Name_____   Period _____   Date _____

Mathlinks

7-9
STUDENT PACKET

MATHLINKS: GRADE 7
STUDENT PACKET 9
SOLVING EQUATIONS

WORD BANK

Word or Phrase	Definition or Description	Example or Picture
addition property of equality		
consecutive integers		
equation		
equivalent expressions		
inequality		
multiplication property of equality		
perimeter		
rational number		
solution to an equation		

SOLVING EQUATIONS: MENTAL MATH STRATEGIES

Summary

We will solve equations using mental strategies. We will solve problems involving the lengths of sides, the perimeter, and the area of triangles, rectangles and regular polygons.

Goals

- Solve equations mentally.
- Solve problems involving side lengths, perimeter, and area of geometric figures.

Warmup

Solve for the unknown. Write MM if you use mental math. Otherwise, show all your work.
Check each solution by substituting it into the original equation.

1. $-4 = v - 2$	2. $4u = 124$	3. $p + 55 = 96$
4. $\dfrac{1}{2}m = -6$	5. $4.2 = n - 1.8$	6. $\dfrac{p}{4} = -5$
7. $3y = -42$	8. $1.25 = 5t$	9. $\dfrac{1}{3}x = \dfrac{5}{6}$

THE COVER-UP METHOD

Equation	1. $50 = 35 + 5n$	2. $4(3 + m) = 20$
Cover Up Equation	$50 = 35 +$	$4 ($ $) = 20$
Think	50 is 35 plus _____. value under my finger (_____) is _____. expression under my finger value under my finger	4 times _____ is 20. value under my finger (_____) is _____. expression under my finger value under my finger
Solution	The number, n, is _____.	The number, m, is _____.
Check		

Use the cover-up method to solve the following equations. Then check your work.

3. $6 + 5w = 41$	4. $4(m - 5) = 28$	5. $\dfrac{1}{2}(13 + f) = 11$
6. $98 = 9y - 1$	7. $-14 = 7(4 + y)$	8. $\dfrac{k+16}{4} = 8$

PRACTICE

Solve for the unknown. Write MM if you use mental math. Otherwise, show all your work.

1. $4 + 12b = 100$	2. $78 = 5y + 23$	3. $-6n - 152 = -26$
4. $0 = -6(x + 5)$	5. $\dfrac{m}{4} + 6 = 5$	6. $-4(p - 8) = 100$
7. $-6 = \dfrac{-42}{n}$	8. $\dfrac{2(x + 7)}{3} = 8$	9. $0.75x = -2.25$

10. The weight of a bag of apples, a, is unknown. The weight of a bag of oranges is 5 pounds.

   a. Write an expression for the weight of a grocery bag filled with a bag of oranges and a bag of apples.

   b. Write an expression for the weight of 3 grocery bags, each filled with a bag of oranges and a bag of apples.

   c. Write an equation to show that the total weight of the 3 grocery bags is 36 pounds. Then solve the equation.

   d. What does the solution to the equation represent?

PERIMETER AND AREA REVIEW

1. An isosceles triangle has two congruent sides that are 5 inches each and the third side is 9 inches. Sketch, label the side lengths, and find the perimeter.

2. Find the perimeter of each regular polygon below. Each polygon has sides of length 9 centimeters.

   a. Triangle _____

   b. Hexagon _____

   c. Quadrilateral _____

   d. Octagon _____

   e. Pentagon _____

   f. Decagon _____

3. The perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width? Sketch to help you solve the problem.

4. A rectangle has one side that measures 14 inches. Its area is 140 square inches. Sketch, label the side lengths, and find the perimeter.

PERIMETER PROBLEMS

1. The perimeter of a square is 216 units. How long is each side?	2. A regular octagon has a perimeter of 328 units. How long is each side?
a. Sketch:	a. Sketch:
b. Define the variable(s):	b. Define the variable(s):
Let _____ = the length of one side	Let _____ =
c. Write the equation:	c. Write the equation:
d. Solve the equation:	d. Solve the equation:
e. Answer the question:	e. Answer the question:
f. Check your answer:	f. Check your answer:

PERIMETER PROBLEMS (Continued)

3. The perimeter of a rectangle is 256 units. The longer sides are each 28 units more than the shorter sides. Find the dimensions of the rectangle.

3. The perimeter of a rectangle is 256 units. The longer sides are each 28 units more than the shorter sides. Find the dimensions of the rectangle.

   a. Sketch:

   b. Define the variable(s):

     Let _____ =

     Let _____ =

   c. Write the equation:

   d. Solve the equation:

   e. Answer the question:

   f. Check your answer:

4. The length of the second side of a triangle is twice the length of the first side. The length of the third side is 4 units more than the first side. The perimeter of the triangle is 52 units. How long is each side?

   a. Sketch:

   b. Define the variable(s):

   c. Write the equation:

   d. Solve the equation:

   e. Answer the question:

   f. Check your answer:

SOLVING EQUATIONS: BALANCE STRATEGIES

Summary	Goals
We will explore the concept of balance and apply it to solving equations. We will solve problems using algebra.	• Reinforce the importance of balance when solving equations. • Solve equations using properties of equality. • Solve problems involving consecutive integers.

Warmups

1. Circle all the expressions that are equivalent to $15 + 4(3 - 1)$.

$19(3 - 1)$ $\quad\quad\quad$ $15 + 4(2)$ $\quad\quad\quad$ $15 + 12 - 1$ $\quad\quad\quad$ $15 + 12 - 4$

38 $\quad\quad\quad\quad\quad\quad$ $15 + 8$ $\quad\quad\quad\quad\quad$ $4(2) + 15$ $\quad\quad\quad\quad$ $4(3 - 1) + 15$

2. Circle all the expressions that are equivalent to $3x + 6$.

$3(x + 6)$ $\quad\quad\quad\quad$ $6 + 3x$ $\quad\quad\quad\quad$ $6x + 3$ $\quad\quad\quad\quad$ $(x + 2) \bullet 3$

$3(2 + x)$ $\quad\quad\quad\quad$ $3(x + 1) + 3$ $\quad\quad\quad$ $2x + x + 6$ $\quad\quad\quad$ $2x \bullet x + 6$

3. Circle all the expressions that are equivalent to $12 - 4x + 3x$.

$8x + 3x$ $\quad\quad\quad\quad$ $11x$ $\quad\quad\quad\quad\quad$ $12 - x$ $\quad\quad\quad\quad$ $12 - 7x$
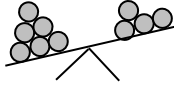
$-x + 12$ $\quad\quad\quad$ $-(12 - 4x + 3x)$ $\quad\quad$ $12 - x + 5 - 5$ $\quad\quad$ $\dfrac{3}{3} \bullet (12 - x)$

BALANCE SCALES

An __equal__ sign signifies that two expressions have the same value.

Equality
6 = 6

Inequality
6 > 4

Start with
this balanced
scale (equality)

Do not start with
this unbalanced
scale (inequality)

We can picture equalities or inequalities with balance scales. Let each "marble" be equal to one unit of weight.

For each problem, start with the **balanced** scale above (6 = 6). Then draw a sketch to illustrate the action. Then write the resulting equality or inequality.

1. Four marbles are removed from the right side of the original scale. Equality or inequality:	2. Three marbles are added to the right side of the scale. Equality or inequality:
3. Two marbles are removed from both sides of the scale. Equality or inequality:	4. One marble is added to both sides of the scale. Equality or inequality:
5. The number of marbles on both sides of the scale are doubled. Equality or inequality:	6. Only two-thirds the numbers of marbles on each side of the scale remain. Equality or inequality:

7. Under what conditions does a scale in balance remain in balance?

8. Under what conditions does a scale in balance become unbalanced?

SOLVING EQUATIONS USING BALANCE STRATEGIES 1

On the scales below, V represents a cup with an unspecified number of marbles in it. Because the cup has an unnamed value, we may use a variable, like *x,* as a placeholder. If more than one cup is on the same balance scale, each must hold the same number of marbles.

1. Write a variable equation for this balanced scale.
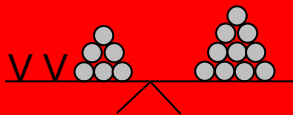
2. Remove six marbles from each side of the scale. Sketch the resulting picture. Is this scale still balanced?

3. Write an equation that illustrates this new picture.

4. Divide each side of the scale into two equal parts. Sketch the picture that represents **one equal part** on each side. Is this scale still balanced?

5. Write an equation that illustrates this new picture.

6. If a scale is balanced, describe in general what you can do to the objects on it so that it remains in balance?

7. The "generic tape diagram" below illustrates another way to represent the equation in problem 1. Write an equation represented by the tape diagram.

x	*x*	6
10		

_____ = _____

8. Remove 6 from each row and draw the new diagram. Then write the new equation that this diagram represents.

9. Therefore, *x* = _____ .

10. How are the diagrams in problems 1 and 7 the same?

SOLVING EQUATIONS USING BALANCE STRATEGIES 2

On the scales below, **V** represents a cup with an unspecified number of marbles in it. Because the cup has an unnamed value, we may use a variable, like *x*, as a placeholder. If more than one cup is on the same balance scale, each must hold the same number of marbles.

1. Write a variable equation for this balanced scale.
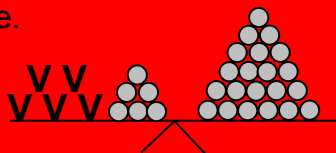
2. Remove six marbles from each side of the scale and sketch the resulting picture. Is this scale still balanced?

3. Write an equation that illustrates this new picture.

4. Divide each side of the scale into five equal parts. Sketch the picture that represents **one equal part** on each side. Is this scale still balanced?

5. Write an equation that illustrates this new picture.

6. Create a generic tape diagram to represent the equation in problem 1.

7. Write an equation that this diagram represents.

8. Remove 6 from each row and draw the new diagram. Then write the new equation that this diagram represents.

9. Therefore, *x* = _____ .

10. What does it mean to solve an equation?

EQUATION SOLVING PRACTICE 1

Use a balance scale or a generic tape diagram to solve each equation below. Clearly show your solutions and check to make sure each is correct.

1. $2x + 5 = 13$	2. $15 = 3x + 9$
3. $4x + 48 = 72$	4. $120 = 3x + 75$
5. $2(x + 4) = 30$	6. $150 = 5(x + 20)$

SOLVING EQUATIONS USING PROPERTIES OF EQUALITY

Properties of equality formalize balance strategies.

1. After Step 1, why does the equation
    remain balanced?

$$Step\ 1 \longrightarrow \begin{array}{rcl} 2x\ +27 & = & 59 \\ -27 & & -27 \\ \hline 2x & = & 32 \end{array}$$

Since subtracting 27 from each side of the equation is the same as adding -27 to each side of the equation, this step illustrates an important property of equality.

> The <u>addition property of equality</u> states that
>
> if $a = b$ and $c = d$, then $a + c = b + d$.

2. Why is $\dfrac{2x}{2} = x$ a true statement?

$$Step\ 2 \longrightarrow \begin{array}{rcl} 2x & = & 32 \\ \dfrac{2x}{2} & = & \dfrac{32}{2} \end{array}$$

3. After Step 2, why does the equation
    remain balanced?

Since dividing each side of the equation by 2 is the same as multiplying each side by $\dfrac{1}{2}$, this step illustrates another important property of equality.

> The <u>multiplication property of equality</u> states that
>
> if $a = b$ and $c = d$, then $a \bullet c = b \bullet d$.

Solve. Show or write what you are doing to **both sides** of each equation.

4. $5m + 62 = 107$	5. $-178 = -13w - 22$	6. $93 + 21(d - 2) = 240$

EQUATION SOLVING PRACTICE 2

Solve each equation using a mental math strategy (MM) or a balance strategy (B). Show your work. Identify your strategy.

1. $6k + 93 = 165$	2. $227 = 19v - 20$	3. $111 + 23(r - 1) = 272$
4. $y + 4y + 23 = 78$	5. $\dfrac{m}{4} - 6 = -20 - 2$	6. $-4(p - 6) + 6 = 120 - 10$
7. $-4 = \dfrac{b - 6}{3}$	8. $12 = \dfrac{10n - 2}{4}$	9. $\dfrac{-4(v + 1)}{6} = -2$

EQUATION SOLVING PRACTICE 2 (Continued)

Vicky and Nicky discussed how they might solve the equation $20d + 78 = 122$.

10. Vicky said, "First I'm going to divide the expressions on both sides of the equation by 20."
    Even though Vicky's strategy is permissible, why might it be difficult to execute?

11. Nicky said, "First I'm going to subtract 78." Even though Nicky has the right idea, explain
    why this language is not precise.

12. Solve the equation above. Show your work.

Jo has $240 in her savings account. She deposits $20 per month for several months.

13. Write a numerical expression for the amount of money that is in Jo's account after 6 months.	14. Write a variable expression for the amount of money that is in Jo's account after n months.
15. Write an equation to represent that after n months, Jo has $580. Then solve the equation for n.	16. Jo decides to be more ambitious about saving. With the same initial amount of money in her account and with deposits of $25 per month, how long will it take for her to save $765? Show all work by writing and solving an equation.

CONSECUTIVE INTEGERS

Here are some examples of sets of <u>consecutive integers</u>:
2, 3   39, 40, 41   95, 96, 97, 98   -21, -20, -19

1. List the consecutive integers that are greater than -55 and less than -49.

2. The sum of two consecutive integers is 21. Find the two numbers.

3. If *p* is an integer:

   a. Write an expression for the integer that is 1 more than *p*.

   b. Write an expression for the sum of these two consecutive integers, the first of which is *p*.

4. The <u>even</u> integers listed in consecutive order are …, -10, -8, -6, -4, -2, 0, 2, 4, 6, 8, 10, …

   a. Describe what you can do to any number in this list to arrive at the next number?

   b. If *n* represents an even integer, write an expression for the next even integer.

   c. Write an expression for the sum of two consecutive even integers, the first of which is *n*.

5. The <u>odd</u> integers listed in consecutive order are …, -9, -7, -5, -3, -1, 1, 3, 5, 7, 9, …

   a. Describe what you can do to any number in this list to arrive at the next number?

   b. If *m* represents an odd integer, what represents the next odd integer?

   c. Write an expression for the sum of two consecutive odd integers, the first of which is *m*.

POSTER PROBLEMS 3

Part 1: Your teacher will divide you into groups.

- Identify members of your group as A, B, C, or D.   I am group member _____.

- Each group will start at a numbered poster. Our group start poster is _____.

- Each group will have a different color marker. Our group marker is _____.

Part 2: Answer the problems on the posters by following your teacher's directions.

Part 3: Return to your seats.

Your teacher will give you numbers to insert into the problem below. Solve the problem in two different ways. Both methods have been started for you.

The sum of two numbers is _____. One number is ____ more than the other. What are the two numbers?

1. Method 1:	2. Method 2:
Let x = the smaller number	Let x = the larger number

3. Explain why it does not matter which number you choose to identify as x.

PRACTICE WITH NUMBER PROBLEMS

1. The sum of three consecutive integers is -72. What is the middle integer?

    a. Define the variable(s):

        Let _____ =

        Let _____ =

        Let _____ =

    b. Write the equation:

    c. Solve the equation:

    d. Answer the question:

    e. Check your answer:

2. The sum of three consecutive odd integers is 477. What is the greatest of these integers?

    a. Define the variable(s):

    b. Write the equation:

    c. Solve the equation:

    d. Answer the question:

    e. Check your answer:

SOLVING EQUATIONS WITH RATIONAL COEFFICIENTS

Summary	**Goals**
We will solve equations with coefficients that are rational numbers. We will solve problems using algebra.	• Apply mental math and balance strategies to solve equations with rational coefficients. • Solve number problems and perimeter problems using algebra.

Warmup

Match at least one answer choice with each equation. Be prepared to justify choices.

Answers	Equation	Answer choices
1. _____	$5(a - 5) = 5a - 25$	a. arithmetic fact
2. _____	$-35 + 35 = 0$	b. order/grouping properties (commutative or associative properties)
3. _____	$\frac{2}{2}a = 1a$	
4. _____	$1a = a$	c. additive inverse property d. additive identity property
5. _____	$(4)(25) = 100$	e. multiplicative inverse property
6. _____	$4x + 5x = (4 + 5)x$	f. multiplicative identity property g. distributive property
7. _____	$4x + 2 - 2 = 10 - 2$	h. addition property of equality
8. _____	$3 \bullet (2 + a) = (a + 2) \bullet 3$	i. multiplication property of equality

9. Herman's work for solving an equation is to the right. Why is it correct for Herman to say he used the "multiplication property of equality" even though he divided both sides of the equation by 3?

$$-15 = 3x$$
$$\frac{-15}{3} = \frac{3x}{3}$$
$$-5 = x$$

10. Circle all the following equations that are equivalent to $4 + 6x = 22$.

$6x = 18$ $4 + x \ 16$ $22 = 4 + 6x$ $\dfrac{4 + 6x}{2} = \dfrac{22}{2}$ $3(4 + 6x) = 66$

BALANCE REVISITED

1. The left side of a balanced scale has 5 pounds of apples and $\frac{1}{2}$ of a bag of apples. The right side has 15 pounds of apples.

   a. Write an equation that describes this situation.

   b. What is the weight of a full bag of apples? _____ Explain.

2. The right side of a balanced scale has 18 pounds of oranges and $\frac{2}{3}$ of a bag of oranges. The left side has 24 pounds of oranges. Write an equation that describes this situation. Then solve it for the weight of a full bag of oranges.

Solve for the unknown. Write MM if you use mental math. Otherwise show all work.

3. $3n + 4.5 - n = 10.5$	4. $\dfrac{9}{15} = \dfrac{(p + 1)}{5}$	5. $-3 + 9 = 7\dfrac{1}{2} - 3k$
6. $\dfrac{w}{10} + 0.6 = 0.8$	7. $-2 = \dfrac{1}{4}v + \dfrac{1}{3}$	8. $2.2 = 3\left(c + 1\dfrac{1}{2}\right) - 0.5$

EQUATIONS PRACTICE

Solve for the unknown. Write MM if you use mental math. Otherwise show all work.

1. $\quad -1.5(x + 2) = -2 - (-8)$	2. $\quad 2y - (y - 0.4) = -0.8$	3. $\quad -\dfrac{1}{2} = \dfrac{1}{2}\left(n + \dfrac{1}{2}\right)$
4. $\quad \dfrac{\left(b - \dfrac{1}{4}\right)}{-3} = -4$	5. $\quad -1.2(y - 1) = 0.8$	6. $\quad -4 = -\dfrac{2}{3}(n - 18)$

7. Myla started out with a bag of grapefruits, and gave some to Alex. Alex weighed what he received and it was $1\dfrac{1}{4}$ pounds.

   a. Write an expression for the weight of the bag after Myla gave the grapefruits to Alex.

   b. Without telling Myla, her sister Daisy took half of what was left (by weight). Write an expression for the weight of Myla's bag after Daisy took the grapefruits.

   c. Myla now weighs what she has left, and it's 4 pounds. Write an equation and solve for the weight of the original bag of grapefruits.

EQUATIONS PRACTICE (Continued)

Solve for the unknown. Write MM if you use mental math. Otherwise show all work.

8. $\quad -9 = -2x - 8\frac{1}{3} - x$	9. $\quad \frac{1}{2}\left(m + \frac{1}{4}\right) = 1\frac{3}{8}$	10. $\quad 4p + \frac{2}{3} - 6p = -\frac{3}{4}$
11. $\quad -42 = -x - 0.4x - 28$	12. $\quad -3(m - 1.2) = 1\frac{3}{4}$	13. $\quad 5\frac{1}{6}p - \frac{2}{3} = -1$

14. Hamish is making a large dinner for his family. He buys 6 pounds of lamb chops, and then spends another $11.70 on potatoes and vegetables. The total comes to $61.20 (before tax). What is the price per pound of lamb chops?

   Answer the question above by writing and solving an equation.

GIVE THE REASONS

Write what was done for each step. Use diagrams, if needed. Check each solution.

1.

	Equation/Steps		State what was done
a.	$-\dfrac{3}{4}(x - 20) = -21$	a.	given equation
b.	$-\dfrac{3}{4}x + 15 = -21$	b.	
c.	$-15 \quad -15$	c.	
d.	$-\dfrac{3}{4}x = -36$	d.	
e.	$\left(-\dfrac{4}{3}\right)\left(-\dfrac{3}{4}x\right) = (-36)\left(-\dfrac{4}{3}\right)$	e.	
f.	$x = 48$	f.	
g.	Check your solution using substitution:		

2.

	Equation/Steps		State what was done
a.	$\dfrac{x}{-3} - 1.8 = -2.4$	a.	given equation
b.	$+ 1.8 \quad + 1.8$	b.	
c.	$\dfrac{x}{-3} = -0.6$	c.	
d.	$(-3)\left(\dfrac{x}{-3}\right) = (-3)(-0.6)$	d.	
e.	$\left(\dfrac{-3x}{-3}\right) = 1.8$	e.	
f.	$x = 1.8$	f.	
g.	Check your solution using substitution:		

FIND THE MISTAKE

Each equation below has been solved incorrectly. Find the mistakes, circle them, and rework the solutions so they are correct. Check each solution.

1.

Equation/Steps	Circle the error and rework the problem
$\dfrac{-x}{0.5} + 4 = -8$	
$(0.5)\left(\dfrac{-x}{0.5} + 4\right) = (0.5)(-8)$	
$-x + 2 = -4$	
$-x + 2 = -4$	
$\underline{} - 2 \quad -2$	
$-x = 8$	
$-x = -8$	
Check your solution using substitution:	

2.

Equation/Steps	Circle the error and rework the problem.
$-\dfrac{2}{3}(x + 3) = 2$	
$-\dfrac{2}{3}x - \dfrac{2}{9} = 2$	
$-\dfrac{2}{3}x - \dfrac{2}{9} = 2$ $+\dfrac{2}{9} \quad +\dfrac{2}{9}$	
$-\dfrac{2}{3}x = 2\dfrac{2}{9}$	
$\left(-\dfrac{3}{2}\right)\left(-\dfrac{2}{3}x\right) = \left(-\dfrac{3}{2}\right)\left(\dfrac{20}{9}\right)$	
$x = -\dfrac{10}{3}$	
Check your solution using substitution:	

NUMBER AND PERIMETER PROBLEMS REVISITED

For each problem, sketch (if needed), define the variable(s), write an equation, solve the equation, answer the question, and check your work.

1. A rectangle has a perimeter of 60 units. Its width is one-third its length. What are its dimensions.	2. The sum of a number, half of the number, and twice the number is -49. What is the number?

SKILL BUILDERS, VOCABULARY, AND REVIEW

SKILL BUILDER 1

Write >, =, or < to make each statement true.

1. $3 - 2(3)$ _____ $8(-2) + 5$	2. $15 \div (-3 + 2)$ _____ $6 - 24 \div (-2)$
3. $-5.2 + (-3.32)$ _____ $(-24.9) \div 3$	4. $-5\dfrac{3}{5} + 4\dfrac{2}{3}$ _____ $8\dfrac{5}{6} - 9\dfrac{1}{3}$
5. $\dfrac{1}{2}(-3.5 - 1.5)$ _____ $\dfrac{3}{4}(-22.5 + 10.5)$	6. $\left(-\dfrac{3}{7}\right)\left(4\dfrac{9}{10}\right) + 5.6$ _____ $8.5 + \dfrac{1}{2} - 10.4$

7. Isabella is in Alaska where the temperature is -17° F. Matteo is in Arizona where it is 85° warmer. What is the temperature in Arizona?

8. A bucket can hold a combination of 5 pounds of dry sand and 2 pounds of water. If Marquille needs 42 buckets of this sandy mixture for his sand castle, how many pounds of dry sand does he need?

SKILL BUILDER 2

Simplify each expression. Then use the distributive property and the GCF of the terms to rewrite each expression so that it is a product of factors.

1. $7g + 2g + 2n + n$	2. $5(y + 2) + 5y - 5$	3. $15 - 4(n + 1) - 2n + 1$

For problems 4 – 6, Andres makes 3 watches every 5 hours.

4. Complete the table.

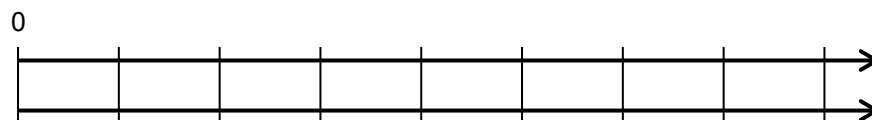|	5		20	60	95		1	2
	3	6				1		

5. Fill in the blanks:

   Andre's rate of making watches is _____ for one hour.

   Andre's unit rate in watches per hour is _____.

   At this rate, Andres will make _____ in 10 hours.

6. Make a double number line diagram to represent this relationship. You do not need to put every value in the table on the number lines.

0

Compute.

7. $\dfrac{\frac{3}{4}}{\frac{5}{8}}$	8. $\dfrac{\frac{8}{3}}{\frac{5}{6}}$

SKILL BUILDER 3

1. The average American walks 35,000 steps per week. Flo wants this to be her goal.

    a. If Flo walks the same number of steps per day, Monday through Sunday, how many steps per day is this?

    b. If Flo chooses to walk 6,500 steps Monday, write a numerical expression that represents the average number of steps she must walk each day Tuesday through Sunday to reach her goal.

    c. Say that Flo actually walks 3,500 steps Tuesday, and commits to walking an equal number of steps per day for the remaining days. Write and solve an equation that represents Flo attaining her goal.

Translate the verbal statements into algebraic inequalities.

Verbal Statement	Algebraic Inequality
2. A number x is less than 3	
3. A number x is greater than or equal to 5	
4. A number x is at most 9	

5. These were the changes each day for stock prices for Natural Gas last week: $-5\frac{1}{5}$, $-\frac{5}{8}$, $4\frac{1}{2}$, $3\frac{3}{4}$, and $-2\frac{4}{5}$. What is the average change in stock price during this 5-day period?

Compute.

6. 75% of 40	7. 15% of 47	8. 80% of 125

SKILL BUILDER 4

Solve.

1. The perimeter of an isosceles triangle is 187 cm. It has two congruent sides that are 10 cm less than four times the length of the third side. What is the length of each of the congruent sides?
 	
  a. Define the variables using words or pictures.
 	
  b. Write an equation and solve.
 	
  c. Write the solution in words.
 	
  d. Check the solution.
	2. The sum of a number and 8 times that number is 1,107. What is the number?
	
	  a. Define the variables using words or pictures.
	
	  b. Write an equation and solve.
	
	  c. Write the solution in words.
	
	  d. Check the solution.

SKILL BUILDER 5

1. Circle all the expressions that are equivalent to $6y - 18 + 2y$.

       $4y + 18$ $8y - 18$ $2(3y - 9 + y)$ $-3(-2y + 6 - y)$

       $-18 + 8y$ $4y + 4y - 18$ $\frac{1}{2}(12y - 18 + 4y)$ $(4y - 9)(-2)$

For each problem, start with a **balanced** scale ($4 = 4$). Then draw a sketch to illustrate the action. Then write the resulting equation or inequality.

2. Two marbles are removed from the right side of the original scale. Equality or inequality:	3. Three marbles are added to the left side of the scale. Equality or inequality:
4. Three marbles are removed from both sides of the scale. Equality or inequality:	5. Two marbles are added to both sides of the scale. Equality or inequality:

Solve. Use a balance scale diagram, a tape diagram, or show what you are doing to both sides of each equation using properties of equality.

6. $6k + 24 = 48$	7. $157 = 11v + 47$	8. $17 + 3r = 319$
9. $y + 6y + 19 = 68$	10. $\frac{m}{5} - 8 = 29 - 2$	11. $5 - 4(x - 3) = 223 - 12$

SKILL BUILDER 6

Solve each equation using a mental math strategy (MM) or a balance strategy (B). Show your work.

1. $-2 = \dfrac{n}{-9} - 10$	2. $\dfrac{x-3}{-8} = -12$	3. $5 - 13 = 3y - 15 + 4y$

4. The sum of three consecutive odd integers is 177. What are the three numbers?

   a. Define the variables.　　　　　　　　b. Write an equation and solve.

   c. Write the solution in words.　　　　　d. Check the solution.

5. The sum of two numbers is 314. One number is 108 less than the other number. Find the two numbers.

6. The sum of three consecutive even numbers is 288. Find the three numbers.

7. If 27 less than twice a number is 25, what is the number?

SKILL BUILDER 7

Solve for the unknown.

1. $-8.2 + 0.4x = -5$	2. $8.8 = -2(v + 2.2)$	3. $3(0.8 - x) + 4x = 3.2$
4. $3\frac{1}{8}x - 5 = 7\frac{1}{2}$	5. $2\frac{1}{5} + \frac{2}{3}x = -6$	6. $4\frac{1}{2} = \frac{3}{4} - 2\frac{5}{8}x$

7. Roscoe is building a sand box in his back yard. He buys 6 bags of sand and spends $23.78 on the box. He spends a total of $55.70 (before tax). How much did each bag of sand cost?

Answer the question by writing and solving an equation.

8. To make one necklace you need $1\frac{1}{4}$ feet of string. Grace makes 15 bracelets and one necklace. She uses a total of $8\frac{3}{4}$ feet of string. How much string did she use for each bracelet?

FOCUS ON VOCABULARY
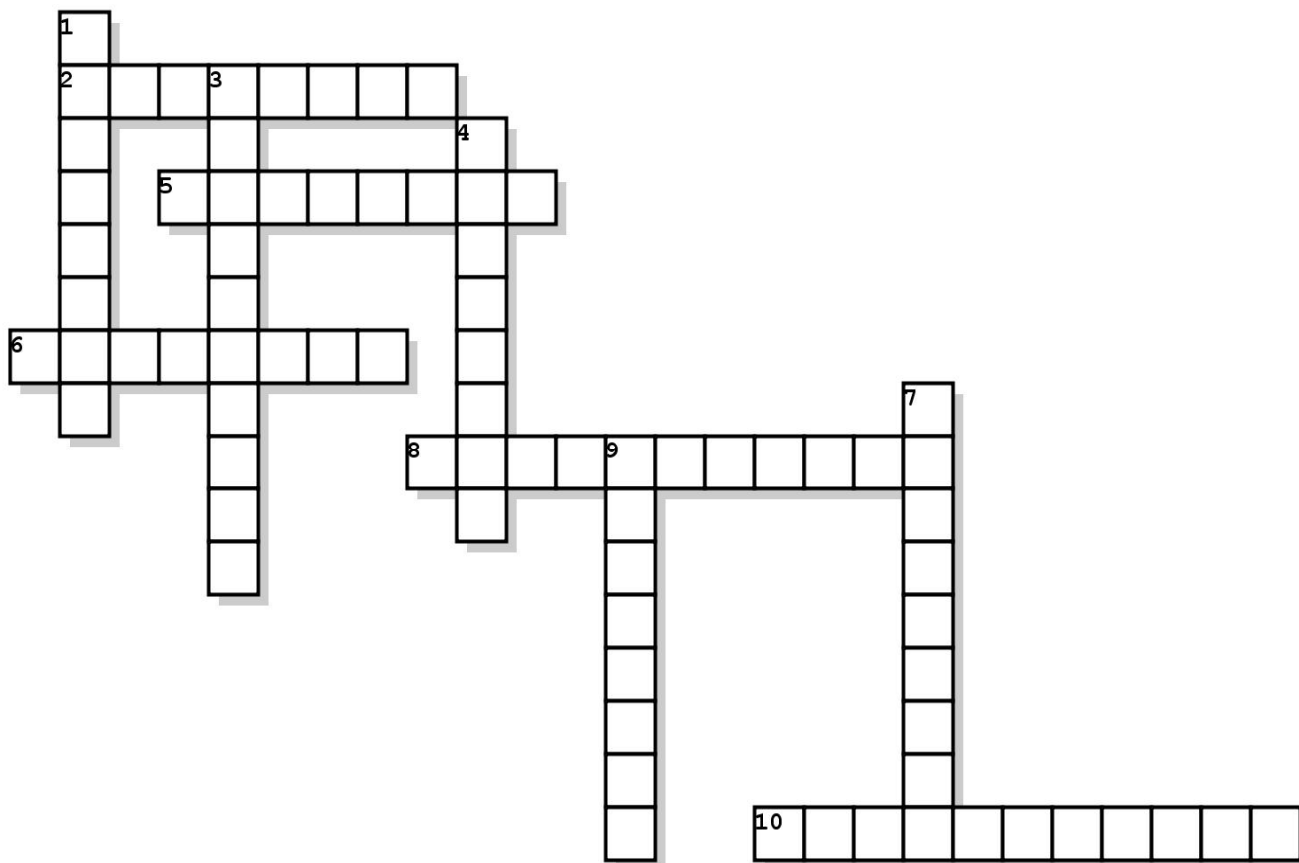
Across

2   property of equality that asserts that equals added to equals are equal

5   five-sided polygon

6   an unknown quantity in an equation

8   integers that are one unit apart

10   combinations of numbers, variables, and operation symbols

Down

1   a quotient of integers is a ____ number

3   statement that asserts that two numbers are not equal

4   value that makes an equation true

7   distance around a polygon

9   statement that asserts that two expressions are equal

(For word hints, see the word bank and other vocabulary used in this packet.)

SELECTED RESPONSE

Show your work on a separate sheet of paper and select the best answer(s).

1. Choose all of the polygons that have a perimeter of 120 cm.

   A. A square with a side length of 30 cm.

   B. An equilateral triangle with a side length of 40 cm.

   C. A rectangle with a length of 80 cm and a width of 40 cm.

   D. A rectangle with a length of 40 cm and a width of 20 cm.

2. Choose all the equations that have a solution of $x = -3$.

   A. $-3 + x = 6$

   B. $15 = \dfrac{-45}{x}$

   C. $12 = 4(x + 6)$

   D. $-2x = -6$

3. If a scale is balanced with 10 marbles on each side, which of the following actions will make the scale unbalanced? Choose all that apply.

   A. Take 2 marbles from one side and put them on the other side.

   B. Remove half of the marbles from both sides.

   C. Add three marbles to both sides.

   D. Triple the number of marbles on one side and remove one-third of the marbles on the other side.

4. When six times a number is added to 5, the result is 17. What is the number?

   A. 10

   B. 2

   C. 12

   D. There is not enough information.

5. Choose all the equations that are equivalent to $2x - 6 = 14$.

   A. $2x - 6 + 6 = 14 + 6$

   B. $\dfrac{2}{2} x - 6 = \dfrac{14}{2}$

   C. $\dfrac{2x - 6}{2} = \dfrac{14}{2}$

   D. $\dfrac{1}{2}(2x - 6) = \dfrac{1}{2} \bullet 14$

   E. $2x = 20$

   F. $x = 10$

KNOWLEDGE CHECK

Show your work on a separate sheet of paper and write your answers on this page.

9.1 Solving Equations: Mental Math Strategies

Solve for the unknown.

1. $16 = 3x + 1$

2. $\dfrac{x-1}{5} = 4$

3. The perimeter of a rectangle is 18 in. The length is 6 in. What is the width? First define your variables and write an equation, then solve using a mental math strategy.

9.2 Solving Equations: Balance Strategies

Use a balance strategy to solve each equation. Show all your work.

4. $85 = 10 + 4x + x$

5. $\dfrac{x+7}{2} = 12$

6. Suzie, Bobby, and Marcie all share the same birthday. Suzie is one year older than Bobby. Bobby is one year older than Marcie. The sum of their ages is 24. What is the age of each person?

9.3 Solving Equations with Rational Coefficients

Solve for the unknown.

7. $\dfrac{1}{2}m + \dfrac{3}{4} = \dfrac{7}{8}$

8. $9.5 = 1.4d - 3.1$

9. $\dfrac{1}{2}(2k + 6) = 0.75$

HOME-SCHOOL CONNECTION

Here are some problems to review with your young mathematician.

1. A balance scale is used as a way to describe equation.

   In your own words, how is a balance scale like an equation?

2. Use a mental math strategy to solve $4 = \frac{1}{3}(x + 1)$. Write your reasoning in words.

3. The sum of three consecutive even integers is 60. What are the numbers?

4. Fiona was trying to solve the equation $\frac{x}{2} + 5 = 12$.

   She multiplied both sides of the equation by 2 and got $x + 5 = 24$.

   Explain Fiona's mistake. Then solve the equation correctly.

Parent (or Guardian) Signature_____

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COMMON CORE STATE STANDARDS – MATHEMATICS

STANDARDS FOR MATHEMATICAL CONTENT

6.EE.A* **Apply and extend previous understandings of arithmetic to algebraic expressions.**

6.EE.2a* Write, read, and evaluate expressions in which letters stand for numbers: Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.*

6.EE.3* Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*

6.EE.B* **Reason about and solve one-variable equations and inequalities.**

6.EE.5* Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.6* Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.7* Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and are all nonnegative rational numbers.

7.NS.A **Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.**

7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

7.EE.A **Use properties of operations to generate equivalent expressions.**

7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.B **Solve real-life and mathematical problems using numerical and algebraic expressions and equations.**

7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

7.EE.4a Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities: Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*

*Content essential for success in 7th grade

STANDARDS FOR MATHEMATICAL PRACTICE

MP1 Make sense of problems and persevere in solving them.

MP2 Reason abstractly and quantitatively.

MP7 Look for and make use of structure.

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