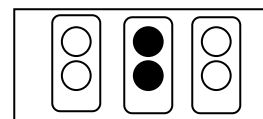


Solution:  $\frac{2}{4}$  or  $\frac{1}{2}$

What fraction of the set is black?



Solution:  $\frac{2}{6}$



Solution:  $\frac{1}{3}$

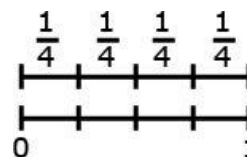
Grade 3 Mathematics – Number and Operations - Fractions

**3.NF.2. Understand a fraction as a number on the number line; represent fractions on a number line diagram.**

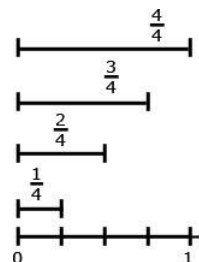
- a. Represent a fraction  $1/b$  on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into  $b$  equal parts. Recognize that each part has size  $1/b$  and that the endpoint of the part based at 0 locates the number  $1/b$  on the number line.
- b. Represent a fraction  $a/b$  on a number line diagram by marking off  $a$  lengths  $1/b$  from 0. Recognize that the resulting interval has size  $a/b$  and that its endpoint locates the number  $a/b$  on the number line.

Students transfer their understanding of parts of a whole to partition a number line into equal parts. There are two new concepts addressed in this standard which students should have time to develop.

- 1. On a number line from 0 to 1, students can partition (divide) it into equal parts and recognize that each segmented part represents the same length.



- 2. Students label each fractional part based on how far it is from zero to the endpoint.



### Grade 3 Mathematics – Number and Operations - Fractions

- 3.NF.3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.**
- a. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.**
  - b. Recognize and generate simple equivalent fractions, e.g.,  $1/2 = 2/4$ ,  $4/6 = 2/3$ . Explain why the fractions are equivalent, e.g., by using a visual fraction model.**
  - c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.**  
*Examples: Express 3 in the form  $3 = 3/1$ ; recognize that  $6/1 = 6$ ; locate  $4/4$  and 1 at the same point of a number line diagram.*
  - d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols  $>$ ,  $=$ , or  $<$ , and justify the conclusions, e.g., by using a visual fraction model.**

An important concept when comparing fractions is to look at the size of the parts and the number of the parts. For example,  $\frac{1}{8}$  is smaller than  $\frac{1}{2}$  because when 1 whole is cut into 8 pieces, the pieces are much smaller than when 1 whole is cut into 2 pieces.

Students recognize when examining fractions with common denominators, the wholes have been divided into the same number of equal parts. So the fraction with the larger numerator has the larger number of equal parts.

$$\frac{2}{6} < \frac{5}{6}$$

To compare fractions that have the same numerator but different denominators, students understand that each fraction has the same number of equal parts but the size of the parts are different. They can infer that the same number of smaller pieces is less than the same number of bigger pieces.

$$\frac{3}{8} < \frac{3}{4}$$

Grade 3 Mathematics – Number and Operations - Fractions

Unwrapped Performance Standards

<b>Concepts:</b> Need to know about:	<b>Skills:</b> Need to be able to:
<p>Fractions</p> <ul style="list-style-type: none"> <li>• whole partitioned into equal parts           <ul style="list-style-type: none"> <li>- regions</li> <li>- number lines               <ul style="list-style-type: none"> <li>○ interval 0-1 as the whole                   <ul style="list-style-type: none"> <li>◆ fraction as the distance from 0</li> </ul> </li> </ul> </li> <li>- numerator (equal parts being counted)</li> <li>- denominator (size or total number of equal parts)               <ul style="list-style-type: none"> <li>○ halves, thirds, fourths, sixths and eighths</li> </ul> </li> </ul> </li> <li>• equivalence           <ul style="list-style-type: none"> <li>- visual models               <ul style="list-style-type: none"> <li>○ same-size fractions</li> <li>○ same point on number line</li> <li>○ whole numbers as fractions</li> </ul> </li> </ul> </li> <li>• comparison (same-size wholes)           <ul style="list-style-type: none"> <li>- same numerators</li> <li>- same denominators</li> <li>- symbols &lt;, &gt;, =</li> <li>- visual models</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ Partition (a whole)           <ul style="list-style-type: none"> <li>○ into equal-size parts</li> </ul> </li> <li>➤ Represent (fractions on a number line diagram)           <ul style="list-style-type: none"> <li>○ by partitioning (the interval from 0-1 (the whole) in equal parts)</li> </ul> </li> <li>➤ Understand (fraction <math>a/b</math> as <math>a</math> parts of size <math>1/b</math>)</li> <li>➤ Recognize and generate (equivalent fractions)           <ul style="list-style-type: none"> <li>○ justify using (visual models)</li> </ul> </li> <li>➤ Express (whole numbers as fractions)</li> <li>➤ Recognize (fractions equivalent to whole numbers)</li> <li>➤ Compare (two fractions)           <ul style="list-style-type: none"> <li>○ using (symbols)               <ul style="list-style-type: none"> <li>▪ justify using (visual models)</li> </ul> </li> </ul> </li> </ul>

## Grade 3 Mathematics – Number and Operations - Fractions

### Big Ideas

Student's statements of enduring ideas

1. The numerator tells the count of the number of equal parts and the denominator tells the number of equal parts in the whole.
2. As the number of equal parts of the whole increases, the size of the equal parts decreases and vice versa.
3. The size of the fractional part is relative to the whole. One-half is not equal to one-half when the wholes are different sizes (e.g.  $\frac{1}{2}$  of a small pizza vs.  $\frac{1}{2}$  of a large pizza).
4. Equivalent fractions are the same size and have the same value, but are written differently.
5. Comparing two fractions requires thinking about the size of the parts and the number of the parts.

### Essential Questions

Teacher's guiding questions

1. How are the numerator and denominator related in a fraction?
2. How does the size of equal parts relate to the number of equal parts of a whole?
3. When is one-half not equal to one-half?
4. What are equivalent fractions?
5. What do you have to think about when comparing fractions?

### Learning Objectives

The students will be able to:

- a. Write fractions that illustrate fair shares, parts of a whole or parts of a set in a variety of contexts.
- b. Represent fractions with models, symbols and words and make connections between the representations.
- c. Solve fair share story problems involving fractions.
- d. Partition the interval from 0-1 on a number line into equal parts and label each part.
- e. Identify equivalent fractions using models, drawings and number lines.
- f. Generate equivalent fractions and justify why they are equivalent.
- g. Express whole numbers as fractions and vice versa.
- h. Compare two fractions with the same numerator or the same denominator.
- i. Justify comparisons of fractions using visual models.

## Grade 3 Mathematics – Number and Operations - Fractions

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate fraction concepts.
- have students use models to show that any fraction can be described as a number of parts of a unit fraction (e.g.  $\frac{3}{4}$  is 3 parts of size  $\frac{1}{4}$ ). In the next grades, students will use this information to decompose fractions.
- facilitate classroom discussions focused on the strategies used to represent, compare and find equivalent fractions
- introduce fraction fair share problems by starting with a number of objects to be shared greater than the number of people sharing and then progress to the number of objects being less. [See explanation and examples.](#)
- model and have students use number lines to represent, compare and find equivalent fractions.
- guide students to make connections among representations of fractions (words, symbols and various visual models).
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students experience and observations of fractions in their world.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- How many different ways to find  $\frac{1}{4}$  exploration (considering examples and non-examples)
- When is  $\frac{1}{2}$  greater than  $\frac{1}{2}$ ? performance task
- Fraction bar/number line equivalence activity
- Comparing fractions - true, false, justify
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

Grade 3 Mathematics – Measurement and Data	
Common Core State Standards in Connecticut	Explanations and Examples*
<p><b>Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.</b></p> <p>3.MD.1. Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.</p> <p>3.MD.2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). (Excludes compound units such as <math>\text{cm}^3</math> and finding the geometric volume of a container.) Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. Excludes multiplicative comparison problems (problems involving notions of “times as much”; see Table 2).</p>	<p>Students in second grade learned to tell time to the nearest five minutes. In third grade, they extend telling time and measure elapsed time both in and out of context using clocks and number lines.</p> <p>Students need multiple opportunities weighing classroom objects and filling containers to help them develop a basic understanding of the size and weight of a liter, a gram, and a kilogram. Milliliters may also be used to show amounts that are less than a liter.</p> <p>Example:        Students identify 5 things that weigh about one gram. They record their findings with words and pictures. (Students can repeat this for 5 grams and 10 grams.) This activity helps develop gram benchmarks. One large paperclip weighs about one gram. A box of large paperclips (100 clips) weighs about 100 grams so 10 boxes would weigh one kilogram.</p>

**Grade 3 Mathematics – Measurement and Data**

**Represent and interpret data.**

3.MD.3. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.*

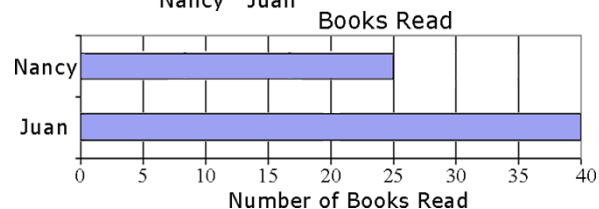
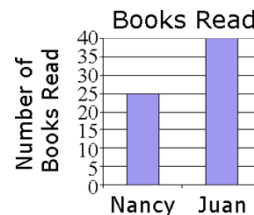
Students should have opportunities reading and solving problems using scaled graphs before being asked to draw one. The following graphs all use five as the scale interval, but students should experience different intervals to further develop their understanding of scale graphs and number facts.

- Pictographs: Scaled pictographs include symbols that represent multiple units. Below is an example of a pictograph with symbols that represent multiple units. Graphs should include a title, categories, category label, key, and data.

Number of Books Read	
Nancy	✧ ✧ ✧ ✧ ✧
Juan	✧ ✧ ✧ ✧ ✧ ✧ ✧ ✧
✧ = 5 Books	

How many more books did Juan read than Nancy?

- Single Bar Graphs: Students use both horizontal and vertical bar graphs. Bar graphs include a title, scale, scale label, categories, category label, and data.



**Grade 3 Mathematics – Measurement and Data**

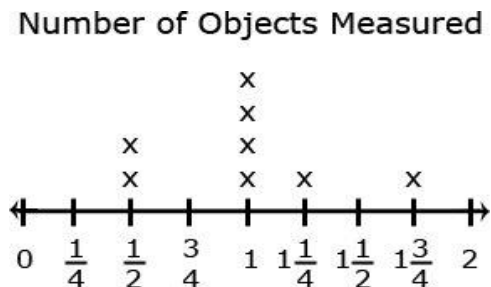
3.MD.4. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

Students in second grade measured length in whole units using both metric and U.S. customary systems. It’s important to review with students how to read and use a standard ruler including details about halves and quarter marks on the ruler. Students should connect their understanding of fractions to measuring to one-half and one-quarter inch. Third graders need many opportunities measuring the length of various objects in their environment.

Some important ideas related to measuring with a ruler are:

- The starting point of where one places a ruler to begin measuring
- Measuring is approximate. Items that students measure will not always measure exactly  $\frac{1}{4}$ ,  $\frac{1}{2}$  or one whole inch. Students will need to decide on an appropriate estimate length.
- Making paper rulers and folding to find the half and quarter marks will help students develop a stronger understanding of measuring length

Students generate data by measuring and create a line plot to display their findings. An example of a line plot is shown below:



## Grade 3 Mathematics – Measurement and Data

### Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

3.MD.5. Recognize area as an attribute of plane figures and understand concepts of area measurement.

- A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area.
- A plane figure which can be covered without gaps or overlaps by  $n$  unit squares is said to have an area of  $n$  square units.

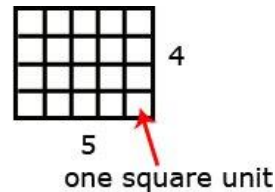
3.MD.6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

3.MD.7. Relate area to the operations of multiplication and addition.

- Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.
- Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.

Students develop understanding of using square units to measure area by:

- Using different sized square units
- Filling in an area with the same sized square units and counting the number of square units
- An interactive whiteboard would allow students to see that square units can be used to cover a plane figure.



Using different sized graph paper, students can explore the areas measured in square centimeters and square inches.

Students tile areas of rectangles, determine the area, record the length and width of the rectangle, investigate the patterns in the numbers, and discover that the area is the length times the width.

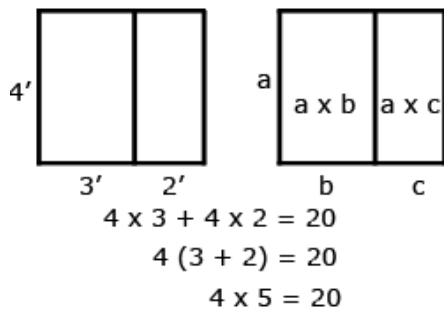
Example:

Joe and John made a poster that was 4' by 3'. Mary and Amir made a poster that was 4' by 2'. They placed their posters on the wall side-by-side so that there was no space between them. How much area will the two posters cover?

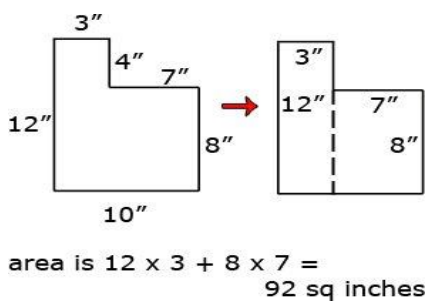
**Grade 3 Mathematics – Measurement and Data**

- c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths  $a$  and  $b + c$  is the sum of  $a \times b$  and  $a \times c$ . Use area models to represent the distributive property in mathematical reasoning.
- d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.

Students use pictures, words, and numbers to explain their understanding of the distributive property in this context.



Example:  
 Students can decompose a rectilinear figure into different rectangles. They find the area of the figure by adding the areas of each of the rectangles together.



3.MD.8. Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Students develop an understanding of the concept of perimeter by walking around the perimeter of a room, using rubber bands to represent the perimeter of a plane figure on a geoboard, or tracing around a shape on an interactive whiteboard. They find the perimeter of objects; use addition to find perimeters; and recognize the patterns that exist when finding the sum of the lengths and widths of rectangles.

## Grade 3 Mathematics – Measurement and Data

Students use geoboards, tiles, and graph paper to find all the possible rectangles that have a given perimeter (e.g., find the rectangles with a perimeter of 14 cm.) They record all the possibilities using dot or graph paper, compile the possibilities into an organized list or a table, and determine whether they have all the possible rectangles.

Given a perimeter and a length or width, students use objects or pictures to find the missing length or width. They justify and communicate their solutions using words, diagrams, pictures, numbers, and an interactive whiteboard.

Students use geoboards, tiles, graph paper, or technology to find all the possible rectangles with a given area (e.g. find the rectangles that have an area of 12 square units.) They record all the possibilities using dot or graph paper, compile the possibilities into an organized list or a table, and determine whether they have all the possible rectangles. Students then investigate the perimeter of the rectangles with an area of 12.

Area	Length	Width	Perimeter
12 sq. in.	1 in.	12 in.	26 in.
12 sq. in.	2 in.	6 in.	16 in.
12 sq. in.	3 in.	4 in.	14 in.
12 sq. in.	4 in.	3 in.	14 in.
12 sq. in.	6 in.	2 in.	16 in.
12 sq. in.	12 in.	1 in.	26 in.

The patterns in the chart allow the students to identify the factors of 12, connect the results to the commutative property, and discuss the differences in perimeter within the same area. This chart can also be used to investigate rectangles with the same perimeter. It is important to include squares in the investigation.

Grade 3 Mathematics – Measurement and Data	
Unwrapped Performance Standards	
<b>Concepts:</b> Need to know about:	<b>Skills:</b> Need to be able to:
<p>Time</p> <ul style="list-style-type: none"> <li>• nearest minute</li> <li>• elapsed time (minute intervals)               <ul style="list-style-type: none"> <li>- word problems                   <ul style="list-style-type: none"> <li>○ number line diagrams</li> </ul> </li> </ul> </li> </ul> <p>Liquid Volume/Mass</p> <ul style="list-style-type: none"> <li>• liters, milliliters, grams, kilograms               <ul style="list-style-type: none"> <li>- word problems (one-step)                   <ul style="list-style-type: none"> <li>○ same-size units</li> <li>○ drawings</li> </ul> </li> </ul> </li> </ul> <p>Linear Measurement</p> <ul style="list-style-type: none"> <li>• rulers               <ul style="list-style-type: none"> <li>- half inch</li> <li>- quarter inch</li> </ul> </li> </ul> <p>Area</p> <ul style="list-style-type: none"> <li>• counting of unit squares (square cm, square m, square in, square feet, improvised units)               <ul style="list-style-type: none"> <li>- square with side length of 1 unit</li> <li>- no gaps or overlaps</li> </ul> </li> <li>• tiling of rectangles               <ul style="list-style-type: none"> <li>- multiplication of side lengths of rectangles</li> <li>- concrete representation of the distributive property</li> </ul> </li> <li>• decomposing rectilinear figures (non-overlapping areas)               <ul style="list-style-type: none"> <li>- additive</li> </ul> </li> <li>• real-world problems</li> </ul>	<ul style="list-style-type: none"> <li>➤ Tell and write (time)</li> <li>➤ Calculate (elapsed time)</li> <li>➤ Solve (elapsed time world problems)               <ul style="list-style-type: none"> <li>○ using (number line diagrams)</li> </ul> </li> <li>➤ Measure and estimate (liquid volume and mass)               <ul style="list-style-type: none"> <li>○ using (standard units)</li> </ul> </li> <li>➤ Solve (word problems)               <ul style="list-style-type: none"> <li>○ involving (same-sized units)</li> <li>○ using (drawings)</li> </ul> </li> <li>➤ Measure (lengths)               <ul style="list-style-type: none"> <li>○ using (rulers)</li> </ul> </li> <li>➤ Measure (areas)               <ul style="list-style-type: none"> <li>○ by counting (unit squares)</li> </ul> </li> <li>➤ Find (area)               <ul style="list-style-type: none"> <li>○ by tiling</li> <li>○ by multiplying side lengths of rectangles                   <ul style="list-style-type: none"> <li>▪ using (real-world problems)</li> </ul> </li> <li>○ by decomposing (rectilinear figures) and adding (areas of non-overlapping parts)                   <ul style="list-style-type: none"> <li>▪ using (real-world problems)</li> </ul> </li> </ul> </li> <li>➤ Represent (the distributive property)               <ul style="list-style-type: none"> <li>○ using (area models)</li> </ul> </li> </ul>

### Grade 3 Mathematics – Measurement and Data

#### Perimeter

- polygons

#### Data Analysis

- scaled picture and bar graph
  - several categories
  - one- and two-step problems
    - How many more?
    - How many less?
- line plot
  - linear measurements

- Solve (real-world and mathematical problems)
  - find (perimeter, given side lengths)
  - find (unknown side length, given perimeter)
  - create (rectangles with same perimeter, different areas)
  - create (rectangles with same area, different perimeters)
- Draw (scaled picture graph and bar graph)
  - representing (several categories)
- Solve (one- and two-step word problems)
  - using (scaled bar graph)
- Display (measurement data)
  - using (line plots)

## Grade 3 Mathematics – Measurement and Data

### Big Ideas

Student's statements of enduring ideas

1. Being able to tell time and find elapsed time is useful for making plans and schedules and determining how long an event lasts.
2. Measurement allows us to tell how many standard units of an attribute an item has and solve problems with the quantities.
3. Liquid volume and mass tell us how much matter in a three-dimensional space.
4. We estimate the measurement of an object by comparing the object to personal referents or easy-to-use “benchmark” units.
5. We collect, organize, represent, and analyze data in order to answer a question or solve a problem.
6. Area is a measure of the region inside a 2-dimensional figure and is measured in square units.
7. Perimeter is a linear measure of the distance around a figure.

### Essential Questions

Teacher's guiding questions

1. Why is it useful to know about time?
2. Why is measurement useful?
3. What are we measuring when we find liquid volume or mass?
4. How do we estimate the measurement of an object?
5. Why do we collect, organize, represent and analyze data?
6. What are we measuring when we find area?
7. What are we measuring when we find perimeter?

## Grade 3 Mathematics – Measurement and Data

### Learning Objectives

The students will be able to:

- a. Tell and write time to the nearest minute.
- b. Determine elapsed time in minutes.
- c. Solve elapsed time word problems using number lines.
- d. Estimate and measure liquid volumes and mass.
- e. Identify personal referents for metric measures including grams, kilograms and liters.
- f. Solve measurement problems with all four operations.
- g. Represent measurement problems using drawings and number lines.
- h. Create scaled picture and scaled bar graphs to represent categorical data.
- i. Solve one- and two-step word problems using information presented in scaled bar graphs.
- j. Measure lengths to the  $\frac{1}{2}$  and  $\frac{1}{4}$  inch using a ruler.
- k. Create line plots from measurement data with a horizontal scale of whole numbers, halves or quarters.
- l. Measure areas by tiling and counting unit squares.
- m. Determine areas of rectangles by multiplying side lengths.
- n. Solve real-world area problems.
- o. Represent products as rectangular arrays.
- p. Show the distributive property using area models.
- q. Find the area of irregular shapes (rectilinear only).
- r. Find perimeter of polygons.
- s. Determine an unknown side length of polygon given a perimeter.
- t. Create and solve problems with rectangles with the same perimeter and different areas and vice versa.

## Grade 3 Mathematics – Measurement and Data

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives, tools and/or technology to model and have students investigate measurement and data concepts.
- have students use a number line to represent and solve elapsed time problems.
- encourage students to generate personal referents for a variety of units of volume and mass (gram, kilogram, liter).
- have students use tools (grid paper, rulers, etc.) and/or technology to create line plots, scaled bar and picture graphs with appropriate titles and labels.
- engage students in investigating the relationship between the area of a tiled rectangle and the length and width of its sides.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students experience and observations of measurement in their world.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Investigating volumes lab
- Pencil length line plot activity
- Scaled graphs performance task
- [Rectangle perimeter/area investigation](#)
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

Grade 3 Mathematics – Geometry

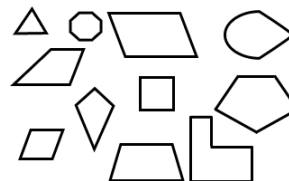
Common Core State Standards in Connecticut

Explanations and Examples\*

**Reason with shapes and their attributes.**

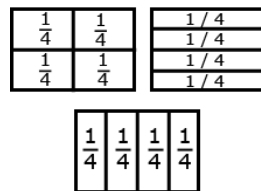
3.G.1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

In second grade, students identify and draw triangles, quadrilaterals, pentagons, and hexagons. Third graders build on this experience and further investigate quadrilaterals (technology may be used during this exploration). Students recognize shapes that are and are not quadrilaterals by examining the properties of the geometric figures. They conceptualize that a quadrilateral must be a closed figure with four straight sides and begin to notice characteristics of the angles and the relationship between opposite sides. Students should be encouraged to provide details and use proper vocabulary when describing the properties of quadrilaterals. They sort geometric figures (see examples below) and identify squares, rectangles, and rhombuses as quadrilaterals.



3.G.2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape*

Given a shape, students partition it into equal parts, recognizing that these parts all have the same area. They identify the fractional name of each part and are able to partition a shape into parts with equal areas in several different ways.



Grade 3 Mathematics – Geometry	
Unwrapped Performance Standards	
<u>Concepts:</u> Need to know about:	<u>Skills:</u> Need to be able to:
<p>Quadrilaterals</p> <ul style="list-style-type: none"> <li>• polygon with four straight sides               <ul style="list-style-type: none"> <li>- rhombus                   <ul style="list-style-type: none"> <li>○ 4 congruent sides</li> </ul> </li> <li>- rectangle                   <ul style="list-style-type: none"> <li>○ 4 right angles</li> </ul> </li> <li>- square                   <ul style="list-style-type: none"> <li>○ 4 congruent sides</li> <li>○ 4 right angles</li> </ul> </li> </ul> </li> </ul> <p>Partitioning of shapes</p> <ul style="list-style-type: none"> <li>• parts that have equal area</li> </ul> <p>area of each part expressed as a unit fraction</p>	<ul style="list-style-type: none"> <li>➤ Recognize (quadrilaterals)               <ul style="list-style-type: none"> <li>○ using (shared attributes)</li> </ul> </li> <li>➤ Draw (quadrilaterals that are non-examples of rhombi, rectangles, and squares)</li>   <li>➤ Partition (shapes into equal parts)</li> <li>➤ Express (equal parts of a shape)               <ul style="list-style-type: none"> <li>○ using (unit fractions)</li> </ul> </li> </ul>
<p><b>Big Ideas</b>            Student’s statements of enduring ideas</p>	
<ol style="list-style-type: none"> <li>1. Polygons can be compared, sorted and classified using attributes, e.g. number of sides.</li> <li>2. Partitioning a shape into equal parts in more than one way can help us see that equal parts can look different, but have the same area.</li> </ol>	
<p><b>Essential Questions</b>            Teacher’s guiding questions</p>	
<ol style="list-style-type: none"> <li>1. How can polygons be described and classified?</li> <li>2. How does partitioning help us reason about shapes?</li> </ol>	

## Grade 3 Mathematics – Geometry

### Learning Objectives

The students will be able to:

- a. Recognize rhombuses, rectangles and squares as examples of quadrilaterals.
- b. Draw examples of quadrilaterals that are not rectangles, rhombuses or squares.
- c. Justify solutions to sorting problems involving quadrilaterals.
- d. Partition rectangles into parts with equal areas and name the area of each part as a unit fraction of the whole.

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate quadrilaterals, as well as area and fraction concepts.
- use examples and non-examples of specific quadrilaterals to develop students' understanding of defining attributes.
- have students use the Four Square model to help define geometric vocabulary.
- provide opportunities for students to explore the partitioning of a rectangle into the same number of equal pieces in multiple ways.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students' experience and observations of geometry in their world.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

**Grade 3 Mathematics – Geometry**

**Assessments/Common Learning Experiences**

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Quadrilateral sort
- Partitioning exploration
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets)
- Topic assessments
- District benchmark assessments

## Appendix

Table 1: Multiplication and Division Situations<sup>1</sup>

	Unknown Product	Group Size Unknown ("How many in each group?" Division)	Number of Groups Unknown ("How many groups?" Division)
	$3 \times 6 = ?$	$3 \times ? = 18$ , and $18 \div 3 = ?$	$? \times 6 = 18$ , and $18 \div 6 = ?$
Equal Groups	<p>There are 3 bags with 6 plums in each bag. How many plums are there in all?</p> <p><i>Measurement example.</i> You need 3 lengths of string, each 6 inches long. How much string will you need altogether?</p>	<p>If 18 plums are shared equally into 3 bags, then how many plums will be in each bag?</p> <p><i>Measurement example.</i> You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?</p>	<p>If 18 plums are to be packed 6 to a bag, then how many bags are needed?</p> <p><i>Measurement example.</i> You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?</p>
Arrays <sup>4</sup> Area <sup>5</sup>	<p>There are 3 rows of apples with 6 apples in each row. How many apples are there?</p> <p><i>Area example.</i> What is the area of a 3 cm by 6 cm rectangle?</p>	<p>If 18 apples are arranged into 3 equal rows, how many apples will be in each row?</p> <p><i>Area example.</i> A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?</p>	<p>If 18 apples are arranged into equal rows of 6 apples, how many rows will there be?</p> <p><i>Area example.</i> A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?</p>
Compare	<p>A blue hat costs \$6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost?</p> <p><i>Measurement example.</i> A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?</p>	<p>A red hat costs \$18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost?</p> <p><i>Measurement example.</i> A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?</p>	<p>A red hat costs \$18 and a blue hat costs \$6. How many times as much does the red hat cost as the blue hat?</p> <p><i>Measurement example.</i> A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?</p>
General	$a \times b = ?$	$a \times ? = p$ , and $p \div a = ?$	$? \times b = p$ , and $p \div b = ?$

<sup>4</sup>The language in the array examples shows the easiest form of array problems. A harder form is to use the terms rows and columns: The apples in the grocery window are in 3 rows and 6 columns. How many apples are in there? Both forms are valuable.

<sup>5</sup>Area involves arrays of squares that have been pushed together so that there are no gaps or overlaps, so array problems include these especially important measurement situations.



**Bristol Public Schools  
 Office of Teaching & Learning**

**DEPARTMENT:** Elementary Mathematics

**COURSE:** Grade 5 Mathematics

**COURSE DESCRIPTION**

<b>Mathematical topics include:</b>	<b>Instruction focuses on three critical areas:</b>
<ul style="list-style-type: none"> <li>• decimals to thousandths;</li> <li>• multiplication and division of whole numbers;</li> <li>• decimal computation;</li> <li>• fraction computation;</li> <li>• numerical expressions;</li> <li>• measurement;</li> <li>• conversion</li> <li>• line plots;</li> <li>• volume;</li> <li>• coordinate grids;</li> <li>• 2-dimensional shapes</li> </ul>	<p><b>Fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions).</b>          Students apply their understanding of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators as equivalent calculations with like denominators. They develop fluency in calculating sums and differences of fractions, and make reasonable estimates of them. Students also use the meaning of fractions, of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for multiplying and dividing fractions make sense. (Note: this is limited to the case of dividing unit fractions by whole numbers and whole numbers by unit fractions.)</p> <p><b>Extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations.</b>          Students develop understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.</p> <p><b>Developing understanding of volume.</b>          Students recognize volume as an attribute of three-dimensional space. They understand that volume can be measured by finding the total number of same-size units of volume required to fill the space without gaps or overlaps. They understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. They select appropriate units, strategies, and tools for solving problems that involve estimating and measuring volume. They decompose three-dimensional shapes and find volumes of right rectangular prisms by viewing them as decomposed into layers of arrays of cubes. They measure necessary attributes of shapes in order to determine volumes to solve real world and mathematical problems.</p>

## **DEPARTMENT PHILOSOPHY**

The philosophy of the elementary mathematics department is to develop mathematically literate and productive students who can effectively and efficiently apply mathematics in their lives to make informed decisions about the world around them. To be mathematically literate, one must understand major mathematics concepts, possess computational facility and have the ability to apply these understandings to situations in daily life. Making connections between mathematics and other disciplines is key to the appropriate application of mathematics skills and concepts to solve problems. The ability to read, discuss and write within the discipline of mathematics is an integral skill that supports mathematical understanding, reasoning and communication. The opportunity to think critically and creatively to solve problems is important to deepen mathematical knowledge and foster innovation. A rich mathematical experience in the elementary grades is essential to provide the foundational knowledge and skills that prepare students to be mathematically literate, productive citizens.

The Bristol elementary mathematics curriculum focuses on high expectations for **all** students and provides a balanced approach to mathematics education, placing equal importance on conceptual understanding, computational and procedural fluency and problem solving through the use of a variety of strategies, tools and technologies. The mathematics curriculum is responsive to the individual needs of students. While providing a structure tied to the Common Core State Standards in Connecticut, it allows for classroom experiences, additional supports and enrichment ensuring students' access to the content at an appropriate level of challenge.

## **DEPARTMENT GOALS**

Through a planned, sequential curriculum, Bristol Public schools strives to educate each student in conjunction with the Common Core State Standards in Connecticut. As a result, students will be able to demonstrate knowledge and skills in each of the following:

- ◆ Operations and Algebraic Thinking
- ◆ Number and Operations in Base Ten
- ◆ Number and Operations - Fractions
- ◆ Measurement and Data
- ◆ Geometry

In addition, teachers will support students in developing the following mathematical practices aligned to those found in the Common Core State Standards in Connecticut.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

## **PHILOSOPHY OF INSTRUCTION**

Based on our department philosophy and goals, elementary math teachers will:

- ensure a minimum of one hour of daily instructional time for mathematics (kindergarten – 30 minutes);
- provide a safe, supportive and respectful classroom environment conducive to learning, where students are encouraged to take risks and share ideas;
- have a deep understanding of the mathematical concepts and skills in the curriculum and strong pedagogical content knowledge;
- use the BOE approved textbook and a variety of resources to have students read about, explore and reinforce curriculum concepts and skills;
- build upon students' prior knowledge and experience, and real-world events, to foster connections and make learning relevant and meaningful;
- provide students with developmentally appropriate opportunities to question, explore, observe, synthesize and draw conclusions based on their mathematics understanding;
- use high-level questions and rich tasks to facilitate classroom discourse, both oral and written, to encourage student-student, student-teacher and teacher-student communication;
- incorporate and highlight key mathematical vocabulary during instruction and require students to use this vocabulary appropriately in their communications;
- model and have students use manipulatives, tools and technology to actively explore and build understanding of mathematical concepts;
- structure learning experiences that utilize a variety of grouping strategies to encourage collaborative problem solving; and
- differentiate instruction to meet the needs of a variety of learners based on student readiness, interest, and learning style and provide supplemental mathematics intervention or enrichment as needed.

**Note: The instructional strategies recommended in our resource document are specific examples of these expectations in practice. They serve as a starting point for planning and implementing instruction that will develop our students as thinkers. Teachers may create new instructional strategies and activities as they continue to grow professionally and as they develop an understanding of each student's unique strengths, weaknesses, and interests.**

## **PHILOSOPHY OF ASSESSMENT**

Based on our department philosophy and goals, elementary math teachers will:

- align assessments with instruction;
- use a variety of formative and summative assessment throughout each unit of instruction;
- design and use assessments that include questions at varied levels of cognitive demand;
- analyze results and plan or modify instruction based on the results;
- provide specific, constructive feedback for students;
- support students in goal setting and the monitoring and evaluation of their progress; and
- collaborate with colleagues and use scoring rubrics to evaluate student work as appropriate.

Grade 5 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

Common Core State Standards in Connecticut

Explanations and Examples\*

**Write and interpret numerical expressions.**

5.OA.1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

This standard builds on the expectations of third grade where students are expected to start learning the conventional order. Students need experiences with multiple expressions that use grouping symbols throughout the year to develop understanding of when and how to use parentheses, brackets, and braces. First, students use these symbols with whole numbers. Then the symbols can be used as students add, subtract, multiply and divide decimals and fractions.

Examples:

- $(26 + 18) \div 4$  Answer: 11
- $\{[2 \times (3+5)] - 9\} + [5 \times (23-18)]$  Answer: 32
- $12 - (0.4 \times 2)$  Answer: 11.2
- $(2 + 3) \times (1.5 - 0.5)$  Answer: 5
- $6 - \left(\frac{1}{2} + \frac{1}{3}\right)$  Answer: 5  $\frac{1}{6}$
- $\{ 80 [ 2 \times (3 \frac{1}{2} + 1 \frac{1}{2} ) ] \} + 100$  Answer: 108

To further develop students' understanding of grouping symbols and facility with operations, students place grouping symbols in equations to make the equations true or they compare expressions that are grouped differently.

Examples:

- $15 - 7 - 2 = 10 \rightarrow 15 - (7 - 2) = 10$
  - $3 \times 125 \div 25 + 7 = 22 \rightarrow [3 \times (125 \div 25)] + 7 = 22$
  - $24 \div 12 \div 6 \div 2 = 2 \times 9 + 3 \div \frac{1}{2} \rightarrow 24 \div [(12 \div 6) \div 2] = (2 \times 9) + (3 \div \frac{1}{2})$
  - Compare  $3 \times 2 + 5$  and  $3 \times (2 + 5)$
- Compare  $15 - 6 + 7$  and  $15 - (6 + 7)$

Grade 5 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

5.OA.2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation “add 8 and 7, then multiply by 2” as  $2 \times (8 + 7)$ . Recognize that  $3 \times (18932 + 921)$  is three times as large as  $18932 + 921$ , without having to calculate the indicated sum or product.*

**Analyze patterns and relationships.**

5.OA.3. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule “Add 3” and the starting number 0, and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*

Students use their understanding of operations and grouping symbols to write expressions and interpret the meaning of a numerical expression.

Examples:

- Students write an expression for calculations given in words such as “divide 144 by 12, and then subtract  $7/8$ .” They write  $(144 \div 12) - 7/8$ .

Students recognize that  $0.5 \times (300 \div 15)$  is  $1/2$  of  $(300 \div 15)$  without calculating the quotient.

Example:

Use the rule “add 3” to write a sequence of numbers. Starting with a 0, students write 0, 3, 6, 9, 12, . . .

Use the rule “add 6” to write a sequence of numbers. Starting with 0, students write 0, 6, 12, 18, 24, . . .

After comparing these two sequences, the students notice that each term in the second sequence is twice the corresponding terms of the first sequence. One way they justify this is by describing the patterns of the terms. Their justification may include some mathematical notation (See example below). A student may explain that both sequences start with zero and to generate each term of the second sequence he/she added 6, which is twice as much as was added to produce the terms in the first sequence. Students may also use the distributive property to describe the relationship between the two numerical patterns by reasoning that  $6 + 6 + 6 = 2(3 + 3 + 3)$ .

$$0, \quad +^3 3, \quad +^3 6, \quad +^3 9, \quad +^3 12, \dots$$

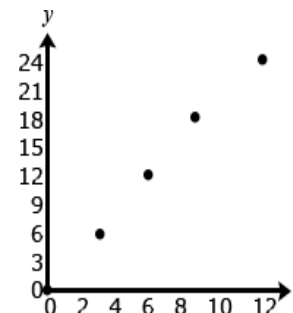
$$0, \quad +^6 6, \quad +^6 12, \quad +^6 18, \quad +^6 24, \dots$$

Grade 5 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

Once students can describe that the second sequence of numbers is twice the corresponding terms of the first sequence, the terms can be written in ordered pairs and then graphed on a coordinate grid. They should recognize that each point on the graph represents two quantities in which the second quantity is twice the first quantity.

Ordered pairs

- (0, 0)
- (3, 6)
- (6, 12)
- (9, 18)
- (12, 24)



Unwrapped Standards

**Concepts:** Need to know about:

Numerical Expressions

- symbols
  - parentheses
  - brackets
  - braces

Numerical Patterns

- two patterns
  - given rules
  - relationships between corresponding terms
  - graphing of ordered pairs on coordinate plane

**Skills:** Need to be able to:

- Evaluate (expressions)
  - using (symbols)
- Write (expressions)
  - using (symbols)
- Interpret (expressions)
  - without evaluating
- Generate (two patterns)
  - using (two given rules)
- Identify (relationships)
- Form (ordered pairs)
  - using (corresponding terms from two patterns)
- Graph (ordered pairs)
  - using (coordinate plane)

## Grade 5 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Big Ideas

Student's statements of enduring ideas

1. Mathematical situations can be translated and represented abstractly using variables, expressions, and equations.
2. We analyze patterns to determine how they change and identify relationships.

### Essential Questions

Teacher's guiding questions

1. How can we represent mathematical situations?
2. Why do we analyze patterns?

### Learning Objectives

The students will be able to:

- a. Write simple expressions that represent numerical calculations.
- b. Interpret expressions without evaluating them.
- c. Write and evaluate numerical expressions that contain parentheses, brackets, or braces.
- d. Generate two numerical patterns using two given rules.
- e. Create ordered pairs using corresponding terms from two patterns.
- f. Examine and describe the relationships between corresponding terms from two numerical patterns.
- g. Graph ordered pairs on a coordinate plane.

## Grade 5 Mathematics – OPERATIONS AND ALGEBRAIC THINKING

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate expressions and patterns.
- have students explore situations relevant to their lives to create, model and work with numerical and other expressions.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Expression Match
- Whadja-Get?
- Pattern Relationship Performance Task
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

## Grade 5 Mathematics – Number and Operations in Base Ten

### Common Core State Standards in Connecticut

### Explanations and Examples\*

#### Understand the place value system.

5.NBT.1. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and  $\frac{1}{10}$  of what it represents in the place to its left

In fourth grade, students examined the relationships of the digits in numbers for whole numbers only. This standard extends this understanding to the relationship of decimal fractions. Students use base ten blocks, pictures of base ten blocks, and interactive images of base ten blocks to manipulate and investigate the place value relationships. They use their understanding of unit fractions to compare decimal places and fractional language to describe those comparisons.

Before considering the relationship of decimal fractions, students express their understanding that in multi-digit whole numbers, a digit in one place represents 10 times what it represents in the place to its right and  $\frac{1}{10}$  of what it represents in the place to its left.

A student thinks, “I know that in the number 5555, the 5 in the tens place (5555) represents 50 and the 5 in the hundreds place (5555) represents 500. So a 5 in the hundreds place is ten times as much as a 5 in the tens place or a 5 in the tens place is  $\frac{1}{10}$  of the value of a 5 in the hundreds place.

To extend this understanding of place value to their work with decimals, students use a model of one unit; they cut it into 10 equal pieces, shade in, or describe  $\frac{1}{10}$  of that model using fractional language (“This is 1 out of 10 equal parts. So it is  $\frac{1}{10}$ ”. I can write this using  $\frac{1}{10}$  or 0.1”). They repeat the process by finding  $\frac{1}{10}$  of a  $\frac{1}{10}$  (e.g., dividing  $\frac{1}{10}$  into 10 equal parts to arrive at  $\frac{1}{100}$  or 0.01) and can explain their reasoning, “0.01 is  $\frac{1}{10}$  of  $\frac{1}{10}$  thus is  $\frac{1}{100}$  of the whole unit.”

In the number 55.55, each digit is 5, but the value of the digits is different because of the placement.

5	5	.	5	5
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## Grade 5 Mathematics – Number and Operations in Base Ten

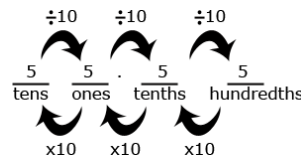
5.NBT.2. Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10

The 5 that the arrow points to is  $\frac{1}{10}$  of the 5 to the left and 10 times the 5 to the right. The 5 in the ones place is  $\frac{1}{10}$  of 50 and 10 times five tenths.

5	5	.	5	5
---	---	---	---	---



The 5 that the arrow points to is  $\frac{1}{10}$  of the 5 to the left and 10 times the 5 to the right. The 5 in the tenths place is 10 times five hundredths.



Examples:

Students might write:

- $36 \times 10 = 36 \times 10^1 = 360$
- $36 \times 10 \times 10 = 36 \times 10^2 = 3600$
- $36 \times 10 \times 10 \times 10 = 36 \times 10^3 = 36,000$
- $36 \times 10 \times 10 \times 10 \times 10 = 36 \times 10^4 = 360,000$

Students might think and/or say:

- I noticed that every time, I multiplied by 10 I added a zero to the end of the number. That makes sense because each digit's value became 10 times larger. To make a digit 10 times larger, I have to move it one place value to the left.
- When I multiplied 36 by 10, the 30 became 300. The 6 became 60 or the 36 became 360. So I had to add a zero at the end to have the 3 represent 3 one-hundreds (instead of 3 tens) and the 6 represents 6 tens (instead of 6 ones).

## Grade 5 Mathematics – Number and Operations in Base Ten

5.NBT.3. Read, write, and compare decimals to thousandths.

- a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g.,  $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$ .
- b. Compare two decimals to thousandths based on meanings of the digits in each place, using  $>$ ,  $=$ , and  $<$  symbols to record the results of comparisons.

Students should be able to use the same type of reasoning as above to explain why the following multiplication and division problem by powers of 10 make sense.

- $523 \times 10^3 = 523,000$  The place value of 523 is increased by 3 places.
- $5.223 \times 10^2 = 522.3$  The place value of 5.223 is increased by 2 places.
- $52.3 \div 10^1 = 5.23$  The place value of 52.3 is decreased by one place.

Students build on the understanding they developed in fourth grade to read, write, and compare decimals to thousandths. They connect their prior experiences with using decimal notation for fractions and addition of fractions with denominators of 10 and 100. They use concrete models and number lines to extend this understanding to decimals to the thousandths. Models may include base ten blocks, place value charts, grids, pictures, drawings, manipulatives, technology-based, etc. They read decimals using fractional language and write decimals in fractional form, as well as in expanded notation as show in the standard 3a. This investigation leads them to understanding equivalence of decimals ( $0.8 = 0.80 = 0.800$ ).

Example:

Some equivalent forms of 0.72 are:

$72/100$	$70/100 + 2/100$
$7/10 + 2/100$	$0.720$
$7 \times (1/10) + 2 \times (1/100)$	$7 \times (1/10) + 2 \times (1/100) + 0 \times (1/1000)$
$0.70 + 0.02$	$720/1000$

Students need to understand the size of decimal numbers and relate them to common benchmarks such as 0, 0.5 (0.50 and 0.500), and 1. Comparing tenths to tenths, hundredths to hundredths, and thousandths to thousandths is simplified if

## Grade 5 Mathematics – Number and Operations in Base Ten

5.NBT.4. Use place value understanding to round decimals to any place

students use their understanding of fractions to compare decimals.

Example:

Comparing 0.25 and 0.17, a student might think, “25 hundredths is more than 17 hundredths”. They may also think that it is 8 hundredths more. They may write this comparison as  $0.25 > 0.17$  and recognize that  $0.17 < 0.25$  is another way to express this comparison.

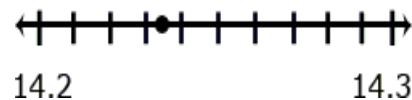
Comparing 0.207 to 0.26, a student might think, “Both numbers have 2 tenths, so I need to compare the hundredths. The second number has 6 hundredths and the first number has no hundredths so the second number must be larger. Another student might think while writing fractions, “I know that 0.207 is 207 thousandths (and may write  $207/1000$ ). 0.26 is 26 hundredths (and may write  $26/100$ ) but I can also think of it as 260 thousandths ( $260/1000$ ). So, 260 thousandths is more than 207 thousandths.

When rounding a decimal to a given place, students may identify the two possible answers, and use their understanding of place value to compare the given number to the possible answers.

Example:

Round 14.235 to the nearest tenth.

- Students recognize that the possible answer must be in tenths thus, it is either 14.2 or 14.3. They then identify that 14.235 is closer to 14.2 (14.20) than to 14.3 (14.30).



## Grade 5 Mathematics – Number and Operations in Base Ten

### Perform operations with multi-digit whole numbers and with decimals to hundredths.

.NBT.5. Fluently multiply multi-digit whole numbers using the standard algorithm.

5.NBT.6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

In prior grades, students used various strategies to multiply. Students can continue to use these different strategies as long as they are efficient, but must also understand and be able to use the standard algorithm. In applying the standard algorithm, students recognize the importance of place value.

Example:

$123 \times 34$ . When students apply the standard algorithm, they, decompose 34 into  $30 + 4$ . Then they multiply 123 by 4, the value of the number in the ones place, and then multiply 123 by 30, the value of the 3 in the tens place, and add the two products

In fourth grade, students' experiences with division were limited to dividing by one-digit divisors. This standard extends students' prior experiences with strategies, illustrations, and explanations. When the two-digit divisor is a "familiar" number, a student might decompose the dividend using place value.

Example:

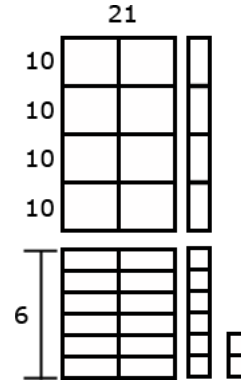
- Using expanded notation  $\sim 2682 \div 25 = (2000 + 600 + 80 + 2) \div 25$
- Using his or her understanding of the relationship between 100 and 25, a student might think  $\sim$ 
  - I know that 100 divided by 25 is 4 so 200 divided by 25 is 8 and 2000 divided by 25 is 80.
  - 600 divided by 25 has to be 24.
  - Since  $3 \times 25$  is 75, I know that 80 divided by 25 is 3 with a remainder of 5. (Note that a student might divide into 82 and not 80)
  - I can't divide 2 by 25 so 2 plus the 5 leaves a remainder of 7.
  - $80 + 24 + 3 = 107$ . So, the answer is 107 with a remainder of 7.

## Grade 5 Mathematics – Number and Operations in Base Ten

Using an equation that relates division to multiplication,  $25 \times n = 2682$ , a student might estimate the answer to be slightly larger than 100 because s/he recognizes that  $25 \times 100 = 2500$ .

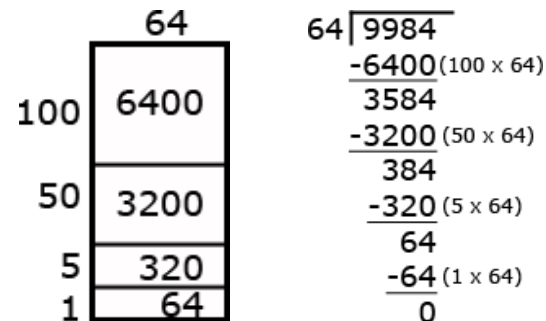
Example:  $968 \div 21$

- Using base ten models, a student can represent 962 and use the models to make an array with one dimension of 21. The student continues to make the array until no more groups of 21 can be made. Remainders are not part of the array.



Example:  $9984 \div 64$

- An area model for division is shown below. As the student uses the area model, s/he keeps track of how much of the 9984 is left to divide.



## Grade 5 Mathematics – Number and Operations in Base Ten

5.NBT.7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

This standard requires students to extend the models and strategies they developed for whole numbers in grades 1-4 to decimal values. Before students are asked to give exact answers, they should estimate answers based on their understanding of operations and the value of the numbers.

Examples:

- $3.6 + 1.7$ 
  - A student might estimate the sum to be larger than 5 because 3.6 is more than  $3\frac{1}{2}$  and 1.7 is more than  $1\frac{1}{2}$ .
- $5.4 - 0.8$ 
  - A student might estimate the answer to be a little more than 4.4 because a number less than 1 is being subtracted.
- $6 \times 2.4$ 
  - A student might estimate an answer between 12 and 18 since  $6 \times 2$  is 12 and  $6 \times 3$  is 18. Another student might give an estimate of a little less than 15 because s/he figures the answer to be very close, but smaller than  $6 \times 2\frac{1}{2}$  and think of  $2\frac{1}{2}$  groups of 6 as  $12$  (2 groups of 6) +  $3$  ( $\frac{1}{2}$  of a group of 6).

Students should be able to express that when they add decimals they add tenths to tenths and hundredths to hundredths. So, when they are adding in a vertical format (numbers beneath each other), it is important that they write numbers with the same place value beneath each other. This understanding can be reinforced by connecting addition of decimals to their understanding of addition of fractions. Adding fractions with denominators of 10 and 100 is a standard in fourth grade.

## Grade 5 Mathematics – Number and Operations in Base Ten

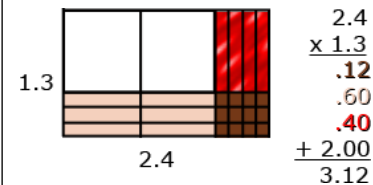
Example:  $4 - 0.3$

- 3 tenths subtracted from 4 wholes. The wholes must be divided into tenths.



The answer is 3 and  $\frac{7}{10}$  or 3.7.

Example: An area model can be useful for illustrating products.

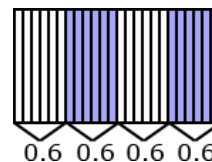


Students should be able to describe the partial products displayed by the area model. For example,

- “ $\frac{3}{10}$  times  $\frac{4}{10}$  is  $\frac{12}{100}$ .
- $\frac{3}{10}$  times 2 is  $\frac{6}{10}$  or  $\frac{60}{100}$ .
- 1 group of  $\frac{4}{10}$  is  $\frac{4}{10}$  or  $\frac{40}{100}$ .
- 1 group of 2 is 2.”

Example of division: finding the number in each group or share

- Students should be encouraged to apply a fair sharing model separating decimal values into equal parts such as



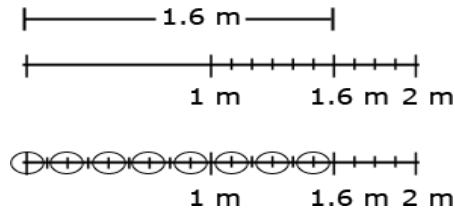
## Grade 5 Mathematics – Number and Operations in Base Ten

Example of division: find the number of groups

- Joe has 1.6 meters of rope. He has to cut pieces of rope that are 0.2 meters long. How many can he cut?

To divide to find the number of groups, a student might draw a segment to represent 1.6 meters. In doing so, s/he would count in tenths to identify the 6 tenths, and be able to identify the

number of 2 tenths within the 6 tenths. The student can then extend the idea of counting by tenths to divide the one meter into tenths and determine that there are 5 more groups of 2 tenths.



- count groups of 2 tenths without the use of models or diagrams. Knowing that 1 can be thought of as  $10/10$ , a student might think of 1.6 as 16 tenths. Counting 2 tenths, 4 tenths, 6 tenths, . . . 16 tenths, a student can count 8 groups of 2 tenths.
- Use their understanding of multiplication and think, "8 groups of 2 is 16, so 8 groups of  $2/10$  is  $16/10$  or  $1 \frac{6}{10}$ ."

## Grade 5 Mathematics – Number and Operations in Base Ten

### Unwrapped Performance Standards

**Concepts:** Need to know about:

**Skills:** Need to be able to:

**Place Value**

- multi-digit number
  - digit in one place
    - is 10 times as much as it represents in the place to its right
    - is 1/10 of what it represents in the place to its left
  - patterns when multiplying and dividing
    - powers of 10
      - whole number exponent
    - number of zeros
    - placement of the decimal point
- decimals to thousandths
  - representations
    - number names
    - expanded form
    - base-ten numerals
  - comparison
    - two decimals
    - symbols  $<$ ,  $=$ ,  $>$
  - rounding
    - any place

**Operations**

- whole numbers
  - multiplication
    - standard algorithm

- Explain (patterns of zeros)
  - multiplying by (powers of 10)
    - using (exponents)
- Explain (patterns in the placement of the decimal point)
  - multiplying or dividing by (powers of 10)
    - using (exponents)
- Read and write (decimals)
  - using (representations)
- Compare (two decimals)
  - using (symbols)
- Round (decimals)
- Multiply fluently (multi-digit whole numbers)
  - using (standard algorithm)

## Grade 5 Mathematics – Number and Operations in Base Ten

- division
    - quotients
    - strategies
      - place value
      - properties of operations
      - relationship between  $\times$  and  $\div$
    - representations
      - equations
      - rectangular arrays
      - area models
  - decimals to hundredths
    - addition, subtraction, multiplication, division
      - concrete models
      - drawings
      - strategies
        - place value
        - properties of operations
        - relationship between  $+$  and  $-$
- Divide (up to a 4- digit by a 2- digit number)
    - using strategies
    - illustrate and explain
      - using representations
  - Add, subtract, multiply and divide (decimals)
    - using (models or drawings)
    - using (strategies)
      - relate strategies to a (written method)
      - explain reasoning

## Grade 5 Mathematics – Number and Operations in Base Ten

### Big Ideas

Student's statements of enduring ideas

1. Our number system is a base-ten system. A given place value is ten times greater than the value of the place to its right (500 is ten times greater than 50) and  $\frac{1}{10}$  the value of the place to its left (0.3 is  $\frac{1}{10}$  the value of 3).
2. Understanding place value enables us to represent, compare order and round numbers and perform computations.
3. Properties of operations allow us to reorder, decompose and/or compose numbers in order to make computation simpler.
4. Division is the opposite of or “undoes” multiplication.

### Essential Questions

Teacher's guiding questions

1. How is our number system organized?
2. How can understanding place value help us?
3. How do the properties of operations make computation simpler?
4. How are multiplication and division related?

### Learning Objectives

The students will be able to:

- a. Describe the relationship between two adjacent place-values.
- b. Interpret whole number place values (ones, tens, hundreds, thousands, etc.) as powers of ten.
- c. Represent powers of 10 using whole number exponents.
- d. Analyze and explain patterns that occur when multiplying a whole number by a power of 10.
- e. Analyze and explain patterns that occur when decimal numbers are multiplied or divided by a power of 10.
- f. Read and write decimals to thousandths, using base-ten numerals, number names, and expanded form.
- g. Compare two decimals to thousandths, using  $<$ ,  $=$ , and  $>$  symbols.
- h. Round decimals to any place.
- i. Fluently multiply multi-digit whole numbers using the standard algorithm.
- j. Find quotients of whole numbers with up to four-digit dividends and two-digit divisors using strategies.
- k. Illustrate and explain division calculations using equations, arrays, and/or area models.
- l. Add, subtract, multiply and divide decimals to hundredths, using concrete models, drawings and/or strategies.
- m. Relate decimal computation strategies and models to a written method and explain the reasoning used.

## Grade 5 Mathematics – Number and Operations in Base Ten

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate number concepts and computation involving whole numbers and decimals.
- model and have students use number lines to locate, compare, and round decimals.
- guide students to make connections among representations of whole numbers and decimals, e.g., expanded form (including powers of ten), written form, standard form, visual models.
- introduce a variety of methods for solving division problems and allow students to choose their preferred method based on what makes sense to them.
- encourage students to estimate solutions to decimal computation problems to judge the reasonableness of the solution with respect to the placement of the decimal point.
- provide templates/graphic organizers/journals to record and support the use of drawings, strategies, and the problem-solving process for problems involving decimal computation.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students experience and observations of whole numbers and decimals in their world.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

## Grade 5 Mathematics – Number and Operations in Base Ten

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.  
Teachers will assess and provide feedback to students about the following:

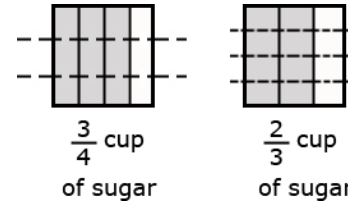
- Power of Ten Pattern Exploration
- Decimal Digit Draw
- Target Quotient
- Where's the Point?
- Division Error Analysis Performance Task
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

## Grade 5 Mathematics – Number and Operations - Fractions

Common Core State Standards in Connecticut	Explanations and Examples*
<p><b>Use equivalent fractions as a strategy to add and subtract fractions.</b></p> <p>5.NF.1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. <i>For example, <math>\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}</math>.</i> (In general, <math>\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}</math>.)</p> <p>5.NF.2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. <i>For example, recognize an incorrect result <math>\frac{2}{5} + \frac{1}{2} = \frac{3}{7}</math>, by observing that <math>\frac{3}{7} &lt; \frac{1}{2}</math>.</i></p>	<p>Students should apply their understanding of equivalent fractions developed in fourth grade and their ability to rewrite fractions in an equivalent form to find common denominators. They should know that multiplying the denominators will always give a common denominator but may not result in the smallest denominator.</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• <math>\frac{2}{5} + \frac{7}{8} = \frac{16}{40} + \frac{35}{40} = \frac{51}{40}</math></li> <li>• <math>3\frac{1}{4} - \frac{1}{6} = 3\frac{3}{12} - \frac{2}{12} = 3\frac{1}{12}</math></li> </ul> <p>Examples:</p> <p>Jerry was making two different types of cookies. One recipe needed <math>\frac{3}{4}</math> cup of sugar and the other needed <math>\frac{2}{3}</math> cup of sugar. How much sugar did he need to make both recipes?</p> <ul style="list-style-type: none"> <li>• <b>Mental estimation:</b> A student may say that Jerry needs more than 1 cup of sugar but less than 2 cups. An explanation may compare both fractions to <math>\frac{1}{2}</math> and state that both are larger than <math>\frac{1}{2}</math> so the total must be more than 1. In addition, both fractions are slightly less than 1 so the sum cannot be more than 2.</li> </ul>

## Grade 5 Mathematics – Number and Operations - Fractions

- Area model



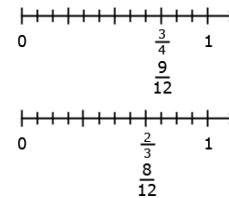
$$\frac{3}{4} = \frac{9}{12}$$

$$\frac{2}{3} = \frac{8}{12}$$

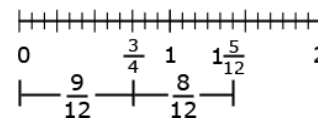
**Error! Digit**

**expected.**  $\frac{9}{12} + \frac{2}{3} = \frac{17}{12} = \frac{12}{12} + \frac{5}{12} = 1\frac{5}{12}$

- Linear model



Solution:



Example: Using a bar diagram

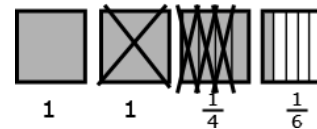
- Sonia had  $2\frac{1}{3}$  candy bars. She promised her brother that she would give him  $\frac{1}{2}$  of a candy bar. How much will she have left after she gives her brother the amount she promised?
- If Mary ran 3 miles every week for 4 weeks, she would reach her goal for the month. The first day of the first week she ran  $1\frac{3}{4}$  miles. How many miles does she still need to run the first week?

## Grade 5 Mathematics – Number and Operations - Fractions

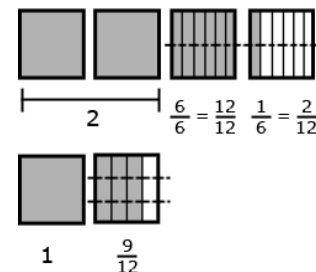
- Using addition to find the answer:  $1 \frac{3}{4} + n = 3$
- A student might add  $1 \frac{1}{4}$  to  $1 \frac{3}{4}$  to get to 3 miles. Then he or she would add  $\frac{1}{6}$  more. Thus  $1 \frac{1}{4}$  miles +  $\frac{1}{6}$  of a mile is what Mary needs to run during that week.

Example: Using an area model to subtract

- This model shows  $1 \frac{3}{4}$  subtracted from  $3 \frac{1}{6}$  leaving  $1 + \frac{1}{4} + \frac{1}{6}$  which a student can then change to  $1 + \frac{3}{12} + \frac{2}{12} = 1 \frac{5}{12}$ .



- $3 \frac{1}{6}$  and  $1 \frac{3}{4}$  can be expressed with a denominator of 12. Once this is done a student can complete the problem,  $2 \frac{14}{12} - 1 \frac{9}{12} = 1 \frac{5}{12}$ .
- This diagram models a way to show how  $3 \frac{1}{6}$  and  $1 \frac{3}{4}$  can be expressed with a denominator of 12. Once this is accomplished, a student can complete the problem,  $2 \frac{14}{12} - 1 \frac{9}{12} = 1 \frac{5}{12}$ .



## Grade 5 Mathematics – Number and Operations - Fractions

### Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

5.NF.3. Interpret a fraction as division of the numerator by the denominator ( $a/b = a \div b$ ). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret  $3/4$  as the result of dividing 3 by 4, noting that  $3/4$  multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size  $3/4$ . If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*

Estimation skills include identifying when estimation is appropriate, determining the level of accuracy needed, selecting the appropriate method of estimation, and verifying solutions or determining the reasonableness of situations using various estimation strategies. Estimation strategies for calculations with fractions extend from students' work with whole number operations and can be supported through the use of physical models.

Example:

- Elli drank  $\frac{3}{5}$  quart of milk and Javier drank  $\frac{1}{10}$  of a quart less than Ellie. How much milk did they drink all together?

Solution:

- $\frac{3}{5} - \frac{1}{10} = \frac{6}{10} - \frac{1}{10} = \frac{5}{10}$  This is how much milk Javier drank
- $\frac{3}{5} + \frac{5}{10} = \frac{6}{10} + \frac{5}{10} = \frac{11}{10}$  Together they drank  $1\frac{1}{10}$  quarts of milk

This solution is reasonable because Ellie drank more than  $\frac{1}{2}$  quart and Javier drank  $\frac{1}{2}$  quart so together they drank slightly more than one quart.

Students are expected to demonstrate their understanding using concrete materials, drawing models, and explaining their thinking when working with fractions in multiple contexts. They read  $3/5$  as “three fifths” and after many experiences with sharing problems, learn that  $3/5$  can also be interpreted as “3 divided by 5.”

Examples:

- Ten team members are sharing 3 boxes of cookies. How much of a box will each student get?

## Grade 5 Mathematics – Number and Operations - Fractions

- When working this problem a student should recognize that the 3 boxes are being divided into 10 groups, so s/he is seeing the solution to the following equation,  $10 \times n = 3$  (10 groups of some amount is 3 boxes) which can also be written as  $n = 3 \div 10$ . Using models or diagram, they divide each box into 10 groups, resulting in each team member getting  $3/10$  of a box.
- Two afterschool clubs are having pizza parties. For the Math Club, the teacher will order 3 pizzas for every 5 students. For the student council, the teacher will order 5 pizzas for every 8 students. Since you are in both groups, you need to decide which party to attend. How much pizza would you get at each party? If you want to have the most pizza, which party should you attend?
- The six fifth grade classrooms have a total of 27 boxes of pencils. How many boxes will each classroom receive?

Students may recognize this as a whole number division problem but should also express this equal sharing problem as  $27/6$ . They explain that each classroom gets  $27/6$  boxes of pencils and can further determine that each classroom get  $4 \frac{3}{6}$  or  $4 \frac{1}{2}$  boxes of pencils.

## Grade 5 Mathematics – Number and Operations - Fractions

5.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

- a. Interpret the product  $(a/b) \times q$  as  $a$  parts of a partition of  $q$  into  $b$  equal parts; equivalently, as the result of a sequence of operations  $a \times q \div b$ . For example, use a visual fraction model to show  $(2/3) \times 4 = 8/3$ , and create a story context for this equation. Do the same with  $(2/3) \times (4/5) = 8/15$ . (In general,  $(a/b) \times (c/d) = ac/bd$ .)
- b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

Students are expected to multiply fractions including proper fractions, improper fractions, and mixed numbers. They multiply fractions efficiently and accurately as well as solve problems in both contextual and non-contextual situations.

As they multiply fractions such as  $3/5 \times 6$ , they can think of the operation in more than one way.

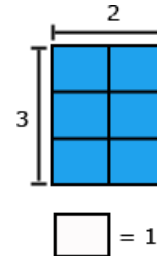
- $3 \times (6 \div 5)$  or  $(3 \times 6) \div 5$
- $(3 \times 6) \div 5$  or  $18 \div 5$  ( $18/5$ )

Students create a story problem for  $3/5 \times 6$  such as,

- Isabel had 6 feet of wrapping paper. She used  $3/5$  of the paper to wrap some presents. How much does she have left?
- Every day Tim ran  $3/5$  of mile. How far did he run after 6 days? (Interpreting this as  $6 \times 3/5$ )

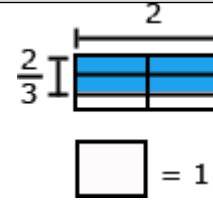
Examples: Building on previous understandings of multiplication

- Rectangle with dimensions of 2 and 3 showing that  $2 \times 3 = 6$ .

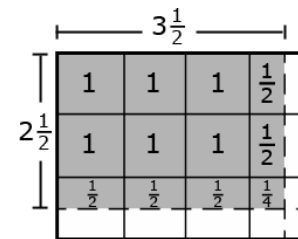


- Rectangle with dimensions of 2 and  $2/3$  showing that  $2 \times 2/3 = 4/3$

## Grade 5 Mathematics – Number and Operations - Fractions



- $2\frac{1}{2}$  groups of  $3\frac{1}{2}$ :



- In solving the problem  $\frac{2}{3} \times \frac{4}{5}$ , students use an area model to visualize it as a 2 by 4 array of small rectangles each of
- which has side lengths  $\frac{1}{3}$  and  $\frac{1}{5}$ . They reason that  $\frac{1}{3} \times \frac{1}{5} = \frac{1}{(3 \times 5)}$  by counting squares in the entire rectangle, so the area of the shaded area is  $(2 \times 4) \times \frac{1}{(3 \times 5)} = \frac{2 \times 4}{3 \times 5}$ . They can explain that the product is less than  $\frac{4}{5}$  because they are finding  $\frac{2}{3}$  of  $\frac{4}{5}$ . They can further estimate that the answer must be between  $\frac{2}{5}$  and  $\frac{4}{5}$  because  $\frac{2}{3}$  of  $\frac{4}{5}$  is more than  $\frac{1}{2}$  of  $\frac{4}{5}$  and less than one group of  $\frac{4}{5}$ .

## Grade 5 Mathematics – Number and Operations - Fractions

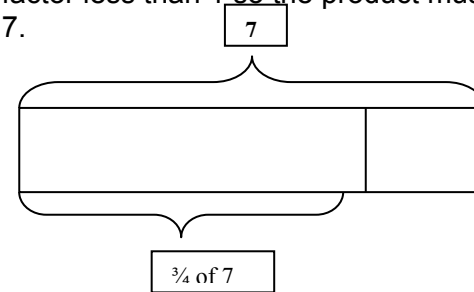
5.NF.5. Interpret multiplication as scaling (resizing), by:

- a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
- b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence  $a/b = (n \times a)/(n \times b)$  to the effect of multiplying  $a/b$  by 1.

5.NF.6. Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

Examples:

- $\frac{3}{4} \times 7$  is less than 7 because 7 is multiplied by a factor less than 1, so the product must be less than 7.



- $2\frac{2}{3} \times 8$  must be more than 8 because 2 groups of 8 is 16 and  $2\frac{2}{3}$  is almost 3 groups of 8. So the answer must be close to, but less than 24.
- $\frac{3}{4} = \frac{5 \times 3}{5 \times 4}$  because multiplying  $\frac{3}{4}$  by  $\frac{5}{5}$  is the

same as multiplying by 1.

Examples:

- Evan bought 6 roses for his mother.  $\frac{2}{3}$  of them were red. How many red roses were there?
- Using a visual, a student divides the 6 roses into 3 groups and counts how many are in 2 of the 3 groups.



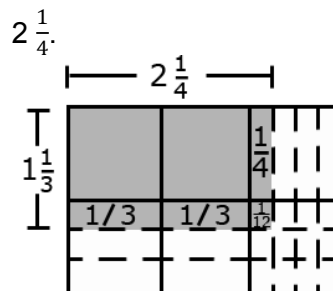
## Grade 5 Mathematics – Number and Operations - Fractions

- A student can use an equation to solve.  

$$\frac{2}{3} \times 6 = \frac{12}{3} = 4 \text{ red roses}$$

- Mary and Joe determined that the dimensions of their school flag needed to be  $1\frac{1}{3}$  ft. by  $2\frac{1}{4}$  ft. What will be the area of the school flag?

- A student can draw an array to find this product and can also use his or her understanding of decomposing numbers to explain the multiplication. Thinking ahead a student may decide to multiply by  $1\frac{1}{3}$  instead of  $2\frac{1}{4}$ .



The explanation may include the following:

- First, I am going to multiply  $2\frac{1}{4}$  by 1 and then by  $\frac{1}{3}$ .
- When I multiply  $2\frac{1}{4}$  by 1, it equals  $2\frac{1}{4}$ .
- Now I have to multiply  $2\frac{1}{4}$  by  $\frac{1}{3}$ .
- $\frac{1}{3}$  times 2 is  $\frac{2}{3}$ .
- $\frac{1}{3}$  times  $\frac{1}{4}$  is  $\frac{1}{12}$ .
- So the answer is  $2\frac{1}{4} + \frac{2}{3} + \frac{1}{12}$  or  $2\frac{3}{12} + \frac{8}{12} + \frac{1}{12}$   
 $= 2\frac{12}{12} = 3$

## Grade 5 Mathematics – Number and Operations - Fractions

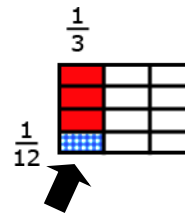
5.NF.7. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.)

- a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for  $(1/3) \div 4$ , and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that  $(1/3) \div 4 = 1/12$  because  $(1/12) \times 4 = 1/3$ .*
- b. Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for  $4 \div (1/5)$ , and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that  $4 \div (1/5) = 20$  because  $20 \times (1/5) = 4$ .*
- c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each person get if 3 people share  $1/2$  lb of chocolate equally? How many  $1/3$ -cup servings are in 2 cups of raisins?*

In fifth grade, students experience division problems with whole number divisors and unit fraction dividends (fractions with a numerator of 1) or with unit fraction divisors and whole number dividends. Students extend their understanding of the meaning of fractions, how many unit fractions are in a whole, and their understanding of multiplication and division as involving equal groups or shares and the number of objects in each group/share. In sixth grade, they will use this foundational understanding to divide into and by more complex fractions and develop abstract methods of dividing by fractions.

Division Example: Knowing the number of groups/shares and finding how many/much in each group/share

- Four students sitting at a table were given  $1/3$  of a pan of brownies to share. How much of a pan will each student get if they share the pan of brownies equally?
  - The diagram shows the  $1/3$  pan divided into 4 equal shares with each share equaling  $1/12$  of the pan.



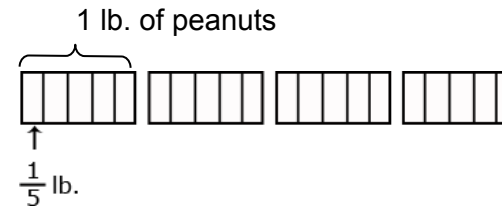
Examples:

Knowing how many in each group/share and finding how many groups/shares

- Angelo has 4 lbs of peanuts. He wants to give each of his friends  $1/5$  lb. How many friends can receive  $1/5$  lb of peanuts?

## Grade 5 Mathematics – Number and Operations - Fractions

A diagram for  $4 \div \frac{1}{5}$  is shown below. Students explain that since there are five fifths in one whole, there must be 20 fifths in 4 lbs.



- How much rice will each person get if 3 people share  $\frac{1}{2}$  lb of rice equally?

$$\frac{1}{2} \div 3 = \frac{3}{6} \div 3 = \frac{1}{6}$$

- A student may think or draw  $\frac{1}{2}$  and cut it into 3 equal groups then determine that each of those part is  $\frac{1}{6}$ .
- A student may think of  $\frac{1}{2}$  as equivalent to  $\frac{3}{6}$ .  $\frac{3}{6}$  divided by 3 is  $\frac{1}{6}$

## Grade 5 Mathematics – Number and Operations - Fractions

### Unwrapped Performance Standards

**Concepts:** Need to know about:

**Skills:** Need to be able to:

**Fraction interpretation**

- division of numerator by the denominator
  - word problems involving division of whole numbers
    - answers as fractions or mixed numbers
    - representation
      - visual fraction models
      - equations

- Interpret (a fraction as division)
- Solve (word problems)
  - using (visual fraction models or equations)

**Addition and subtraction**

- unlike denominators
  - fractions and mixed numbers
    - equivalent fractions
- word problems
  - fractions (including unlike denominators) referring to same-size wholes
    - visual fraction models
    - equations
    - benchmark fractions and number sense
      - mental estimation
      - reasonableness of answers

- Add and subtract (fractions)
  - using (equivalent fractions)
- Solve (word problems)
  - using (visual models or equations)
- Estimate and assess (solutions to word problems)
  - using (benchmark fractions and number sense)

**Multiplication**

- fraction or whole number by a fraction
  - $a/b \times q = a \times q \div b$
  - $a/b \times c/d = (ac)/(bd)$
  - equation
  - visual model
  - story context

- Multiply (a fraction or whole number by a fraction)
  - using (visual models)
- Create (a story context for a fraction multiplication equation)

## Grade 5 Mathematics – Number and Operations - Fractions

- area of a rectangle with fractional side lengths
  - tiling
    - unit squares
  - multiplying side lengths
  - representation of fraction products
- scaling
  - comparison between size of product and factors
    - without calculation
  - equivalence
    - $a/b = (n \times a)/(n \times b)$  is the same as  $a/b \times 1$
- real-world problems
  - fractions and mixed numbers
    - visual models
    - equations

### Division

- unit fractions by whole numbers and vice versa
  - visual model
  - story context or real-world problem
  - relationship between multiplication and division

- Find (area)
  - by (tiling)
  - by multiplying side lengths
- Represent (fraction products)
  - using (rectangular areas)
- Compare (size of product)
  - to (size of factors)
  - without performing (calculation)
- Explain (results of multiplying a given number by a fraction)
  - when the fraction is greater than 1
  - when the fraction is less than 1
  - when the fraction is equal to 1
- Solve (real-world problems)
  - using (visual models or equations)
- Divide (a whole number by a unit fraction and vice versa)
  - using (visual models)
  - using (relationship between multiplication and division)
- Create (a story context for a fraction division equation)
- Solve (real-world fraction division problems)
  - using (visual models and equations)

## Grade 5 Mathematics – Number and Operations - Fractions

### Big Ideas

Student's statements of enduring ideas

1. Equivalent fractions can be used to replace given fractions to make calculations simpler.
2. We decompose fractions into sums or products of fractions to make computation easier or to simplify expressions.
3. We can interpret a fraction as a division problem, where the numerator is divided by the denominator.
4. When multiplying a given fraction by a factor, the product will either be greater than, equal to, or less than the fraction depending on how the factor compares to 1.
5. The common operation categories, computation strategies, properties of operations, and inverse relationships among operations for whole numbers apply to fractions.

### Essential Questions

Teacher's guiding questions

1. How can equivalent fractions be used to add and subtract fractions with unlike denominators?
2. Why do we decompose fractions?
3. How is a fraction related to division?
4. How is the size of a factor related to the size of the product when multiplying a given fraction?
5. How does whole number computation relate to fraction computation?

### Learning Objectives

The students will be able to:

- a. Add and subtract fractions with unlike denominators, including mixed numbers.
- b. Solve word problems involving addition and subtraction of fractions.
- c. Use benchmark fractions and number sense to estimate and assess reasonableness of answers to addition and subtraction fraction word problems.
- d. Interpret a fraction as a division problem.
- e. Solve word problems involving division of whole numbers using visual models and equations, expressing the quotients as fractions or mixed numbers.
- f. Multiply a fraction or a whole number by a fraction, using visual fraction models to justify solutions.
- g. Create story problems for fraction multiplication equations.
- h. Represent and find the area of a rectangle with fractional side lengths using area models.

## Grade 5 Mathematics – Number and Operations - Fractions

- i. Prove the area of a rectangle with fractional side lengths found by counting unit squares is equivalent to the area of the rectangle found by multiplying the side lengths.
- j. Represent fractional products as rectangular areas.
- k. Compare the size of a product to the size of the factors, without calculating.
- l. Explain the results of multiplying a given fraction by a number that is greater than 1, less than 1, or equal to 1.
- m. Solve real-world problems involving multiplication of fractions and mixed numbers.
- n. Divide unit fractions by whole numbers and vice versa.
- o. Create story problems for division fraction problems that involve a whole number and a unit fraction.
- p. Solve real-world problems involving dividing unit fractions by whole numbers and vice versa.

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate computation involving fractions.
- model and have students use number lines and area models to solve fraction computation problems.
- guide students to make connections between whole number computation and fraction computation.
- introduce a variety of problem solving situations involving fractional computation and have students develop models, write equations and judge the reasonableness of the result.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students experience and observations of fractions in their world.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

## Grade 5 Mathematics – Number and Operations - Fractions

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Fractions as Division Problems Activity
- Story Problem Equation Match
- Digit Draw Fraction Computation Game
- Fraction Computation Performance Task – Multiple Representations
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

## Grade 5 Mathematics – Measurement and Data

### Common Core State Standards in Connecticut

#### Convert like measurement units within a given measurement system

5.MD.1. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

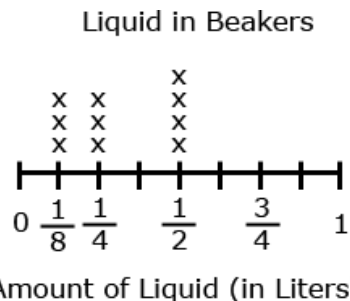
#### Represents and interpret data

5.MD.2. Make a line plot to display a data set of measurements in fractions of a unit ( $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$ ). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.*

### Explanations and Examples\*

In fifth grade, students build on their prior knowledge of related measurement units to determine equivalent measurements. Prior to making actual conversions, they examine the units to be converted, determine if the converted amount will be more or less units than the original unit, and explain their reasoning. They use several strategies to convert measurements. When converting metric measurement, students apply their understanding of place value and decimals.

Ten beakers, measured in liters, are filled with a liquid.



The line plot above shows the amount of liquid in liters in 10 beakers. If the liquid is redistributed equally, how much liquid would each beaker have? (This amount is the mean.)

Students apply their understanding of operations with fractions. They use either addition and/or multiplication to determine the total number of liters in the beakers. Then the sum of the liters is shared evenly among the ten beakers.

## Grade 5 Mathematics – Measurement and Data

### Geometric measurement understand concepts of volume and relate volume to multiplication and to addition

5.MD.3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

- a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume.
- b. A solid figure which can be packed without gaps or overlaps using  $n$  unit cubes is said to have a volume of  $n$  cubic units.

5.MD.4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

5.MD.5. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

- a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying

Students’ prior experiences with volume were restricted to liquid volume. As students develop their understanding volume they understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. This cube has a length of 1 unit, a width of 1 unit and a height of 1 unit and is called a cubic unit. This cubic unit is written with an exponent of 3 (e.g.,  $\text{in}^3$ ,  $\text{m}^3$ ). Students connect this notation to their understanding of powers of 10 in our place value system. Models of cubic inches, centimeters, cubic feet, etc are helpful in developing an image of a cubic unit. Students estimate how many cubic yards would be needed to fill the classroom or how many cubic centimeters would be needed to fill a pencil box.

Students understand that same sized cubic units are used to measure volume. They select appropriate units to measure volume. For example, they make a distinction between which units are more appropriate for measuring the volume of a gym and the volume of a box of books. They can also improvise a cubic unit using any unit as a length (e.g., the length of their pencil). Students can apply these ideas by filling containers with cubic units (wooden cubes) to find the volume. They may also use drawings or interactive computer software to simulate the same filling process.

Technology Connections:

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=6>

Students need multiple opportunities to measure volume by filling rectangular prisms with cubes and looking at the relationship between the total volume and the area of the base. They derive the volume formula (volume equals the area of the base times the height) and explore how this idea would apply to other prisms. Students use the associative property of multiplication

## Grade 5 Mathematics – Measurement and Data

the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.

- b. Apply the formulas  $V = l \times w \times h$  and  $V = b \times h$  for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.
- c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

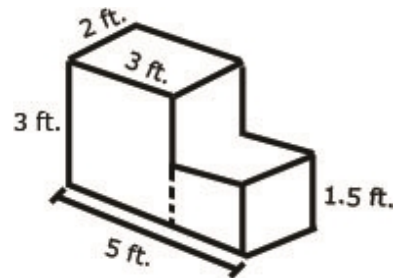
and decomposition of numbers using factors to investigate rectangular prisms with a given number of cubic units.

Examples:

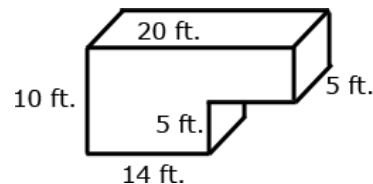
- When given 24 cubes, students make as many rectangular prisms as possible with a volume of 24 cubic units. Students build the prisms and record possible dimensions.

Length	Width	Height
1	2	12
2	2	6
4	2	3
8	3	1

- Students determine the volume of concrete needed to build the steps in the diagram below.



- A homeowner is building a swimming pool and needs to calculate the volume of water needed to fill the pool. The design of the pool is shown in the illustration below.



## Grade 5 Mathematics – Measurement and Data

### Unwrapped Performance Standards

<b>Concepts:</b> Need to know about:	<b>Skills:</b> Need to be able to:
<p><b>Conversions within a Measurement System</b></p> <ul style="list-style-type: none"> <li>• different-sized standard units</li> <li>• problem solving               <ul style="list-style-type: none"> <li>- multi-step, real-world</li> </ul> </li> </ul> <p><b>Data</b></p> <ul style="list-style-type: none"> <li>• line plots               <ul style="list-style-type: none"> <li>- representation of measurements                   <ul style="list-style-type: none"> <li>○ fractions of a unit (1/2, 1/4, 1/8)</li> </ul> </li> </ul> </li> </ul> <p><b>Volume</b></p> <ul style="list-style-type: none"> <li>• attribute of solid figures               <ul style="list-style-type: none"> <li>- cubic unit                   <ul style="list-style-type: none"> <li>○ side length of 1 unit</li> </ul> </li> </ul> </li> <li>• counting unit cubes (cm<sup>3</sup>, in<sup>3</sup>, ft<sup>3</sup>, improvised units)               <ul style="list-style-type: none"> <li>- no gaps</li> <li>- no overlaps</li> </ul> </li> <li>• formulas               <ul style="list-style-type: none"> <li>- <math>V = l \times w \times h</math> (length <math>\times</math> width <math>\times</math> height)</li> <li>- <math>V = b \times h</math> (base area <math>\times</math> height)</li> </ul> </li> <li>• solid figures composed of two-non-overlapping right rectangular prisms               <ul style="list-style-type: none"> <li>○ additive</li> </ul> </li> <li>• real-world problems</li> </ul>	<ul style="list-style-type: none"> <li>➤ Convert (among different-sized standard units)               <ul style="list-style-type: none"> <li>○ within (a given measurement system)</li> </ul> </li> <li>➤ Solve (multi-step, real-world problems)               <ul style="list-style-type: none"> <li>○ using (conversions)</li> </ul> </li> <li>➤ Make (line plot)               <ul style="list-style-type: none"> <li>○ to display (data set)</li> </ul> </li> <li>➤ Solve (problems)               <ul style="list-style-type: none"> <li>○ using (line plots)</li> </ul> </li> <li>➤ Measure (volume of rectangular prisms)               <ul style="list-style-type: none"> <li>○ by counting (unit cubes)                   <ul style="list-style-type: none"> <li>▪ having (no gaps or overlaps)</li> </ul> </li> <li>○ connect (counting cubes to formula)</li> </ul> </li> <li>➤ Find (volume of rectangular prisms)               <ul style="list-style-type: none"> <li>○ using (formula)</li> </ul> </li> <li>➤ Find (volume of two non-overlapping rectangular prisms)               <ul style="list-style-type: none"> <li>○ by adding (volumes)</li> </ul> </li> <li>➤ Solve (real-world volume problems)</li> </ul>

## Grade 5 Mathematics – Measurement and Data

### Big Ideas

Student's statements of enduring ideas

1. We convert units of measure by understanding how the units are related to each other (e.g., 5 m is 100 times 5 cm).
2. We collect, organize, represent, and analyze data in order to answer a question or solve a problem.
3. Volume measures the amount of space in cubic units inside a solid figure.

### Essential Questions

Teacher's guiding questions

1. How do we convert units of measure?
2. Why do we collect, organize, represent and analyze data?
3. What does volume measure in a solid figure?

### Learning Objectives

The students will be able to:

- a. Convert among different-sized standard units within a given system and justify solutions.
- b. Solve real-world measurement conversion problems.
- c. Create a line plot to display fractional measurement data ( $\frac{1}{2}$ ,  $\frac{1}{4}$ , or  $\frac{1}{8}$ ).
- d. Solve problems involving measurement data displayed in line plots using all four operations.
- e. Determine the volume of rectangular prisms by packing and counting unit cubes.
- f. Find the volume of rectangular prisms by multiplying the height by the base area.
- g. Decompose a given volume into three factors that could represent the dimensions of a rectangular prism.
- h. Apply volume formulas ( $V = l \times w \times h$  and  $V = b \times h$ ) to solve real-world problems.
- i. Find the volume of solid figures composed of two non-overlapping parts to solve real-world problems.

## Grade 5 Mathematics – Measurement and Data

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate measurement conversions and volume.
- have students use tools (grid paper, rulers, etc.) and/or technology to create line plots with appropriate titles and labels and use them to solve real-world measurement problems.
- introduce measurement conversions by using concrete models and tools, and have students use graphic organizers, two-column tables and mnemonic devices to show relationships and solve measurement conversion problems.
- engage students in investigating the relationship between the number of unit cubes that fill a rectangular prism and the length, width and height of the prism in order to discover the volume formulas.
- present students with a variety of real-world application problems that involve volume.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- build upon students experience and observations of measurement in their world.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom's Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

## Grade 5 Mathematics – **Measurement and Data**

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- Measurement Line Plot Performance Task
- Rectangular Prism Volume Discovery Activity
- Hit the Target Measurement Game
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets, spiral reviews)
- Topic assessments
- District benchmark assessments

## Grade 5 Mathematics – Geometry

### Common Core State Standards in Connecticut

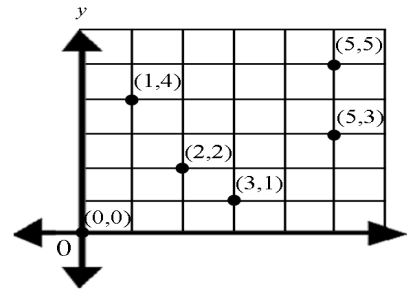
#### Graph points on the coordinate plane to solve real world and mathematical problems.

5.G.1. Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g.,  $x$ -axis and  $x$ -coordinate,  $y$ -axis and  $y$ -coordinate).

### Explanations and Examples\*

Examples:

- Students can use a classroom size coordinate system to physically locate the coordinate point  $(5, 3)$  by starting at the origin point  $(0, 0)$ , walking 5 units along the  $x$  axis to find the first number in the pair  $(5)$ , and then walking up 3 units for the second number in the pair  $(3)$ . The ordered pair names a point in the plane.



- Graph and label the points below in a coordinate system.
  - A  $(0, 0)$
  - B  $(5, 1)$
  - C  $(0, 6)$
  - D  $(2.5, 6)$
  - E  $(6, 2)$
  - F  $(4, 1)$
  - G  $(3, 0)$

## Grade 5 Mathematics – Geometry

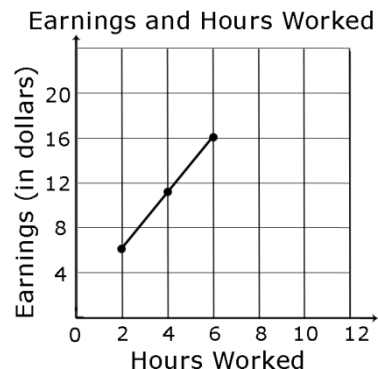
5.G.2. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

**Classify two dimensional figures into categories based on their properties.**

5.G.3. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*

Examples:

- Sara has saved \$20. She earns \$8 for each hour she works.
  - If Sara saves all of her money, how much will she have after working 3 hours? 5 hours? 10 hours?
  - Create a graph that shows the relationship between the hours Sara worked and the amount of money she has saved.
  - What other information do you know from analyzing the graph?
- Use the graph below to determine how much money Jack makes after working exactly 9 hours.



Geometric properties include properties of sides (parallel, perpendicular, congruent), properties of angles (type, measurement, congruent), and properties of symmetry (point and line).

Example:

- If the opposite sides on a parallelogram are parallel and congruent, then rectangles are parallelograms

## Grade 5 Mathematics – Geometry

5.G.4. Classify two-dimensional figures in a hierarchy based on properties.

A sample of questions that might be posed to students include:

- A parallelogram has 4 sides with both sets of opposite sides parallel. What types of quadrilaterals are parallelograms?
- Regular polygons have all of their sides and angles congruent. Name or draw some regular polygons.
- All rectangles have 4 right angles. Squares have 4 right angles so they are also rectangles. True or False?
- A trapezoid has 2 sides parallel so it must be a parallelogram. True or False?

Technology Connections:

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=70>

Properties of figure may include:

- Properties of sides—parallel, perpendicular, congruent, number of sides
- Properties of angles—types of angles, congruent

Examples:

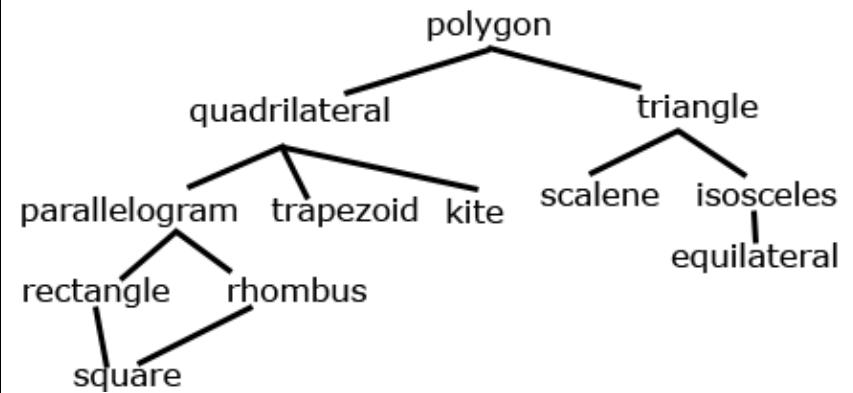
- A right triangle can be both scalene and isosceles, but not equilateral.
- A scalene triangle can be right, acute and obtuse.

Triangles can be classified by:

- Angles
  - Right: The triangle has one angle that measures  $90^\circ$ .
  - Acute: The triangle has exactly three angles that measure between  $0^\circ$  and  $90^\circ$ .
  - Obtuse: The triangle has exactly one angle that measures greater than  $90^\circ$  and less than  $180^\circ$ .

## Grade 5 Mathematics – Geometry

- Sides
  - Equilateral: All sides of the triangle are the same length.
  - Isosceles: At least two sides of the triangle are the same length.
  - Scalene: No sides of the triangle are the same length.



## Grade 5 Mathematics – Geometry

### Unwrapped Performance Standards

#### **Concepts:** Need to know about:

##### Coordinate System

- perpendicular number lines
  - x- and y-axes
    - origin
      - intersection
      - zero point on each line
  - x-and y-coordinates
    - ordered pairs
      - first number indicates how far to travel from the origin along the x-axis
      - second number indicates how far to travel from the origin along the y-axis
- real-world and mathematical problems
  - points in the first quadrant

##### 2-Dimensional Figures

- hierarchy of classification
  - based on properties and attributes
    - categories
      - subcategories

#### **Skills:** Need to be able to:

- Define (a coordinate system)
  - using (pair of perpendicular lines)
- Locate (a given point in a coordinate plane)
  - using (an ordered pair of numbers)
- Interpret (coordinate values)
  - in the (context of a real-world situation)
- Represent (real-world and mathematical problems)
  - by graphing (points in the first quadrant)
- Classify (figures in a hierarchy)
  - based on (properties)

## Grade 5 Mathematics – Geometry

### Big Ideas

Student's statements of enduring ideas

1. An object's location in space can be described quantitatively.
2. Two-dimensional figures can be described, classified and analyzed by their properties.

### Essential Questions

Teacher's guiding questions

1. How can we describe an object's location in space?
2. How can two-dimensional figures be described, classified and analyzed?

### Learning Objectives

The students will be able to:

- a. Locate a point in the first quadrant of a coordinate plane using an ordered pair of numbers (coordinates).
- b. Find the coordinates of a given point in the first quadrant of a coordinate plane.
- c. Graph points in the first quadrant of the coordinate plane to represent real-world and mathematical problems.
- d. Interpret coordinate values of points in terms of the context of a real-world or mathematical situation.
- e. Classify two-dimensional figures in a hierarchy based on properties.
- f. Describe common attributes of two-dimensional figures within a category or subcategory.

## Grade 5 Mathematics – Geometry

### Instructional Strategies

Based on our department philosophy for student learning, mathematics teachers will:

- use a variety of manipulatives and/or technology to model and have students investigate 2- dimensional figures and their attributes.
- build upon students experience and observations of determining locations in the world.
- use graphic organizers to investigate and show relationships among two-dimensional figures.
- highlight topic vocabulary using a classroom word wall and hold students accountable for their use of new vocabulary orally and in writing.
- provide opportunities for students to share their strategies and thinking to build mathematical knowledge.
- incorporate the use of questions to address a variety of cognitive levels (Bloom’s Taxonomy) orally and in writing.
- utilize a variety of student groupings to support differentiation, address learner needs and promote student-to-student discourse.
- model and provide problems to engage students in the 4-step process for problem solving: 1. *understand* the problem; 2. *plan* a strategy; 3. *solve* by putting the plan or strategy into action; and 4. *check* to see if the solution makes sense for the situation described in the problem, is accurate, and if there are other possible solutions.

### Assessments/Common Learning Experiences

Through these assessments/experiences, students will demonstrate mastery of the learning objectives.

Teachers will assess and provide feedback to students about the following:

- X’s and O’s Coordinate Grid Activity
- Mystery Point Game
- Shape Classification Activity
- Common Attribute Performance Task
- Formative assessments to determine student understanding, (e.g., pre-assessments, journal prompts, exit tickets)
- Topic assessments
- District benchmark assessments

## **Non-Instructional Operations**

### **Student Transportation**

The Bristol Board of Education will provide transportation to all eligible students residing within Bristol in a manner consistent with Connecticut General Statutes.

All school age students, who reside in Bristol and are attending Bristol Schools, or specified State Regional Technical Schools, shall be eligible for transportation or remuneration in lieu of transportation according to the specifications of this policy.

#### **Authority:**

The designated staff of the Bristol Board of Education shall have full authority to:

1. fix the routes and establish loading and discharge points along the routes;
2. determine the safest walking distance based on the extent and seriousness of the highway and road hazards;
3. accommodate physically exceptional children and require acceptable data or a physician's certificate concerning the health or condition of the child at any time; and
4. delegate disciplinary authority to building administrators.

#### **Routes and Services:**

1. School Transportation services are provided exclusively for the benefit and safety of the student population and are to be used only in support of programs authorized by and under the auspices of the School Board.
2. A written request must be submitted by the parent/guardian to the principal of the school for his/her official approval each time a child is to take a bus other than his/her regular one.
3. In all cases covered by this policy, the parent or guardian is jointly responsible with the school system for the student until he/she boards the bus, or if walking, arrives on the school grounds. At the end of each day, the parent or guardian is jointly responsible with the school system for the student at the time he/she exits the bus, or if walking, exits the school grounds.
4. Cul-de-Sacs: For safety reasons Bristol school buses do not enter into cul-de-sacs unless the child has a physical impairment that would prohibit the child from walking to the entrance corner.

## Non-Instructional Operations

### Student Transportation

#### Walkers and Riders

Eligibility for transportation is dependent upon the following definitions:

##### 1. Definitions:

- a. Walker: A student who is not eligible for transportation because they live within the walking distance proscribed for that level.
- b. Rider: A student who lives outside of the walk zone, within a designated hazard route, or has needs identified in an I.E.P or Section 504 Plan.
- c. Walking Distance: means the linear measure of a prescribed or authorized pedestrian route between the pupil's residence and his/her school from a point at the curb or edge of a public road or highway nearest the pupil's residence to the nearest allowable paved access of the school.

#### Eligibility for Transportation

Transportation of both public and private school students who are living at the following distances from their respective schools will be transported at the expense of the Board:

1. Kindergarten students living more than (1) one mile from their schools;
  - a. Kindergarten students who receive transportation both to and from school will embark and disembark as near their residence as practical during the mid-day bus trip only. An adult must be present for the student to disembark from the bus. At all other times, those students will utilize the normally planned bus stops.
  - b. Kindergarten students who are designated **walkers** will be offered transportation accommodations during the mid-day to school and from school changeover.
2. Elementary school students in grades one — five living more than (1) one mile from their schools;
3. K-8 students living more than one (1) mile from their school;
4. Middle school living more than (1.5) one and one half miles from their school;
5. High school students living more than (2) two miles from their school; and
6. A student living in an area designated as a hazard route by the Police Department.

## **Non-Instructional Operations**

### **Student Transportation**

#### **Student Transportation Plans**

1. Parents/Guardians must inform the school of their transportation plan at the beginning of the school year. If a child is entitled to transportation, but the parent chooses to drop off and/or pick up their child, the school should be notified of this decision in writing.
2. To best insure the safety of our students, bus routes must be consistent on a daily basis. That is, students will not be dropped off at a variety of locations. Parents will be responsible for transporting their children to locations other than the regular daily bus stop.
3. Transportation is provided to the child's residence bus stop or child care provider. A fixed schedule of pick up and drop off is required to ensure the safety of every child. Any changes to a child's regular transportation plan must be made in writing 48 hours in advance.

#### **Out of District Transportation**

The Bristol Board of Education does not provide transportation for students attending Magnet or Charter Schools outside of the City of Bristol.

#### **Child Care Transportation**

1. Transportation shall be provided for children who live in an elementary public school area who are normally eligible for transportation and attend a parent authorized child care program in that school attendance area.
2. Children within an elementary public school area not normally eligible for busing who attend a parent authorized child care program whose location is eligible for busing will be allowed busing privileges *on a space available basis*. Space available basis shall mean that the children who are not normally eligible for transportation and are permitted to ride buses to or from a parent authorized babysitter who is located in an eligible transportation area shall NOT be permitted to continue with transportation, if/when the bus reaches capacity.
3. Students will not be transported to child care providers outside of their school-of-attendance area.

## **Non-Instructional Operations**

### **Student Transportation – Child Care - Continued**

4. Transportation shall not be provided to or from a parent authorized child care provider located within the walk zone of a public school.
5. Each parent must complete the parent authorization form in order to be eligible for child care transportation.

### **Appeals**

1. Discuss the matter with the principal of the school to which the student is assigned.
2. If no resolution is reached under (1) above, discuss the matter with the Transportation Coordinator.
3. If no resolution is reached under (2) above, discuss the matter with the Deputy Superintendent of Schools
4. Any parent, guardian, student at majority or officer, who believes that the Superintendent, or his/her designee, has not furnished school accommodations, by transportation or otherwise to himself or herself or to his/her child manner consistent with the laws of the State of Connecticut or the Guidelines pursuant to this policy may, in writing, request a hearing before the Board to show the Board the manner in which the Superintendent has so failed to furnish such accommodations.
  - a. The Board shall hold a hearing within (10) Days following receipt of such request.
  - b. The hearing before the Board will be in compliance with the provisions of Section 4-177 to 4-180 inclusive of the Connecticut General Statutes.
5. In conducting a transportation hearing, the role of the Board of Education may be fulfilled by any of the following options:
  - A. A hearing conducted by the Board of Education with at least three members present.
  - B. A hearing conducted by a sub-committee (typically three members) of the Board as appointed by the Board chairperson.
  - C. A hearing conducted by a hearing officer as designated by vote of the Board of Education.

## **Non-Instructional Operations**

### **Student Transportation – Appeals - Continued**

A tape recording shall be made of such hearing.

The Superintendent of Schools and the Chairperson of the Board of Education will use their discretion in determining which of the above options will be utilized in the scheduling of each individual transportation hearing.

### **Transportation Complaints**

All transportation school bus safety complaints must be submitted in writing to the Deputy Superintendent of Schools. Transportation safety complaints must be specific as to date, time and location of the incident; the name of the driver or number of the bus involved; nature of the complaint; names of witnesses; and name, address, and signature of the complainant.

Based on the nature of the complaint, the Deputy Superintendent may elect to take immediate action and/or forward the complaint to the appropriate authority, School Principal, Police Department, Transportation Coordinator, etc. The Deputy Superintendent will respond in writing to the complainant within (30) days.

#### **Legal Reference:**

##### **Connecticut General Statutes**

9-177 to 4-180	Contested cases. Notice. Record
10-97	Transportation to Vocational Schools
10-186	Duties of local and regional Boards of Education Hearing. Appeal
10-220	Duties of Boards of Education
10-220c	Transportation of children over private roads immunity from liability
10-280a	Transportation for pupils in non-profit schools outside school district
14-126a	Commissioner to make regulations regarding reporting of school bus accident
14-275a	Use of standard school bus required
14-275b	Transportation of mobility impaired students
14-275c	Regulations re school buses and motor vehicles used to transport special education students

Policy adopted: November 7, 2001

Policy Revised: September 8, 2004

Policy Revised: June 6, 2012

Appendix A

**CHILD CARE AUTHORIZATION**

I \_\_\_\_\_ hereby authorize the Bristol Board of  
(Parent or Guardians name)

Education to Pick up and/or Drop off my child at the following child care provider.

Student: School:

Grade: Parent/Guardian Contact #:

Child Care Provider's Name:

Child Care Provider Address:

Child Care Provider's PHONE NUMBER: \_\_\_\_\_

DAYS ATTENDING DAY CARE: \_\_\_ MON \_\_\_ TUES \_\_\_ WED \_\_\_ THUR \_\_\_ FRI

PICKUP [a.m.] Address:

DROP OFF [p.m.]Address:

EFFECTIVE DATE: \_\_\_\_\_ SCHOOL YEAR \_\_\_\_\_

I understand that the pick up and/or drop off address **MUST BE ON AN EXISTING BUS ROUTE** for the school year *and* **MUST BE IN MY CHILD'S PUBLIC SCHOOL ATTENDANCE AREA.** I will accept full responsibility for my child when he /she is at this address.

**Please submit this authorization form to the main office at your child's school, and allow 48 hours in change of transportation to take effect.**

Any changes to this plan must be made in writing and submitted to the school principal who will forward it to the Transportation Coordinator.

\_\_\_\_\_  
SIGNATURE OF PARENT OR GUARDIAN

\_\_\_\_\_  
DATE

**THIS FORM MUST BE COMPLETED ON AN ANNUAL BASIS, FOR AUTHORIZATION TO CONTINUE FROM ONE YEAR TO THE NEXT.**