Summer 8^{th} grade Math packet

Dear Parents, Guardians, and Students,

The 8^{th} grade teachers at Rotolo Middle School are already busy preparing a great year for you! They have provided two opportunities for you to review essential math skills that will help you be successful in 8^{th} grade. Please choose **ONE** of the following, TenMarks online program or Summer Packet, to complete over the summer.

TenMarks Online Summer Program.
Parents, we are very excited to inform you about a free program offered by TenMarks Education that will provide your child with access to a powerful, personalized summer math program designed to help them prepare for a successful school year. The expectation is for students to spend an hour per week on this program.
The program is called TenMarks Summer Math Program and here is how it works:

1. Visit http://summer.tenmarks.com and sign up.
2. At the start of the program, your child will receive a short diagnostic assessment based on the grade s/he is entering this fall.
3. The assessment will be automatically graded and TenMarks will create a personalized program designed for your child to prepare for the upcoming year.
4. At the end of the summer, print the student report card and bring it to their 8^{th} grade math teacher.

The TenMarks Summer Math Program will guide your child through their personalized program, one topic at a time. Each assignment contains embedded instruction (hints, video lessons, and interventions) to help your child refresh concepts from the past year and prepare for the ones ahead. This will not count for a grade, however, teachers will review the student report card and will reference these skills throughout the school year.

Summer Packet
The second option is the completion of a summer packet that can be found online http://rms.bps101.net/ (hard copies will be available in the main office at RMS throughout the summer). Please select the correct packet for the course you will be taking in 8th grade (Math 1 **OR** Math 2 **OR** Math 3).

It will not be assessed and will not count for a grade. However, teachers will collect completed packets and the skills reviewed will be referenced throughout the school year. Please bring the completed packet to school on the first day.
Each new topic in the packet has an example and a hint on how to solve the problems on the page. Please read them carefully before answering the problems.

Parents, so you know how well-prepared your child is for 8^{th} grade math, please check the answers and mark incorrect answers with a colored pen. If your child is struggling with a particular topic please encourage your child to redo the problems associated with that skill. An additional resource that your child may find helpful is www.khanacademy.org.

Please choose **ONE of the above opportunities to prepare your child for a successful year in 8^{th} grade math.
Reminder: In the fall, please bring back a printed report card from TenMarks **OR** the completed paper copy of the summer packet. Your math teacher will be collecting this on the first day of school!

We look forward to meeting all of you in the upcoming school year. Enjoy your summer!

Thank you,
Your Eighth Grade Math teachers

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1-5 The Distributive Property *(Pages 26–31)*

A **term** is a number, a variable, or a product or quotient of numbers and variables. Some examples of terms are x^2 and $3y$. The expression $3a + 5$ has two terms. **Like terms** are terms that contain the same variable, with corresponding variables having the same power. For example, $2x^2$ and $7x^2$ are like terms, but $4b^2$ and $2b$ are not. The expressions $8g + 4g$ and $12g$ are **equivalent expressions** because they denote the same number. An expression is in **simplest form** when it is replaced by an equivalent expression having no like terms and no parentheses. The **coefficient** of a term is the numerical factor. For example, in $8g$, 8 is the coefficient. You can use these facts plus the **Distributive Property** to simplify expressions.

Distributive Property	For any numbers *a*, *b*, and *c*, $a(b + c) = ab + ac$ and $(b + c)a = ba + ca$; $a(b - c) = ab - ac$ and $(b - c)a = ba - ca$.

Examples

a. Rewrite $7(2x + 3)$ without parentheses.

Use the Distributive Property.

$7(2x + 3) = 14x + 21$

The expression $14x + 21$ is in simplest form because it has no parentheses and no like terms.

b. Simplify the expression $3x^2 + 2x + 6x + x^2$.

Group and combine like terms using the Distributive Property.

$3x^2 + 2x + 6x + x^2$

$= 3x^2 + x^2 + 2x + 6x$ — *Rearrange the terms.*

$= (3 + 1)x^2 + (2 + 6)x$ — *Remember, $x^2 = 1x^2$.*

$= 4x^2 + 8x$ — *Simplify.*

Practice

Use the distributive property to rewrite each expression without parentheses.

1. $3(a + 4)$ **2.** $2(x + 3)$ **3.** $(h - 5)6$

4. $-3(b + f)$ **5.** $x(2 + y)$ **6.** $a(b + c)$

Simplify each expression, if possible. If not possible, write *in simplest form*.

7. $4x + 2x$ **8.** $6a + 3b$ **9.** $12xy + 4xy$

10. $11m + 7m^2 + 5m^2$ **11.** $10b + 6b^2 + 4b^3$ **12.** $27x^2 - 18x^2$

13. $15b^3 + 10b + 20b^3$ **14.** $2x^2 + 2x^2$ **15.** $3y^4 - 9y^5 + 15y^4 + 3y^6$

16. Mental Math How would you use the Distributive Property to find the product of 6 and 104 mentally? Show your steps.

17. **Standardized Test Practice** Use the Distributive Property to rewrite the expression $2(m + 4h + 2a)$ without using parentheses.

A $2m + 4h + 2a$ **B** $2m + 8h + 4a$ **C** $m + 4h^2 + 4a$ **D** $4m + 4h + 4a$

Answers: 1. $3a + 12$ 2. $2x + 6$ 3. $6h - 30$ 4. $-3b - 3f$ 5. $2x + xy$ 6. $ab + ac$ 7. $6x$ 8. in simplest form 9. $16xy$
10. $11m + 12m^2$ 11. in simplest form 12. $9x^2$ 13. $35b^3 + 10b$ 14. $4x^2$ 15. $18y^4 - 9y^5 + 3y^6$
16. $6(100 + 4) = 600 + 24 = 624$ 17. B

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2-4 Dividing Rational Numbers *(Pages 84–87)*

You can use the same rules of signs when dividing rational numbers that you used for multiplying.

Dividing Two Rational Numbers	The quotient of two numbers having the *same sign* is positive. The quotient of two numbers having *different signs* is negative.

If a fraction has one or more fractions in the numerator or denominator, it is a **complex fraction**. To simplify a complex fraction, rewrite it as a division expression.

Examples

a. Simplify $\dfrac{\frac{4}{7}}{-8}$.

Rewrite the complex fraction as $\frac{4}{7} \div (-8)$.

$\frac{4}{7} \div (-8) = \frac{4}{7} \cdot \left(-\frac{1}{8}\right)$ — *Multiply by* $-\frac{1}{8}$, *the reciprocal of* -8.

$= -\frac{4}{56}$ or $-\frac{1}{14}$ — *The signs are different, so the product is negative.*

b. Simplify $\dfrac{-2x + 10y}{5}$.

$\frac{-2x + 10y}{5} = \frac{-2x}{5} + \frac{10y}{5}$ — *Divide each term by 5.*

$= -\frac{2}{5}x + 2y$ — *Simplify.*

Practice

Simplify.

1. $22 \div \left(\frac{11}{13}\right)$

2. $24 \div \left(-\frac{1}{8}\right)$

3. $\frac{-14}{-2}$

4. $\dfrac{-\frac{15}{64}}{3}$

5. $\dfrac{-\frac{30}{7}}{-10}$

6. $\dfrac{8}{-\frac{4}{9}}$

7. $\frac{-32m}{8}$

8. $-18t \div \frac{8}{9}$

9. $\frac{2a + 8}{4}$

10. $\frac{8x + 42y}{6}$

11. $\frac{-12h + (-18g)}{3}$

12. $\frac{54s + 3w}{-6}$

Evaluate each expression if $x = 4$, $y = -5$, and $z = -1.5$.

13. $\frac{y}{z}$

14. $\frac{xy}{xz}$

15. $\frac{x + z}{3}$

16. **Standardized Test Practice** How many boxes of peanuts can you get from 52 pounds of peanuts if each box holds $1\frac{5}{8}$ pounds of peanuts?

A 84 **B** 32 **C** 26 **D** 50

Answers: 1. 26 2. −192 3. 7 4. $-\frac{5}{64}$ 5. $\frac{3}{7}$ 6. −18 7. $-4m$ 8. $-20\frac{1}{4}t$ 9. $\frac{1}{2}a + 2$ 10. $1\frac{1}{3}x + 7y$ 11. $-4h - 6g$ 12. $-9s - \frac{1}{2}w$ 13. $3\frac{1}{3}$ 14. $3\frac{1}{3}$ 15. $\frac{5}{6}$ 16. B

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3-4 Solving Multi-Step Equations *(Pages 142–148)*

Solving Multi-Step Equations	• Work backward to isolate the variable and solve the equation. • Use subtraction to undo addition, and use addition to undo subtraction. • Use multiplication to undo division, and use division to undo multiplication.

Consecutive integers are integers in counting order, such as −3, −2, and −1.

Examples

a. Solve $\frac{2x-3}{4} = 9$.

Multiply each side by 4 to eliminate the fraction.

$4\left(\frac{2x-3}{4}\right) = 9(4)$

$2x - 3 = 36$

Next, undo the subtraction by adding 3 to each side.

$2x - 3 + 3 = 36 + 3$

$2x = 39$

Last, undo the multiplication by dividing each side by 2.

$\frac{2x}{2} = \frac{39}{2}$

$x = 19\frac{1}{2}$

b. Find 3 consecutive odd integers whose sum is −3.

Let n = the least odd integer. Then n + 2 = the next greater odd integer, and n + 4 = the greatest of the three odd integers.

$n + (n + 2) + (n + 4) = -3$

$3n + 6 = -3$ *Add like items.*

$3n + 6 - 6 = -3 - 6$ *Subtract 6 from each side.*

$3n = -9$ *Simplify.*

$\frac{3n}{3} = \frac{-9}{3}$ *Divide each side by 3.*

$n = -3$ *Simplify.*

$n + 2 = -3 + 2$ or −1 and $n + 4 = -3 + 4$ or 1, so the consecutive odd integers are −3, −1, and 1.

Practice

Solve each equation. Check your solution.

1. $10 - 7p = -18$ **2.** $-1.9r + 9.3 = 15$ **3.** $6 = \frac{s}{3}$ **4.** $\frac{-4m-3}{-6} = -9$

5. $-6 = \frac{-2n-3}{4}$ **6.** $\frac{t}{5} - 4 = -10$ **7.** $11 = -7 - \frac{g}{3}$ **8.** $\frac{5}{6}b + 8 = -11$

9. $13 = -8 - 3t$ **10.** $-\frac{3+n}{7} = -5$ **11.** $\frac{s+4}{-2} = -16$ **12.** $3 - 9t = 21$

Define a variable, write an equation, and solve each problem.

13. Find two consecutive odd integers whose sum is 128.

14. Find three consecutive even integers whose sum is 90.

15. **Standardized Test Practice** Sally is eight years older than John. John is fourteen years older than Kareem. If the sum of all three ages is 90, how old is Kareem?

A 8 **B** 18 **C** 28 **D** 40

Answers: 1. 4 2. −3 3. 18 4. $-14\frac{1}{4}$ 5. $10\frac{1}{2}$ 6. −30 7. −54 8. $-22\frac{4}{5}$ 9. −7 10. 32 11. 28 12. −2 13. 63, 65 14. 28, 30, 32 15. B

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3-5 Solving Equations with the Variable on Each Side *(Pages 149–154)*

To solve an equation that has the variable on both sides, use the properties of equality to write an equivalent equation that has the variable on only one side. Then solve. When you solve equations that contain grouping symbols, you may need to use the distributive property to remove the grouping symbols. Some equations may have no solution because there is no value of the variable that will result in a true equation. For example, $x + 1 = x + 2$ has no solution; it cannot be true. An equation that is true for every value of the variable is called an **identity**. For example, $x + x = 2x$ is true for every value of x.

Examples

a. Solve $3(x - 2) = 4x + 5$.

First use the distributive property to remove the parentheses.

$3x - 6 = 4x + 5$

Next, collect all the terms with x on one side of the equal sign by subtracting 3x from each side.

$3x - 6 - 3x = 4x + 5 - 3x$

$-6 = x + 5$ — *Add like terms.*

$-6 - 5 = x + 5 - 5$ — *Subtract 5 from each side.*

$-11 = x$ — *Simplify.*

b. Solve $\frac{1}{2}y = \frac{1}{3}y + 2$.

First, multiply each side by 6, the LCD, to clear the fractions from the problem.

$6 \cdot \frac{1}{2}y = 6\left(\frac{1}{3}y + 2\right)$

$6 \cdot \frac{1}{2}y = 6 \cdot \frac{1}{3}y + 6 \cdot 2$

$3y = 2y + 12$

Next, collect all the terms with y on one side of the equal sign by subtracting 2y from each side.

$3y - 2y = 2y - 2y + 12$

$y = 12$

Try These Together

1. Solve $4x + 3 = 5x + 7$.
   HINT: Subtract 4x from each side.

2. Solve $7 + 3t = \frac{6 - t}{2}$.
   HINT: Multiply each side by 2.

Practice

Solve each equation. Then check your solution.

3. $18 + 2n = 4n - 9$
4. $10 - 2.7y = y + 9$
5. $\frac{2}{3}n + 6 = \frac{1}{4}n - 3$
6. $11.1c - 2.4 = -8.3c + 6.4$
7. $3 - 4x = 8x + 8$
8. $\frac{3}{5}d + 5 = \frac{1}{3}d - 3$
9. $3(2x - 1) = 9(x + 3)$
10. $2(2x - 5) = 6x + 4$
11. $-6(4x + 1) = 5 - 11x$
12. $\frac{5}{6}(12p + 4) = -13p + 4$
13. $-8\left(\frac{1}{4}n - 3\right) = n + 2$
14. $\frac{2 + t}{3} = 4 - \frac{6}{7}t$

15. **Standardized Test Practice** Nine less than half n is equal to one plus the product of $-\frac{1}{8}$ and n. Find the value of n.

    A 24 **B** −21 **C** 8 **D** 16

Answers: 1. −4 2. $-\frac{8}{7}$ 3. 13.5 4. $\frac{10}{37}$ 5. $-21\frac{3}{5}$ 6. $\frac{44}{97}$ 7. $-\frac{5}{12}$ 8. −30 9. −10 10. −7 11. $-\frac{11}{13}$ 12. $\frac{2}{69}$ 13. $7\frac{1}{3}$ 14. 2.8 15. D

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3-8 Solving Equations and Formulas

(Pages 166–170)

Some equations contain more than one variable. To solve an equation or formula for a specific variable, you need to get that variable by itself on one side of the equation. When you divide by a variable in an equation, remember that division by 0 is undefined.

When you use a formula, you may need to use **dimensional analysis**, which is the process of carrying units throughout a computation.

Examples

a. Solve the formula $d = rt$ for t.

The variable t has been multiplied by r, so divide each side by r to isolate t.

$\frac{d}{r} = \frac{rt}{t}$ or $\frac{d}{r} = t$

Thus $t = \frac{d}{r}$, *where* $r \neq 0$.

b. Find the time it takes to drive 75 miles at an average rate of 35 miles per hour.

Use the formula you found for t in Example A.

$t = \frac{d}{r}$

$t = \frac{75\ mi}{35\ \frac{mi}{h}}$ *Use dimensional analysis.* $\frac{mi}{\frac{mi}{h}} = \frac{mi}{1} \cdot \frac{h}{mi} = h$

$t = 2\frac{1}{7}$ *hours*

Try These Together

1. Solve $4a + b = 3a$ for a.
HINT: Begin by subtracting 3a from each side.

2. Solve $\frac{c + d}{3} = 2c$ for c.
HINT: Begin by multiplying each side by 3.

Practice

Solve each equation for the variable specified.

3. $f = epd$, for e
4. $12g + 31h = -8g$, for h
5. $y = mx + b$, for b
6. $v = r + at$, for r
7. $\frac{3x + y}{c} = 4$, for c
8. $\frac{5xy + n}{2} = -6$, for y
9. $m + n + 2p = 3$, for m
10. $6y + z = bc - 2y$, for y
11. $3x - 4y = 7$, for y
12. $s = \frac{n}{2}(a + t)$, for n
13. $v = \frac{4}{3}r$, for r
14. $W = mgh$, for g
15. $PV = nRT$, for V
16. $G = F - D$, for D
17. $6t + 62s = \frac{1}{2}(3t - 42s)$, for t
18. $3c + 5d = 7d - 6c$, for d

19. **Standardized Test Practice** Four ninths of a number c increased by 4 is 18 less than one eighth times another number d. Solve for c.

A $c = \frac{9}{32}d + 31\frac{1}{2}$ **B** $c = \frac{4}{72}d + \frac{4}{72}$ **C** $c = \frac{9}{32}d - 49\frac{1}{2}$ **D** $c = \frac{4}{72}d - 31\frac{1}{2}$

Answers: 1. $a = -b$ 2. $c = \frac{d}{5}$ 3. $e = \frac{f}{pd}$ 4. $h = \frac{-20g}{31}$ 5. $b = y - mx$ 6. $r = v - at$ 7. $c = \frac{3x + y}{4}$ 8. $y = \frac{-n - 12}{5x}$ 9. $m = 3 - n - 2p$ 10. $y = \frac{bc - z}{8}$ 11. $y = \frac{3x - 7}{4}$ 12. $n = \frac{2s}{a + t}$ 13. $r = \frac{3}{4}v$ 14. $g = \frac{W}{mh}$ 15. $V = \frac{nRT}{P}$ 16. $D = F - G$ 17. $t = -\frac{166s}{9}$ 18. $d = \frac{9c}{2}$ 19. C

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3-9 Weighted Averages *(Pages 171–177)*

Sometimes the numbers that go into an average do not all have the same weight or importance. In such cases, you may want to use a **weighted average**. Two applications of weighted averages are mixture problems and problems involving **uniform motion**, or motion at a constant rate or speed. The formula *distance* = *rate* · *time*, or $d = rt$ is used to solve uniform motion problems.

Example

How much pure juice and 20% juice should you mix to make 4 quarts of 50% juice?

Let p = the amount of pure juice to be added. Then, make a table of the information.

	Quarts	*Amount of Juice*
Pure juice (100%)	p	*100% of* $p = 1 \cdot p$ *or* p
20% juice	$4 - p$	*20% of* $4 - p = 0.2(4 - p)$
50% juice	4	*50% of* $4 = 0.5 \cdot 4$ *or* 2

Next, write an equation with the expression for each amount of juice.

pure juice + 20% juice = 50% juice

$$p + 0.2(4 - p) = 2$$
$$p + 0.8 - 0.2p = 2$$
$$(1 - 0.2)p + 0.8 = 2$$
$$0.8p + 0.8 = 2$$
$$0.8p = 1.2$$
$$p = 1.5$$

You should mix 1.5 quarts of pure juice with 4 − 1.5 or 2.5 quarts of 20% juice to obtain a 4 quart mixture that is 50% juice.

Practice

1. **Entertainment** Symphony tickets cost \$16 for adults and \$8 for students. A total of 634 tickets worth \$8432 were sold. Use the table to find how many adult and student tickets were sold.

	Number Sold	Price Per Ticket	Total Price
Adult Tickets	x		
Student Tickets	$634 - x$		

2. **Transportation** A truck and a jeep leave Melbourne, the truck heading east and the jeep heading west. The jeep is traveling 5 mph slower than the truck. In 3 hours, the vehicles are 465 miles apart. Draw a diagram of the situation and then use the table to find the speed of each vehicle. (*Hint:* eastbound distance + westbound distance = total distance apart.)

	Rate (mph)	Time (hours)	Distance (miles)
Truck	x	3	
Jeep		3	

3. **Standardized Test Practice** A group of twenty people bought popcorn at a movie. A regular popcorn cost \$2 and a large popcorn cost \$3. If the total bill for popcorn was \$49, how many bags of each size did they buy?

A 5 regular, 15 large
B 12 regular, 8 large
C 11 regular, 9 large
D 7 regular, 13 large

Answers: 1. 420 adult; 214 student 2. See Answer Key for diagram; truck: 80 mph, jeep: 75 mph 3. C

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4-5 Graphing Linear Equations *(Pages 218–223)*

A **linear equation** may contain one or two variables with no variable having an exponent other than 1. A linear equation can be written in the form $Ax + By = C$, where A, B, and C are any real numbers, and A and B are not both zero. To graph a linear equation, find at least two solutions of the equation. Then, plot the points and draw a straight line through them.

Examples

a. Determine whether the equation $y = 2x - 1$ is a linear equation. If it is, rewrite the equation in the form $Ax + By = C$.

This is a linear equation, since the equation contains only two variables and the power on each variable is 1. First, rewrite the equation so that both variables are on the same side of the equation.

$y = 2x - 1$

$-2x + y = -1$ *Subtract 2x from each side.*

The equation is now in the form $Ax + By = C$, where $A = -2$, $B = 1$, and $C = -1$.

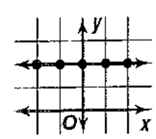
b. Graph the equation $y = 2$.

Select five values for the domain and make a table.

x	y	(x, y)
−2	2	(−2, 2)
−1	2	(−1, 2)
0	2	(0, 2)
1	2	(1, 2)
2	2	(2, 2)

Note that because the equation does not contain the variable x, x can be any value and the y value will still be 2.

Then graph the ordered pairs and connect them to draw the line. Note that the graph of $y = 2$ is a horizontal line through (0, 2).



Try These Together

1. Rewrite the equation $x = 3$ in the form $Ax + By = C$.
HINT: Since there is no variable y in this equation, use the placeholder 0y.

2. Graph the equation $3x - y = 5$.
HINT: To find values for y more easily, solve the equation for y. Subtract 3x from each side and then divide each side by −1.

Practice

Determine whether each equation is a linear equation. If an equation is linear, rewrite it in the form $Ax + By = C$.

3. $y = 2x^2 - 3$
4. $x = 2y + 8$
5. $y = -1$
6. $y = -4x + 1$
7. $3x = 5y + 7$
8. $8 - y = x$

Graph each equation.

9. $y = x + 4$
10. $y = 3x - 1$
11. $y = 3 - 2x$
12. $y - 3 = 0$
13. $y + 5 = 0$
14. $x - 2 = 0$
15. $x - y = 6$
16. $x + y = 15$
17. $2x + y = 4$

18. **Standardized Test Practice** Write the equation $y = 2x - 8$ in the standard form $Ax + By = C$.

A $y + 2x = -8$ **B** $y - 2x = -8$ **C** $-2x + y = -8$ **D** $2x + y = -8$

Answers: 1. $1x + 0y = 3$ 2. See Answer Key. 3. no 4. yes; $x - 2y = 8$ 5. yes; $0x + y = -1$ 6. yes; $4x + y = 1$ 7. yes; $3x - 5y = 7$ 8. yes; $x + y = 8$ 9–17. See Answer Key. 18. C

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4-6 Functions *(Pages 226–231)*

A **function** is a relation in which each element of the domain is paired with *exactly* one element of the range. Equations that are functions can be written in a form called **functional notation,** $f(x)$ (read "f of x"). In a function, x is an element of the domain and $f(x)$ is the corresponding element in the range.

Vertical Line Test	If each vertical line passes through no more than one point of the graph of a relation, then the relation is a function.

Examples

a. Is {(1, 2), (1, 3)} a function? Is {(1, 4), (3, 2), (5, 4)} a function?

1st relation: not a function
This relation has 1 paired with both 2 and 3.

2nd relation: a function
In this relation, each x-value is paired with no more than one y-value. A function can have a y-value paired with more than one x-value.

b. If $f(x) = 3x - 1$ and $g(x) = 2x$, find $f(1)$ and $g(3)$.

$f(x) = 3x - 1$
$f(1) = 3(1) - 1$ or 2 — *Replace x with 1.*
$g(x) = 2x$
$g(3) = 2(3)$ or 6 — *Replace x with 3.*

Practice

Determine whether each relation is a function.

1.

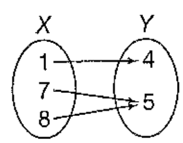
x	y
−1	10
−2	13
−3	16

2.

x	y
2	0
2	−1
3	−4

3.

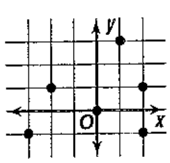
x	y
33	10
35	8
36	10

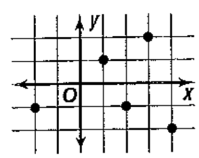
4. 

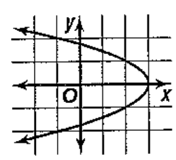
5. {(7, 4), (6, 3), (5, 2)}

6. {(15, 0), (15, −2)}

7. {(0, 1), (2, 1), (0, 3)}

8. 

9. 

10. 

Given $f(x) = -3x$ and $g(x) = x - 5$, find each value.

11. $f(7)$
12. $g(7)$
13. $g(-8)$
14. $f(-1)$
15. $f(a)$
16. $g(m)$
17. $2[g(9)]$
18. $3[f(2)]$

19. **Standardized Test Practice** Martha pays a flat $50 a month for the use of her cell phone. She also pays $0.30 for each minute that she talks over 6 hours. The cost of her phone bill can be represented by $f(x) = 50 + 0.30x$, where x is the number of minutes past 6 hours that she uses the phone. Evaluate $f(60)$ to find the amount of her phone bill if she uses the phone for 7 hours.

A $68.30 **B** $68.00 **C** $50.30 **D** $18.00

Answers: 1. yes 2. no 3. yes 4. yes 5. yes 6. no 7. no 8. no 9. yes 10. no 11. −21 12. 2 13. −13 14. 3 15. −3a 16. m − 5 17. 8 18. −18 19. B

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5-3 Slope-Intercept Form *(Pages 272–277)*

The coordinates at which a graph intersects the axes are known as the **x-intercept** and the **y-intercept**.

Finding Intercepts	To find the x-intercept, substitute 0 for y in the equation and solve for x. To find the y-intercept, substitute 0 for x in the equation and solve for y.
Slope-Intercept Form of a Linear Equation	If a line has a slope of m and a y-intercept of b, then the slope-intercept form of an equation of the line is $y = mx + b$.

Example

Find the x- and y-intercepts of the graph of $2x + 3y = 5$. Then, write the equation in slope-intercept form.

$2x + 3(0) = 5$ *Let y = 0.*
$2x = 5$ *Simplify.*
$x = \frac{5}{2}$ *The x-intercept is* $\frac{5}{2}$.

$2(0) + 3y = 5$ *Let x = 0.*
$3y = 5$ *Simplify.*
$y = \frac{5}{3}$ *The y-intercept is* $\frac{5}{3}$.

Slope-Intercept Form: $2x + 3y = 5$
$3y = -2x + 5$ *Subtract 2x from each side.*
$y = -\frac{2}{3}x + \frac{5}{3}$ *Divide each side by 3.*

Note that in this form we can see that the slope m of the line is $-\frac{2}{3}$, *and the y-intercept b is* $\frac{5}{3}$.

Practice

Find the x- and y-intercepts of the graph of each equation.

1. $6x + 2y = 10$ **2.** $6x - y = -7$ **3.** $8y - 5 = 3x$

Write an equation in slope-intercept form of a line with the given slope and y-intercept. Then write the equation in standard form.

4. $m = 5, b = 5$ **5.** $m = 2, b = -7$ **6.** $m = -3, b = 0$

Find the slope and y-intercept of the graph of each equation.

7. $7y = x - 10$ **8.** $8x - \frac{1}{2}y = -2$ **9.** $4(x - 5y) = 9(x + 1)$

10. Chemistry The graph of an equation to convert degrees Celsius, x, to degrees Fahrenheit, y, has a y-intercept of 32°. Given that water boils at 212°F and at 100°C, write the conversion equation.

11. **Standardized Test Practice** What is the slope-intercept form of an equation for the line that passes through (0, 1) and (3, 37)?

A $y = 12x - 1$ **B** $y = 12x + 1$ **C** $y = -12x - 1$ **D** $y = -12x + 1$

Answers: 1. $\frac{5}{3}$, 5 2. $-\frac{7}{6}$, 7 3. $-\frac{5}{3}$, $\frac{5}{8}$ 4. $y = 5x + 5$, $5x - y = -5$ 5. $y = 2x - 7$, $2x - y = 7$ 6. $y = -3x$, $3x + y = 0$ 7. $\frac{1}{7}$, $-\frac{10}{7}$ 8. 16, 4 9. $-\frac{1}{4}$, $-\frac{9}{20}$ 10. $y = \frac{9}{5}x + 32$ 11. B

9

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5-4 Writing Equations in Slope-Intercept Form *(Pages 280–285)*

You now know how to write an equation for any line with a given slope and y-intercept. It is also possible to write an equation for any line with a given slope and any point on the line. In addition, since you know the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, you can also write an equation of any line given two points.

To write an equation given the slope and one point.	Use $y = mx + b$ for the equation. Replace m with the given slope and the coordinates of the given point for x and y. Solve the equation for the y-intercept, b. Rewrite the equation with the slope for m and the y-intercept for b.
To write an equation given two points.	Use the slope formula to calculate m. Chose any of the two given points to use in place of x and y in $y = mx + b$. Replace m with the slope you just calculated. Solve for b. Rewrite the equation with the slope for m and the y-intercept for b.

Examples **Write an equation in slope-intercept form from the given information.**

a. The slope is 3 and the line passes through the point (5, 16).

$y = mx + b$	*Use slope-intercept form.*
$y = 3x + b$	*Replace m with the slope.*
$16 = 3 \cdot 5 + b$	*Replace x and y.*
$1 = b$	*Solve for b.*
$y = 3x + 1$	*Rewrite the equation.*

b. The line passes through the points (10, −4) and (−7, 13).

$m = \frac{y_2 - y_1}{x_2 - x_1}$	*Use the slope formula.*
$m = \frac{13 - (-4)}{-7 - 10}$	*Substitute.*
$m = -1$	*Solve for m.*
$y = mx + b$	
$-4 = (-1)10 + b$	*Substitute m, x, and y.*
$6 = b$	*Solve for b.*
$y = -x + 6$	*Rewrite the equation.*

Practice

Write an equation in slope-intercept form from the given information.

1. $m = 3, (0, 4)$

2. $m = -\frac{3}{2}, (0, 6)$

3. $m = \frac{1}{2}, (5, 6.5)$

4. $m = 1, (-5, -7)$

5. $(3, -4), (-6, -1)$

6. $(-10, 47), (5, -13)$

7. $(0, -1), (3, 8)$

8. $(5, 8), (-3, 8)$

9. **Standardized Test Practice** Which is the correct slope-intercept equation for a line that passes through the points $(-15, -47)$ and $(-19, -59)$?

A $y = -3x + 2$ **B** $y = 3x + 2$ **C** $y = -3x - 2$ **D** $y = 3x - 2$

Answers: 1. $y = 3x + 4$ 2. $y = -\frac{3}{2}x + 6$ 3. $y = \frac{1}{2}x + 4$ 4. $y = x - 2$ 5. $y = \frac{-1}{3}x - 3$ 6. $y = -4x + 7$ 7. $y = 3x - 1$ 8. $y = 8$ 9. D

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6-3 Solving Multi-Step Inequalities *(Pages 332–337)*

Inequalities involving more than one operation can be solved by undoing the operations in reverse order in the same way you would solve an equation with more than one operation. The important exception is that multiplying or dividing an inequality by a negative number reverses the sign of the inequality.

Example

Solve $-3f - 7 \geq -f + 9$.

$-3f - 7 \geq -f + 9$	
$-3f - 7 + f \geq -f + 9 + f$	*Add f to each side.*
$-2f - 7 \geq 9$	*Combine like terms.*
$-2f - 7 + 7 \geq 9 + 7$	*Add 7 to each side.*
$-2f \geq 16$	*Combine like terms.*
$\frac{-2f}{-2} \leq \frac{16}{-2}$	*Divide each side by −2 and change ≥ to ≤.*
$f \leq -8$	*Simplify.*

The solution set is $\{f \mid f \leq -8\}$.

Try These Together

Solve each inequality. Then check your solution.

1. $2a - 18 \leq 5a + 3$

   HINT: Begin by collecting all the terms with a on one side of the equality sign.

2. $x - 2 < \frac{x + 4}{4}$

   HINT: Begin by multiplying each side by 4.

Practice

Solve each inequality. Then check your solution.

3. $\frac{1}{4}z - 1 \geq 3$
4. $-7x - 8 > 1 - 2x$
5. $2m + 3 > 11$
6. $2w - 3 \geq 8w + 69$
7. $-4 - 2p > 8$
8. $\frac{3h + 1}{4} > -2$
9. $5q - 4 \geq 12 - 3q$
10. $8 + v \geq 2v - 1$
11. $\frac{4(x - 1)}{3} \leq 12$
12. **Money Matters** Sarah does not want to spend more than \$20 for a backpack. At a certain store all backpacks are on sale for 30% off. If she pays 5% sales tax after the discount, what is the regular price of the most expensive backpack she can buy? Define a variable, write an inequality, and then solve.
13. **Standardized Test Practice** Solve $-\frac{1}{3}x + 3 \geq 0$.

    A $\{x \mid x \leq -9\}$ **B** $\{x \mid x \geq -9\}$ **C** $\{x \mid x \leq 9\}$ **D** $\{x \mid x \geq 9\}$

Answers: 1. $\{a \mid a \geq -7\}$ 2. $\{x \mid x < 4\}$ 3. $\{z \mid z \geq 16\}$ 4. $\{x \mid x < -1.8\}$ 5. $\{m \mid m > 4\}$ 6. $\{w \mid w \leq -12\}$ 7. $\{p \mid p < -6\}$ 8. $\{h \mid h > -3\}$ 9. $\{q \mid q \geq 2\}$ 10. $\{v \mid v \leq 9\}$ 11. $\{x \mid x \leq 10\}$ 12. x = cost of backpack; $x - 0.30x + 0.05(x - 0.30x) \leq 20$; \$27.21 13. C

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6-4 Solving Compound Inequalities

(Pages 339–344)

Two inequalities considered together form a **compound inequality**.

AND Compound Inequalities	Compound inequalities that contain the word *and* are true only if both inequalities are true. The graph of a compound inequality containing *and* is the **intersection** of the graphs of the two inequalities that make up the compound inequality. To find the intersection, determine where the two graphs overlap.
OR Compound Inequalities	Compound inequalities that contain the word *or* are true if one or more of the inequalities is true. The graph is the **union** of the graphs of the two inequalities that make up the compound inequality.

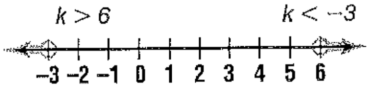
Examples **Solve each compound inequality. Then graph the solution set.**

a. $2k - 5 > 7$ **or** $-3k - 1 > 8$

$2k - 5 > 7$ *or* $-3k - 1 > 8$

$2k > 12$ $\quad -3k > 9$

$k > 6$ $\quad k < -3$



b. $4 < n + 6 < 9$

$n + 6 > 4$ *and* $n + 6 < 9$

$n > -2$ $\quad n < 3$

Try These Together

1. Graph the solution set of $a \geq -9$ and $a < 9$.
   HINT: One circle is closed and the other is open.

2. Graph the solution set of $d < -6$ or $d > 4$.
   HINT: Combine the graphs of $d < -6$ and $d > 4$

Practice

3. Graph the solution set of $n < 7$ and $n \geq 4$.

Solve each compound inequality. Then graph the solution set.

4. $6g - 8 > 4$ or $6g + 2 < -4$
5. $k + 8 > -4$ or $k - 8 < 8$
6. $1 < 2c - 7 < 7$
7. $5r + 3 \geq -2$ and $r \neq 0$

Define a variable, write a compound inequality, and solve each problem. Then check your solution.

8. The sum of three times a number and two lies between 8 and 11.
9. Eight less than 4 times a number is at most 24 and at least -12.
10. **Standardized Test Practice** If the replacement set is all integers, find the solution set for $1 < x - 1 < 3$.
    A {3} **B** {2, 3, 4} **C** all integers **D** no solution

Answers: 1–3. See Answer Key. 4–7. For graphs, see Answer Key. 4. $\{g|g > 2$ or $g < -1\}$ 5. $\{k|k > -12$ or $k < 16\}$ 6. $\{c|4 < c < 7\}$ 7. $\{r|r \geq -1$ and $r \neq 0\}$ 8. $8 < 3x + 2 < 11$; $\{x|2 < x < 3\}$ 9. $24 \geq 4x - 8 \geq -12$; $\{x|8 \geq x \geq -1\}$ 10. A

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6-5 Solving Open Sentences Involving Absolute Value *(Pages 345–351)*

An open sentence involving absolute value can be solved by first rewriting it as a compound sentence.

Rewriting Absolute Value Equations Inequalities	• If $\|x\| = n$, then $x = -n$ or $x = n$. • If $\|x\| < n$, then $x > -n$ and $x < n$. • If $\|x\| > n$, then $x < -n$ or $x > n$.	 (Also true for $\|x\| \leq n$) (Also true for $\|x\| \geq n$)

Examples **Solve each open sentence. Then graph the solution set.**

a. $|2 + 4y| < 6$

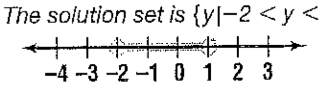
Rewrite as a compound inequality. Then solve.

$2 + 4y > -6$ and $2 + 4y < 6$

$4y > -8$ $\quad 4y < 4$

$y > -2$ $\quad y < 1$

The solution set is $\{y \mid -2 < y < 1\}$.

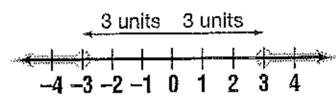


b. $|p| > 3$

Rewrite as a compound inequality. Then solve.

$p < -3$ or $p > 3$

The solution set is $\{p \mid p < -3 \text{ or } p > 3\}$.



Try These Together

1. Solve $|a - 4| = 7$ and graph the solution set.
   HINT: The solution will be two points.

2. Solve $|6s - 4| < 8$ and graph the solution set.
   HINT: The solution will be a line segment.

Practice

Solve each open sentence. Then graph the solution set.

3. $|5d + 1| = 9$
4. $|2 - 2y| > 8$
5. $|3 - n| \leq 4$
6. $|-w + 8| \geq 11$
7. $|2g - 6| < 1$
8. $|1.1z - 3.3| = 7.7$

Express each statement in terms of an inequality involving absolute value.

9. The weight w in a bicycle trailer is allowed to vary from 60 pounds by no more than 40 pounds.

10. The height h of a person allowed on a roller coaster can vary from 65 inches by no more than 13 inches.

11. **Standardized Test Practice** Solve $|x - 5| \leq 7$.

    A $\{x \mid x \leq 12 \text{ or } x \geq -2\}$ **B** $\{x \mid -2 \leq x \leq 12\}$
    C $\{x \mid x \leq 12\}$ **D** $\{x \mid x \geq -2\}$

Answers: 1–8. For graphs, see Answer Key. 1. $\{-3, 11\}$ 2. $\{s \mid -\frac{2}{3} < s < 2\}$ 3. $\{-2, \frac{8}{5}\}$ 4. $\{y \mid y < -3 \text{ or } y > 5\}$ 5. $\{n \mid -1 \leq n \leq 7\}$ 6. $\{w \mid w \leq -3 \text{ or } w \geq 19\}$ 7. $\{g \mid 2.5 < g < 3.5\}$ 8. $\{-4, 10\}$ 9. $|w - 60| \leq 40$ 10. $|h - 65| \leq 13$ 11. B

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7-2 Substitution *(Pages 376–381)*

To solve a system of equations without graphing, you can use the **substitution method** shown in the example below. In general, if you solve a system of equations and the result is a *true* statement, such as $-5 = -5$, the system has *infinitely many* solutions; if the result is a *false* statement, such as $-5 = 7$, the system has *no solution.*

Example

Use substitution to solve the system of equations $x + y = 1$ and $2x + y = -1$.

Step 1: *Solve one of the equations for x or y.*

$x + y = 1$ — *Solve the first equation for x since the*
$x = 1 - y$ — *coefficient of x is 1.*

Step 2: *Substitute this value into the other equation.*

$2x + y = -1$ — *Use the second equation.*
$2(1 - y) + y = -1$ — *Substitute $1 - y$ for x.*
$2 - 2y + y = -1$ — *Distribute.*

Step 3: *Solve this equation.*

$2 - 2y + y = -1$ — *Solve for y.*
$-y = -3$ or $y = 3$

Step 4: *Find the value of the other variable using substitution into either equation.*

$x + y = 1$ — *Use the first equation.*
$x + 3 = 1$ — *Substitute 3 for y.*
$x = -2$ — *Solve for x.*

The solution to the system is $(-2, 3)$.

Check: *Substitute -2 for x and 3 for y in each of the original equations and check for true statements.*

Try These Together

Use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has no solution or infinitely many solutions.

1. $3x + y = 19$, $x - 2y = -10$
2. $2x - y = 7$, $8x + y = 3$
3. $y = 2x - 4$, $y = 2x + 2$
4. $y = -5x + 3$, $y = 3x - 3$

HINT: If possible, choose to first solve an equation for a variable that has a coefficient of 1.

Practice

Use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

5. $5x + 4 = y$, $y - 3x = 7$
6. $3y + x = -1$, $2x + 6 = -3y$
7. $6x - y = 0$, $3x + 4y = 18$
8. $3y - 4x = 2$, $8x = 6y - 4$
9. $2x - y = -4$, $-x + y = -9$
10. $5x - 2y = -6$, $2x + 3y = 9$
11. $3x + y = 28$, $x + 3y = -12$
12. $5x - y = 98$, $-2x + 3y = 5$

13. **Standardized Test Practice** All CDs in the budget bin are priced the same. Packs of AA batteries are on sale. Keisha's total bill (before tax) for 3 CDs and 1 pack of AA batteries was $39. Eduardo's total for 2 CDs and 3 packs of batteries was $33. What was the price of a single CD?

A $3 **B** $10 **C** $12 **D** $13

Answers: 1. (4, 7) 2. (1, −5) 3. no solution 4. $\left(\frac{3}{4}, -\frac{3}{4}\right)$ 5. $\left(1\frac{1}{2}, 11\frac{1}{2}\right)$ 6. $\left(-5, \frac{4}{3}\right)$ 7. $\left(\frac{2}{3}, 4\right)$ 8. infinitely many 9. (−13, −22) 10. (0, 3) 11. (12, −8) 12. (23, 17) 13. C

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7-4 Elimination Using Multiplication

(Pages 387–392)

An extension of the elimination method is to multiply one or both of the equations in a system by some number so that adding or subtracting eliminates a variable.

Examples **Solve each system of equations using elimination.**

a. $x - y = 5$ **and** $3x + 2y = 15$

Multiply the first equation by 2 so that the coefficient of the y-terms in the system will be opposites. Then, add the equations and solve for x.

$$2(x - y) = 2(5) \rightarrow 2x - 2y = 10$$
$$3x + 2y = 15 \qquad (+)\ 3x + 2y = 15$$
$$5x = 25$$
$$x = 5$$

$x - y = 5$ — *Use the first equation.*
$5 - y = 5$ — *Substitute 5 for x.*
$-y = 0 \Rightarrow y = 0$

The solution to this system is (5, 0).

b. $2x + 9y = 43$ **and** $5x - 2y = -15$

Multiply the first equation by 5 and the second equation by −2 so that the coefficients of the x-terms in the system will be opposites. Then, add the equations and solve for y.

$$5(2x + 9y) = 5(43) \rightarrow 10x + 45y = 215$$
$$-2(5x - 2y) = -2(-15) \qquad (+)\ -10x + 4y = 30$$
$$49y = 245$$
$$y = 5$$

$2x + 9y = 43$ — *Use the first equation.*
$2x + 45 = 43$ — *Substitute 5 for y.*
$2x = -2 \Rightarrow x = -1$

The solution to the system is (−1, 5).

Try These Together

Use elimination to solve each system of equations.

1. $2x + y = 4$, $3x - 2y = 6$

2. $-5x + 2y = 5$, $x - y = 2$

3. $4x + 7y = 6$, $6x + 5y = 20$

4. $\frac{x - y}{4} = 1$, $\frac{2x - y}{3} = 4$

Practice

Use elimination to solve each system of equations.

5. $18x + 24y = 288$, $-16x - 12y = -172$

6. $3x + 8y = 11$, $2x + 5y = 18$

7. $y = 4x + 11$, $3x - 2y = -7$

8. $2x - 2y = 16$, $3x + y = 4$

9. $2x + 3y = 0$, $3x + y = 7$

10. $2x + \frac{1}{3}y = -1$, $x - \frac{1}{4}y = -8$

11. $0.4x + 0.2y = 0.4$, $0.2x - 0.3y = 0.4$

12. Algebra Solve using elimination: $\frac{1}{2x - 4} - \frac{2}{y + 1} = 0$ and $\frac{1}{x - 3} - \frac{1}{y + 4} = 0$.

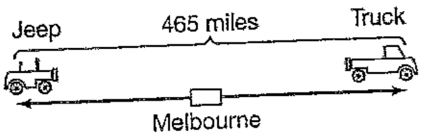
13. **Standardized Test Practice** By which number could you multiply the first equation of the following system to solve the system by elimination?
$-4x - 11y = -32$ and $12x + 10y = 55$

A 3 or −3 **B** 10 or −10 **C** 11 or −11 **D** 12 or −12

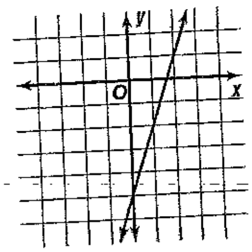
Answers: 1. (2, 0) 2. (−3, −5) 3. (5, −2) 4. (8, 4) 5. (4, 9) 6. (89, −32) 7. (−3, −1) 8. (3, −5) 9. (3, −2) 10. $\left(-3\frac{1}{3}, 18\right)$ 11. $\left(1\frac{1}{4}, -\frac{1}{2}\right)$ 12. $\left(\frac{2}{3}, -6\frac{1}{3}\right)$ 13. A

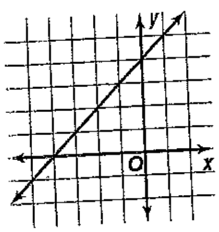
Answer Key

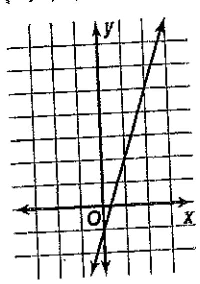
Lesson 3-9

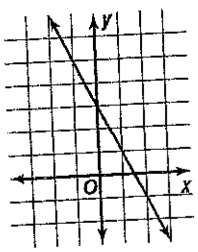
2. 

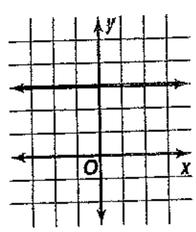
Lesson 4-5

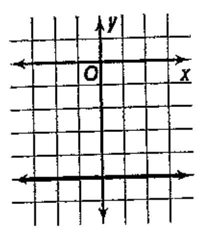
2. $y = 3x - 5$ 

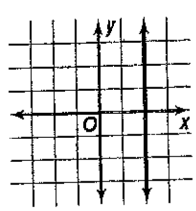
9. 

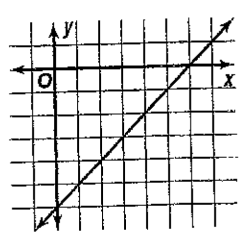
10. 

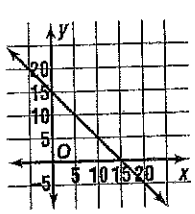
11. 

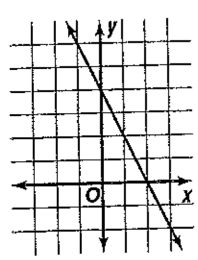
12. 

13. 

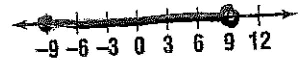
14. 

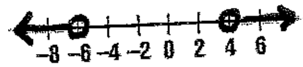
15. 

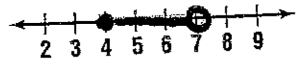
16. 

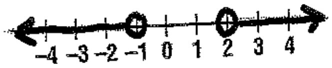
17. 

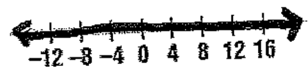
Lesson 6-4

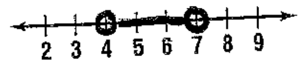
1. 

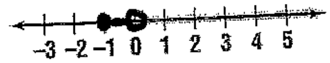
2. 

3. 

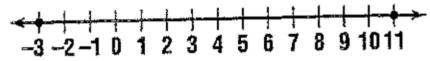
4. 

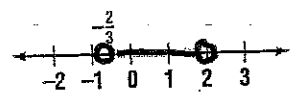
5. 

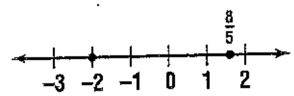
6. 

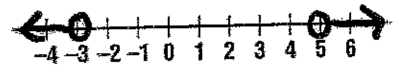
7. 

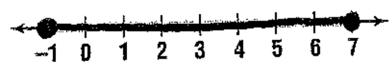
Lesson 6-5

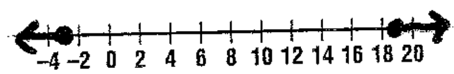
1. 

2. 

3. 

4. 

5. 

6. 

7. 

8.