GLCEs tested on 8th grade MEAP (from the 7th grade GLCEs)

GLCEs in grey will not be tested on 2012-2014 MEAP assessments because they have moved to a higher grade in the Common Core State Standards.

The "core" GLCEs are tested most heavily – 2 items per test on every form of the test. The others are "extended" GLCEs and are sampled with 1 item on random forms of the test. The GLCE descriptors below are abbreviations of the actual GLCEs.

Critical areas in 6th grade mathematics include:

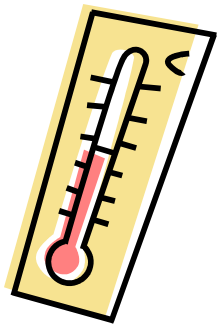
1) Graphing proportional and linear relationships
2) Using scale factors with similar figures
3) Using rates of change in proportionality problems
4) Compute with integers (some teaching resources are attached to this document for this topic)

GLCE	GLCE Grade	CALC	GLCE Descriptor	Match to CCSS	
A.PA.07.01	7th	N	Recognize proportional or linear relationships	7th	core
A.RP.07.02	7th	N	Show linear relats. w/ tables, graphs, formulas	7th	core
A.PA.07.03	7th	Y	Graph linear equations & interpret slope	8th	core
A.PA.07.04	7th	Y	Solve applied linear problems w/ graphs, equations	7th	core
A.PA.07.05	7th	Y	Use proportional & linear relationships	7th	core
A.PA.07.06	7th	Y	Compute the slope of a linear equation	8th	core
A.PA.07.07	7th	Y	Graph linear equa'ns, interpret slope, y- intercept	8th	
A.FO.07.08	7th	Y	Find and interpret x and y intercepts	8th	
A.PA.07.09	7th	Y	Recognize inversely proportional relationships	N	
A.RP.07.10	7th	N	Know properties of the graph of y = k/x	N	
A.PA.07.11	7th	Y	Understand & use basic properties of real numbers	7th	core
A.FO.07.12	7th	Y	Compute simple linear algebraic expressions	7th	
A.FO.07.13	7th	Y	Generate and solve linear equations	7th	
D.RE.07.01	7th	Y	Create, select, interpret graphical representations	6th	core
D.AN.07.02	7th	Y	Make, interpret scatterplots; find line of best fit	8th	core
D.AN.07.03	7th	Y	Interpret relative & cumulative frequencies	6th	
D.AN.07.04	7th	Y	Find, interpret the median, quartiles, and IQR	6th	
G.SR.07.01	7th	N	Use ruler, other tools to draw polygons	7th	
G.TR.07.03	7th	Y	Know properties of similar figures and scale factor.	7th	core
G.TR.07.04	7th	Y	Solve problems of similar figures, scale drawings	7th	core
G.TR.07.05	7th	Y	Show similarity of triangles using properties	7th	core
G.TR.07.06	7th	Y	Use similarity of triangles and scale factor	7th	core
N.MR.07.02	7th	Y	Solve problems involving derived quantities	HS	
N.FL.07.03	7th	Y	Calculate rates of change, including speed	7th	core
N.MR.07.04	7th	Y	Convert ratio quantities between systems of units	7th	core

N.FL.07.05	7th	Y	Solve proportion problems	7th	core
N.MR.07.06	7th	Y	Understand the concept of square root and cube root	8th	
N.FL.07.07	7th	N	Solve problems involving operations with integers	7th	core
N.FL.07.08	7th	N	Add, subtract, multiply & divide rational numbers	7th	core
N.FL.07.09	7th	N	Estimate results of computations with rationals	7th	core

Authentic Situations Involving Integers

Thermometer problems



It's 20° today. The temperature is supposed to reach -8° tonight. How many degrees colder will it be tonight than it was today? Show this on a thermometer/number line.

Look at the chart of temperatures for 7 days in the winter (in Celcius). Compute the difference from one day to the next: "Today was 7° colder than yesterday" or "The temperature went down by 10° from Wednesday to Thursday." Use this notation: "The difference in temperature from Wed to Thurs was -10°" (for when it gets colder).

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
5°	9°	4°	-8°	-10°	-2°	0°

Find the range of temperatures over the week. _____

Find the mean temperature for the week. _____

Elevator problems

An elevator in a tall building has buttons marked with integers. The integer represents how many floors you want to move: positive numbers make the car go up, negative numbers make the car go down. (This is an elevator in the math department building at the U of M.) Figure out which button to push for each of these situations, and write a number sentence to go with each one. (Also, use a vertical number line to show each problem):

a) You're on the 25th floor and want to go to the 10th floor.

b) You're on the 10th floor and want to go to the 3rd sub-basement (3 floors underground).

c) You're on the ground floor and want to go to the 19th floor.

d) You're on the 8th sub-basement (it's a big parking garage) and you want to go to the ground floor.

e) You're on the 15th sub-basement (it's a really big parking garage) and you want to go to the 5th sub-basement, so you can then get some exercise by walking back to the ground floor.

f) You don't know what floor you're on, so you push -7, and you wind up at the 5th floor. What floor did you start on?

g) The lights have gone out in the building (but the power to the elevators still works). You're on the 34th floor, and you push some button (you can't see which one you pushed). When you get out of the elevator, you're three floors below where you parked your car on the 2nd sub-basement. Which button did you push?

Happy and grumpy people

There's a party going on in your house. Some of the people at the party are happy, and the others are grumpy. The mood of the whole party depends on if there are more happy people or more grumpy people. One grumpy person cancels out one happy person. We'll let a happy person be represented by a +1, and a grumpy person is represented by a -1.

a) When the party starts, there are 8 happy people and 3 grumpy people. So the party is mostly happy: +8 + (-3) = +5

b) But then 7 grumpy people come in. What's the mood of the party now? Use integers to express the party's mood. Hint: +5 + (-7) = [Ans: -2]

c) Now the party is too grumpy, so 4 of the happy people leave. Find the mood of the party now, using a number sentence. [Ans: -6]

d) But then a limo full of happy people arrives. 12 happy people join the party. What's the mood now? [Ans: +6]

e) Write a number sentence to express what happens to the mood of the party if 3 grumpy people leave. [Ans: 6 - (-3) = 15 Hence subtracting a negative is like adding a positive.]

Multiplication:

f) 3 limos with 8 happy people each arrive. What happens to the party's mood?

8(+3) = +24 → the party gets much happier

g) 4 limos arrive with 5 grumpy people each. What's the effect on the party's mood?

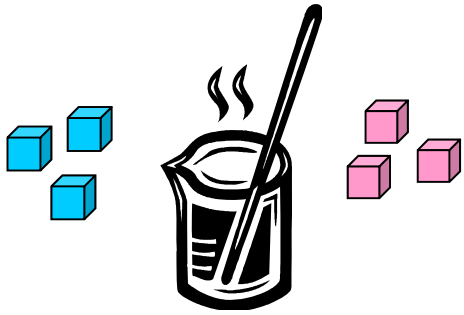
4(-5) = -20 → the party gets much grumpier

h) 2 limos drive off with 6 grumpy people each. What's the effect on the party's mood?

-2(-6) = +12 → the party gets much happier

Hot and Cold Cubes

Another representation of integers that is similar to the grumpy/happy people representation, is from the Interactive Mathematics Program, called "Chef's Hot and Cold Cubes." You can imagine unmeltable ice cubes that represent -1, so when they're added to something they lower the temp by 1 degree, and unburnable hot charcoal cubes that represent +1, so when they're added to something they raise the temp by 1 degree.



a) If a liquid is at 60 degrees and you add 3 hot cubes and 7 cold cubes, what's its new temperature? Write an expression to show what you would do. [Ans: 60 + 3 + (-7) which is 56 degrees]

b) If you add 5 trays full of cold cubes (10 in each tray), what's the new temp? Write the expression. [Ans: 56 + 5(-10) which is 6 degrees]

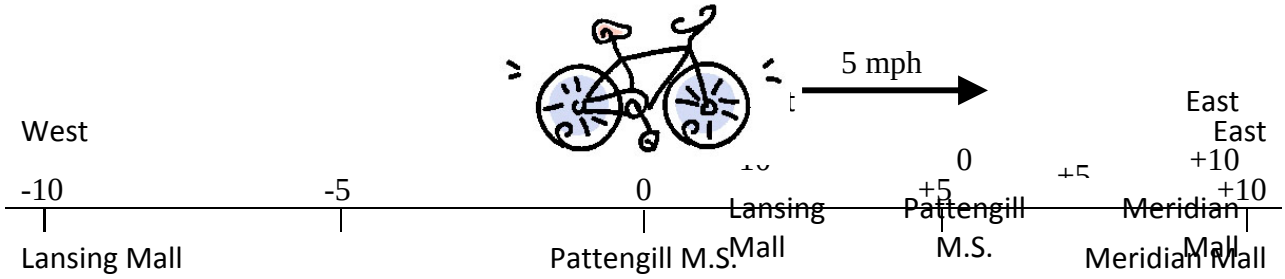
c) If you remove 3 trays of cold cubes (10 in each tray), what's the new temp? Write the expression. [Ans: 6 - 3(-10) or 6 + 30]

Biking across town

Think about riding a bike across town. You're riding at a constant speed from one place to another, down a long, straight road.

For your first bike ride, you're heading east toward Meridian Mall at 5 miles per hour. Meridian Mall is 10 miles east of Pattengill Middle School, and Lansing Mall is 10 miles west of Pattengill.

We'll pretend that the road you're biking on is a big number line. Moving east or to the right on the number line represents going in a positive direction. Moving west or to the left on the number line represents going in a negative direction.



At noon, you pass Pattengill Middle School.

1. In two hours where will you be? 5 x 2 =
2. Two hours ago where were you? 5 x (-2) =

The interesting thing about the second problem is that to find out where you were two hours ago, you multiply by negative time! So going forward in time is positive and going back in time is negative.

For your second bike ride, you are riding west toward the Lansing Mall (going in the negative direction according to our number line). You have just passed Pattengill Middle School.

1. In two hours where will you be? (-5) x 2 =
2. Two hours ago where were you? (-5) x (-2) =

You can see from these examples, that going in a negative direction affects the sign of your speed (-5 mph when going west), while going back in time affects the sign of the time (-2 hrs).

Try these problems. Show your work on a number line if you want.

1. You are biking east (in the positive direction) at 7 mph when you pass the zero mark (Pattengill). Where will you be after 3 hours?

2. You are biking east at 6 mph when you pass the zero mark (Pattengill). Where were you 2 hours ago?

3. You are biking west (in the negative direction) at 8 mph. Where will you be after 3 hours?

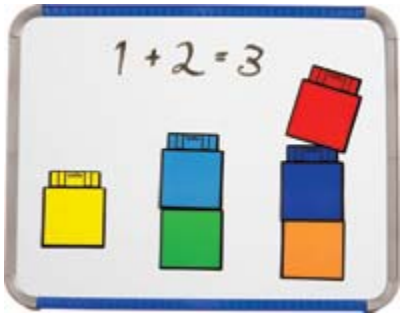
4. You are biking west at 8 ½ mph. Where will you be after 4 hours?

5. You are biking west at 9 mph when you pass the zero mark. Where were you 2 hours ago?

6. You are biking east at 5 mph when you arrive at Meridian mall. Where were you 3 hours ago?

What rules for multiplying can you discover from doing these problems?

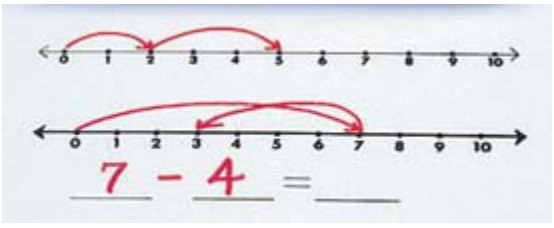
Adding and subtracting



1. Think about the process of adding two whole numbers, either on the number line or with stacking cubes. How does the answer compare to either of the numbers?

Is 8 + 3 the same as 3 + 8 ?

2. Make a model of subtracting whole number on the number line, or with stacking cubes. What happens to the size of the answer when you subtract?



Is 7 - 4 the same as 4 - 7 ?

Think about how you would show that 4 – 7 = -3 on the number line.

3. You know that addition "undoes" subtraction, so if 4 – 7 = -3, how much is -3 + 7 ?

Does this follow what you know about adding?

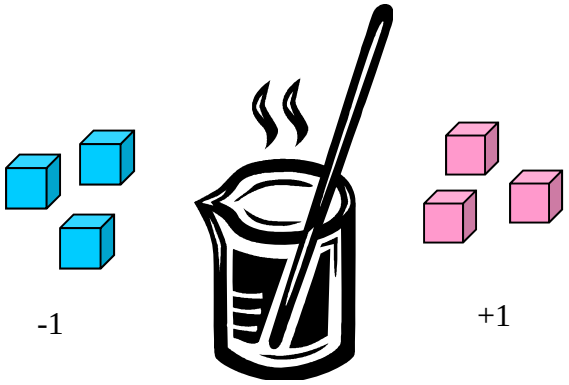
Is -3 + 7 the same as 7 + (-3) ? _____
What does it mean to add a negative number?

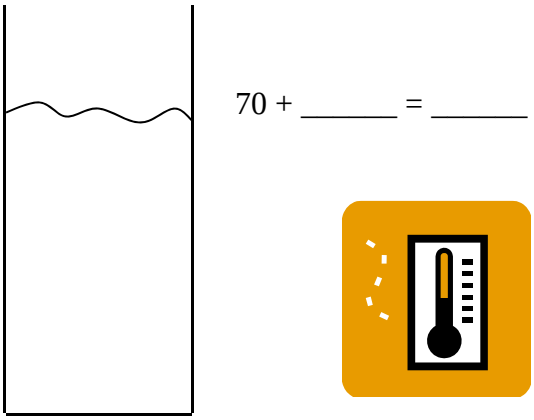
9 + (-6) = _____ 4 + (-8) = _____

4. Given what you know about adding a negative number, what could it mean to subtract a negative number?

Make up some problems to try your ideas:

Imagine a beaker of warm water at 70^{o}. You can add "cold cubes" to the water that lower the temperature by 1 degree. You can add "hot coals" to the water that raise the temperature by 1 degree. The hot coals are marked +1 and the cold cubes are marked -1.





What happens to the temperature of the water if you add 10 hot coals? _____

write the number sentence:

then add 8 cold cubes? _____

write the number sentence:

then take out 5 hot coals? _____

write the number sentence:

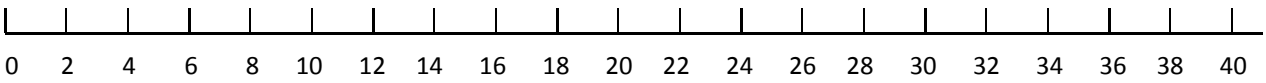
then take out 10 cold cubes (assume you can do this)? _____

write the number sentence:

5 + 8 =	13 – 7 =	7 – 13 =
8 – 10 =	0 – 4 =	-2 + 7 =
-9 + 15 =	20 – 30 =	30 – 20 =
-5 + (-3) =	-10 + (-2) =	

Multiplying and dividing

1. Show how multiplication works on the number line.



Since multiplication is repeated addition, how much is 4 x (-5) = _____

Since multiplication can be done forward or backward, how much is (-5) x 4 = _____

What do you think the answer would be to (-5) x (-4) = _____

2. Division is a process that answers two questions. Here's one of those questions: How can we split up a group of things fairly among several people – how many things would each person get?

> You have 24 cookies and want to share them equally with 6 people. How many cookies would each person get? 24 ÷ 6 = 4 cookies
>
> You are reading a book with 120 pages. If you want to read the same number of pages each night, how many would you have to read each night to finish in 10 days? 120 ÷ 10 = 12 pages (sharing the pages equally among the nights)
>
> A class is taking a field trip. There are 30 students in the class. 6 parents volunteer to drive. How many students have to fit in each car? (sharing the students equally among the cars)

(-10) ÷ 2 can mean, if you shared -10 equally among 2 people, how much would each person get? Draw a picture of 10 -1's and divide them equally into 2 groups. How many are in each group?

-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 So (-10) ÷ 2 = _____

A general rule is, any time you divide a negative number by a positive number, you get a negative number as an answer, because you are counting how many negative numbers there are in each group.

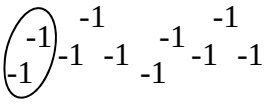
3. The other question that division answers is, How many things of this size fit into the whole?

A cereal box holds 18 cups of cereal. Each serving is 2 cups. How many servings are in the whole box? 18 ÷ 2 = 9 servings (The question can be restated as "How many times does 2 go into 18?)

An airplane hangar is 300 feet long. How many planes can fit into it, end to end, if each plane is 50 feet long? 300 ÷ 50 = 6 planes

A box of books weighs 42 pounds. Each book weights 3 pounds. How many books are there in the box? 42 ÷ 3 = 14 books (How many things of 3 pounds each are there in 42 pounds?)

(-10) ÷ -2 can mean, how many groups of -2 are there in -10? Once again, draw a picture of 10 -1's, but this time, circle groups of 2 of them. How many groups of -2s do you have?



So (-10) ÷ -2 = _____

A general rule is, any time you divide a negative number by a negative number, you get a positive number as an answer, because you're dividing the negative number into groups, and counting the number of groups.

4. What do you think the answer would be to 10 ÷ (-2) = _____