Summer Review Packet
for
Algebra 2 Trigonometry

This packet is a review of topics that were covered Algebra 1 and are contained in chapters one and two of Algebra 2.
All problems are to be completed in pencil on *loose-leaf paper* with all work shown.
All graphs should be drawn on *graph paper*.

Work should be completed and ready to be turned in on the first day of school,
Wednesday, August 19, 2009.
This packet will count as two homework grades <u>and</u> there will be a test on the material during the first week of school.

The Algebra 1 and Algebra 2 textbooks are on line.
ALG 1 - User: ALG105IL Password: t7es20uDla
ALG 2 - User: ALG2 Password: N4c6abrada

Teachers will be available at school on
<u>Tuesday July 7th *and* Thursday July 16th</u>
9:00am - 11:00am
to help and answer any questions you may have.

ENJOY YOUR SUMMER!!

We look forward to seeing you in August!

NAME ________________________

1-5 Study Guide and Intervention

Solving Inequalities

Solve Inequalities The following properties can be used to solve inequalities.

Addition and Subtraction Properties for Inequalities	Multiplication and Division Properties for Inequalities
For any real numbers a, b, and c: **1.** If $a < b$, then $a + c < b + c$ and $a - c < b - c$. **2.** If $a > b$, then $a + c > b + c$ and $a - c > b - c$.	For any real numbers a, b, and c, with $c \neq 0$: **1.** If c is positive and $a < b$, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$. **2.** If c is positive and $a > b$, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$. **3.** If c is negative and $a < b$, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$. **4.** If c is negative and $a > b$, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$.

These properties are also true for $\leq$ and $\geq$.

Example 1 **Solve $2x + 4 > 36$. Then graph the solution set on a number line.**

$2x + 4 - 4 > 36 - 4$

$2x > 32$

$x > 16$

The solution set is $\{x \mid x > 16\}$.

Example 2 **Solve $17 - 3w \geq 35$. Then graph the solution set on a number line.**

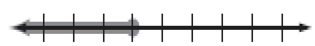
$17 - 3w \geq 35$

$17 - 3w - 17 \geq 35 - 17$

$-3w \geq 18$

$w \leq -6$

The solution set is $(-\infty, -6]$.



Real-World Problems with Inequalities Many real-world problems involve inequalities. The chart below shows some common phrases that indicate inequalities.

<	>	≤	≥
is less than is fewer than	is greater than is more than	is at most is no more than is less than or equal to	is at least is no less than is greater than or equal to

Example **SPORTS The Vikings play 36 games this year. At midseason, they have won 16 games. How many of the remaining games must they win in order to win at least 80% of *all* their games this season?**

Let x be the number of remaining games that the Vikings must win. The total number of games they will have won by the end of the season is $16 + x$. They want to win at least 80% of their games. Write an inequality with $\geq$.

$16 + x \geq 0.8(36)$

$x \geq 0.8(36) - 16$

$x \geq 12.8$

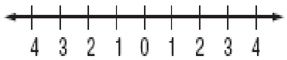
Since they cannot win a fractional part of a game, the Vikings must win at least 13 of the games remaining.

1-5 Practice

Solving Inequalities

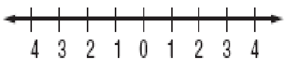
Solve each inequality. Describe the solution set using set-builder or interval notation. Then, graph the solution set on a number line.

1. $8x - 6 \geq 10$

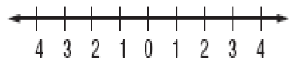


2. $23 - 4u < 11$

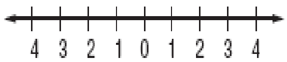
3. $-16 - 8r \geq 0$



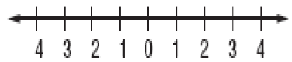
4. $14s < 9s + 5$



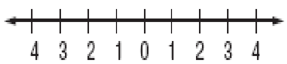
5. $9x - 11 > 6x - 9$



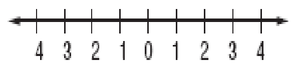
6. $-3(4w - 1) > 18$



7. $1 - 8u \leq 3u - 10$



8. $17.5 < 19 - 2.5x$



9. $9(2r - 5) - 3 < 7r - 4$

10. $1 + 5(x - 8) \leq 2 - (x + 5)$

11. $\frac{4x - 3}{2} \geq -3.5$

12. $q - 2(2 - q) \leq 0$

13. $-36 - 2(w + 77) > -4(2w + 52)$

14. $4n - 5(n - 3) > 3(n + 1) - 4$

Define a variable and write an inequality for each problem. Then solve.

15. Twenty less than a number is more than twice the same number.

16. Four times the sum of twice a number and −3 is less than 5.5 times that same number.

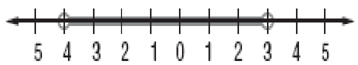
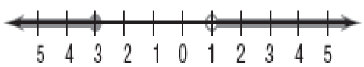
17. HOTELS The Lincoln's hotel room costs \$90 a night. An additional 10% tax is added. Hotel parking is \$12 per day. The Lincoln's expect to spend \$30 in tips during their stay. Solve the inequality $90x + 90(0.1)x + 12x + 30 \leq 600$ to find how many nights the Lincoln's can stay at the hotel without exceeding total hotel costs of \$600.

18. BANKING Jan's account balance is \$3800. Of this, \$750 is for rent. Jan wants to keep a balance of at least \$500. Write and solve an inequality describing how much she can withdraw and still meet these conditions.

1-6 Study Guide and Intervention

Solving Compound and Absolute Value Inequalities

Compound Inequalities A compound inequality consists of two inequalities joined by the word *and* or the word *or*. To solve a compound inequality, you must solve each part separately.

And **Compound Inequalities**	Example: $x > -4$ and $x < 3$ 	The graph is the intersection of solution sets of two inequalities.
Or **Compound Inequalities**	Example: $x \le -3$ or $x > 1$ 	The graph is the union of solution sets of two inequalities.

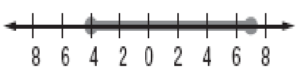
Example 1 **Solve $-3 \le 2x + 5 \le 19$. Graph the solution set on a number line.**

$-3 \le 2x + 5$ and $2x + 5 \le 19$

$-8 \le 2x$ $\quad$ $2x \le 14$

$-4 \le x$ $\quad$ $x \le 7$

$-4 \le x \le 7$

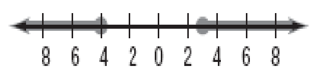


Example 2 **Solve $3y - 2 \ge 7$ or $2y - 1 \le -9$. Graph the solution set on a number line.**

$3y - 2 \ge 7$ or $2y - 1 \le -9$

$3y \ge 9$ or $2y \le -8$

$y \ge 3$ or $y \le -4$

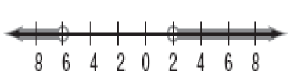


Absolute Value Inequalities Use the definition of absolute value to rewrite an absolute value inequality as a compound inequality.

> For all real numbers a and b, $b > 0$, the following statements are true.
>
> **1.** If $|a| < b$, then $-b < a < b$.
>
> **2.** If $|a| > b$, then $a > b$ or $a < -b$.
>
> These statements are also true for $\le$ and $\ge$.

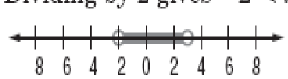
Example 1 **Solve $|x + 2| > 4$. Graph the solution set on a number line.**

By statement 2 above, if $|x + 2| > 4$, then $x + 2 > 4$ or $x + 2 < -4$. Subtracting 2 from both sides of each inequality gives $x > 2$ or $x < -6$.



Example 2 **Solve $|2x - 1| < 5$. Graph the solution set on a number line.**

By statement 1 above, if $|2x - 1| < 5$, then $-5 < 2x - 1 < 5$. Adding 1 to all three parts of the inequality gives $-4 < 2x < 6$. Dividing by 2 gives $-2 < x < 3$.

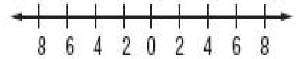


1-6 Practice

Solving Compound and Absolute Value Inequalities

Write an absolute value inequality for each of the following. Then graph the solution set on a number line.

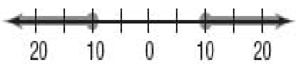
1. all numbers greater than 4 or less than -4



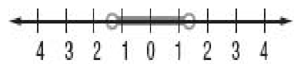
2. all numbers between -1.5 and 1.5, including -1.5 and 1.5

Write an absolute value inequality for each graph.

3.

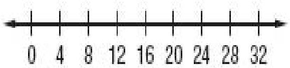


4.

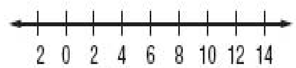


Solve each inequality. Graph the solution set on a number line.

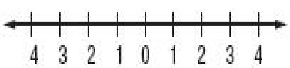
5. $-8 \leq 3y - 20 < 52$



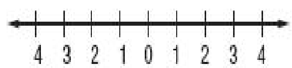
6. $3(5x - 2) < 24$ or $6x - 4 > 4 + 5x$



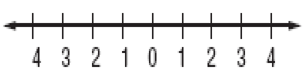
7. $2x - 3 > 15$ or $3 - 7x < 17$



8. $15 - 5x \leq 0$ and $5x + 6 \geq -14$



9. $|2w| \geq 5$



10. $|y + 5| < 2$

11. $|x - 8| \geq 3$

12. $|2z - 2| \leq 3$

13. $|2x + 2| - 7 \leq -5$

14. $|x| > x - 1$

15. $|3b + 5| \leq -2$

16. $|3n - 2| - 2 < 1$

17. RAINFALL In 90% of the last 30 years, the rainfall at Shell Beach has varied no more than 6.5 inches from its mean value of 24 inches. Write and solve an absolute value inequality to describe the rainfall in the other 10% of the last 30 years.

1-1 Study Guide and Intervention

Expressions and Formulas

Order of Operations

Order of Operations	**1.** Simplify the expressions inside grouping symbols. **2.** Evaluate all powers. **3.** Do all multiplications and divisions from left to right. **4.** Do all additions and subtractions from left to right.

Example 1 **Evaluate $[18 - (6 + 4)] \div 2$.**

$[18 - (6 + 4)] \div 2 = [18 - 10] \div 2$
$= 8 \div 2$
$= 4$

Example 2 **Evaluate $3x^2 + x(y - 5)$ if $x = 3$ and $y = 0.5$.**

Replace each variable with the given value.

$3x^2 + x(y - 5) = 3 \cdot (3)^2 + 3(0.5 - 5)$
$= 3 \cdot (9) + 3(-4.5)$
$= 27 - 13.5$
$= 13.5$

Formulas A **formula** is a mathematical sentence that uses variables to express the relationship between certain quantities. If you know the value of every variable except one in a formula, you can use substitution and the order of operations to find the value of the unknown variable.

Example **To calculate the number of reams of paper needed to print n copies of a booklet that is p pages long, you can use the formula $r = \frac{np}{500}$, where r is the number of reams needed. How many reams of paper must you buy to print 172 copies of a 25-page booklet?**

Substitute $n = 172$ and $p = 25$ into the formula $r = \frac{np}{500}$.

$r = \frac{(172)(25)}{500}$

$= \frac{43{,}000}{500}$

$= 8.6$

You cannot buy 8.6 reams of paper. You will need to buy 9 reams to print 172 copies.

1-3 Study Guide and Intervention

Solving Equations

Verbal Expressions to Algebraic Expressions The chart suggests some ways to help you translate word expressions into algebraic expressions. Any letter can be used to represent a number that is not known.

Word Expression	Operation
and, plus, sum, increased by, more than	addition
minus, difference, decreased by, less than	subtraction
times, product, of (as in $\frac{1}{2}$ of a number)	multiplication
divided by, quotient	division

Example 1 **Write an algebraic expression to represent 18 less than the quotient of a number and 3.**

$\frac{n}{3} - 18$

Example 2 **Write a verbal sentence to represent $6(n - 2) = 14$.**

Six times the difference of a number and two is equal to 14.

1-3 Study Guide and Intervention *(continued)*

Solving Equations

Properties of Equality You can solve equations by using addition, subtraction, multiplication, or division.

Addition and Subtraction Properties of Equality	For any real numbers a, b, and c, if $a = b$, then $a + c = b + c$ and $a - c = b - c$.
Multiplication and Division Properties of Equality	For any real numbers a, b, and c, if $a = b$, then $a \cdot c = b \cdot c$ and, if c is not zero, $\frac{a}{c} = \frac{b}{c}$.

Example 1 **Solve $100 - 8x = 140$.**

$$100 - 8x = 140$$
$$100 - 8x - 100 = 140 - 100$$
$$-8x = 40$$
$$x = -5$$

Example 2 **Solve $4x + 5y = 100$ for y.**

$$4x + 5y = 100$$
$$4x + 5y - 4x = 100 - 4x$$
$$5y = 100 - 4x$$
$$y = \frac{1}{5}(100 - 4x)$$
$$y = 20 - \frac{4}{5}x$$

1-3 Practice

Solving Equations

Write an algebraic expression to represent each verbal expression.

1. 2 more than the quotient of a number and 5

2. the sum of two consecutive integers

3. 5 times the sum of a number and 1

4. 1 less than twice the square of a number

Write a verbal expression to represent each equation.

5. $5 - 2x = 4$

6. $3y = 4y^3$

7. $3c = 2(c - 1)$

8. $\frac{m}{5} = 3(2m + 1)$

Name the property illustrated by each statement.

9. If $t - 13 = 52$, then $52 = t - 13$.

10. If $8(2q + 1) = 4$, then $2(2q + 1) = 1$.

11. If $h + 12 = 22$, then $h = 10$.

12. If $4m = -15$, then $-12m = 45$.

Solve each equation. Check your solution.

13. $14 = 8 - 6r$

14. $9 + 4n = -59$

15. $\frac{3}{4} - \frac{1}{2}n = \frac{5}{8}$

16. $\frac{5}{6}s + \frac{3}{4} = \frac{11}{12}$

17. $-1.6r + 5 = -7.8$

18. $6x - 5 = 7 - 9x$

19. $5(6 - 4v) = v + 21$

20. $6y - 5 = -3(2y + 1)$

Solve each equation or formula for the specified variable.

21. $E = mc^2$, for m

22. $c = \frac{2d + 1}{3}$, for d

23. $h = vt - gt^2$, for v

24. $E = \frac{1}{2}Iw^2 + U$, for I

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

25. GEOMETRY The length of a rectangle is twice the width. Find the width if the perimeter is 60 centimeters.

26. GOLF Luis and three friends went golfing. Two of the friends rented clubs for \$6 each. The total cost of the rented clubs and the green fees for each person was \$76. What was the cost of the green fees for each person?

1-4 Study Guide and Intervention

Solving Absolute Value Equations

Absolute Value Expressions The **absolute value** of a number is the number of units it is from 0 on a number line. The symbol $|x|$ is used to represent the absolute value of a number x.

Absolute Value	• **Words**	For any real number a, if a is positive or zero, the absolute value of a is a. If a is negative, the absolute value of a is the opposite of a.
	• **Symbols**	For any real number a, $\lvert a\rvert = a$, if $a \geq 0$, and $\lvert a\rvert = -a$, if $a < 0$.

Example 1 **Evaluate $|-4| - |-2x|$ if $x = 6$.**

$$\begin{aligned}|-4| - |-2x| &= |-4| - |-2 \cdot 6|\\ &= |-4| - |-12|\\ &= 4 - 12\\ &= -8\end{aligned}$$

Example 2 **Evaluate $|2x - 3y|$ if $x = -4$ and $y = 3$.**

$$\begin{aligned}|2x - 3y| &= |2(-4) - 3(3)|\\ &= |-8 - 9|\\ &= |-17|\\ &= 17\end{aligned}$$

Absolute Value Equations Use the definition of absolute value to solve equations containing absolute value expressions.

For any real numbers a and b, where $b \geq 0$, if $\lvert a\rvert = b$ then $a = b$ or $a = -b$.

Always check your answers by substituting them into the original equation. Sometimes computed solutions are not actual solutions.

Example **Solve $|2x - 3| = 17$. Check your solutions.**

Case 1

$$\begin{aligned}a &= b\\ 2x - 3 &= 17\\ 2x - 3 + 3 &= 17 + 3\\ 2x &= 20\\ x &= 10\end{aligned}$$

CHECK

$$\begin{aligned}|2x - 3| &= 17\\ |2(10) - 3| &= 17\\ |20 - 3| &= 17\\ |17| &= 17\\ 17 &= 17 \checkmark\end{aligned}$$

Case 2

$$\begin{aligned}a &= -b\\ 2x - 3 &= -17\\ 2x - 3 + 3 &= -17 + 3\\ 2x &= -14\\ x &= -7\end{aligned}$$

CHECK

$$\begin{aligned}|2(-7) - 3| &= 17\\ |-14 - 3| &= 17\\ |-17| &= 17\\ 17 &= 17 \checkmark\end{aligned}$$

There are two solutions, 10 and −7.

1-4 Practice

Solving Absolute Value Equations

Evaluate each expression if $a = -1$, $b = -8$, $c = 5$, and $d = -1.4$.

1. $|6a|$
2. $|2b + 4|$
3. $-|10d + a|$
4. $|17c| + |3b - 5|$
5. $-6|10a - 12|$
6. $|2b - 1| - |-8b + 5|$
7. $|5a - 7| + |3c - 4|$
8. $|1 - 7c| - |a|$
9. $-3|0.5c + 2| - |-0.5b|$
10. $|4d| + |5 - 2a|$
11. $|a - b| + |b - a|$
12. $|2 - 2d| - 3|b|$

Solve each equation. Check your solutions.

13. $|n - 4| = 13$
14. $|x - 13| = 2$
15. $|2y - 3| = 29$
16. $7|x + 3| = 42$
17. $|3u - 6| = 42$
18. $|5x - 4| = -6$
19. $-3|4x - 9| = 24$
20. $-6|5 - 2y| = -9$
21. $|8 + p| = 2p - 3$
22. $|4w - 1| = 5w + 37$
23. $4|2y - 7| + 5 = 9$
24. $-2|7 - 3y| - 6 = -14$
25. $2|4 - s| = -3s$
26. $5 - 3|2 + 2w| = -7$
27. $5|2r + 3| - 5 = 0$
28. $3 - 5|2d - 3| = 4$

29. **WEATHER** A thermometer comes with a guarantee that the stated temperature differs from the actual temperature by no more than 1.5 degrees Fahrenheit. Write and solve an equation to find the minimum and maximum actual temperatures when the thermometer states that the temperature is 87.4 degrees Fahrenheit.

30. **OPINION POLLS** Public opinion polls reported in newspapers are usually given with a margin of error. For example, a poll with a margin of error of ±5% is considered accurate to within plus or minus 5% of the actual value. A poll with a stated margin of error of ±3% predicts that candidate Tonwe will receive 51% of an upcoming vote. Write and solve an equation describing the minimum and maximum percent of the vote that candidate Tonwe is expected to receive.

1-2 Practice
Properties of Real Numbers

Name the sets of numbers to which each number belongs.

1. 6425 **2.** $\sqrt{7}$ **3.** 2π **4.** 0

5. $\sqrt{\frac{25}{36}}$ **6.** $-\sqrt{16}$ **7.** -35 **8.** -31.8

Name the property illustrated by each equation.

9. $5x \cdot (4y + 3x) = 5x \cdot (3x + 4y)$ **10.** $7x + (9x + 8) = (7x + 9x) + 8$

11. $5(3x + y) = 5(3x + 1y)$ **12.** $7n + 2n = (7 + 2)n$

13. $3(2x)y = (3 \cdot 2)(xy)$ **14.** $3x \cdot 2y = 3 \cdot 2 \cdot x \cdot y$ **15.** $(6 + -6)y = 0y$

16. $\frac{1}{4} \cdot 4y = 1y$ **17.** $5(x + y) = 5x + 5y$ **18.** $4n + 0 = 4n$

Name the additive inverse and multiplicative inverse for each number.

19. 0.4 **20.** -1.6

21. $-\frac{11}{16}$ **22.** $5\frac{5}{6}$

Simplify each expression.

23. $5x - 3y - 2x + 3y$ **24.** $-11a - 13b + 7a - 3b$

25. $8x - 7y - (3 - 6y)$ **26.** $4c - 2c - (4c + 2c)$

27. $3(r - 10s) - 4(7s + 2r)$ **28.** $\frac{1}{5}(10a - 15) + \frac{1}{2}(8 + 4a)$

29. $2(4 - 2x + y) - 4(5 + x - y)$ **30.** $\frac{5}{6}\left(\frac{3}{5}x + 12y\right) - \frac{1}{4}(2x - 12y)$

31. TRAVEL Olivia drives her car at 60 miles per hour for t hours. Ian drives his car at 50 miles per hour for $(t + 2)$ hours. Write a simplified expression for the sum of the distances traveled by the two cars.

32. NUMBER THEORY Use the properties of real numbers to tell whether the following statement is true or false: If $a > b$, it follows that $a\left(\frac{1}{a}\right) > b\left(\frac{1}{b}\right)$. Explain your reasoning.

1-2 Study Guide and Intervention

Properties of Real Numbers

Real Numbers All real numbers can be classified as either rational or irrational. The set of rational numbers includes several subsets: natural numbers, whole numbers, and integers.

R	real numbers	{all rationals and irrationals}
Q	rational numbers	{all numbers that can be represented in the form $\frac{m}{n}$, where m and n are integers and n is not equal to 0}
I	irrational numbers	{all nonterminating, nonrepeating decimals}
N	natural numbers	{1, 2, 3, 4, 5, 6, 7, 8, 9, ...}
W	whole numbers	{0, 1, 2, 3, 4, 5, 6, 7, 8, ...}
Z	integers	{..., −3, −2, −1, 0, 1, 2, 3, ...}

Example **Name the sets of numbers to which each number belongs.**

a. $-\frac{11}{3}$ rationals (Q), reals (R)

Properties of Real Numbers

Real Number Properties		
For any real numbers a, b, and c		
Property	**Addition**	**Multiplication**
Commutative	$a + b = b + a$	$a \cdot b = b \cdot a$
Associative	$(a + b) + c = a + (b + c)$	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$
Identity	$a + 0 = a = 0 + a$	$a \cdot 1 = a = 1 \cdot a$
Inverse	$a + (-a) = 0 = (-a) + a$	If a is not zero, then $a \cdot \frac{1}{a} = 1 = \frac{1}{a} \cdot a$.
Distributive	$a(b + c) = ab + ac$ and $(b + c)a = ba + ca$	

Example **Simplify $9x + 3y + 12y - 0.9x$.**

$$
\begin{aligned}
9x + 3y + 12y - 0.9x &= 9x + (-0.9x) + 3y + 12y && \text{Commutative Property (+)} \\
&= (9 + (-0.9))x + (3 + 12)y && \text{Distributive Property} \\
&= 8.1x + 15y && \text{Simplify.}
\end{aligned}
$$

1-1 Practice

Expressions and Formulas

Find the value of each expression.

1. $3(4 - 7) - 11$

2. $4(12 - 4^2)$

3. $1 + 2 - 3(4) \div 2$

4. $12 - [20 - 2(6^2 \div 3 \times 2^2)]$

5. $20 \div (5 - 3) + 5^2(3)$

6. $(-2)^3 - (3)(8) + (5)(10)$

7. $18 - \{5 - [34 - (17 - 11)]\}$

8. $[4(5 - 3) - 2(4 - 8)] \div 16$

9. $\frac{1}{2}[6 - 4^2]$

10. $\frac{1}{4}[-5 + 5(-3)]$

11. $\frac{-8(13 - 37)}{6}$

12. $\frac{(-8)^2}{5 - 9} - (-1)^2 + 4(-9)$

Evaluate each expression if $a = \frac{3}{4}$, $b = -8$, $c = -2$, $d = 3$, and $e = \frac{1}{3}$.

13. $ab^2 - d$

14. $(c + d)b$

15. $\frac{ab}{c} + d^2$

16. $\frac{d(b - c)}{ac}$

17. $(b - de)e^2$

18. $ac^3 - b^2de$

19. $-b[a + (c - d)^2]$

20. $\frac{ac^4}{d} - \frac{c}{e^2}$

21. $9bc - \frac{1}{e}$

22. $2ab^2 - (d^3 - c)$

23. TEMPERATURE The formula $F = \frac{9}{5}C + 32$ gives the temperature in degrees Fahrenheit for a given temperature in degrees Celsius. What is the temperature in degrees Fahrenheit when the temperature is −40 degrees Celsius?

24. PHYSICS The formula $h = 120t - 16t^2$ gives the height h in feet of an object t seconds after it is shot upward from Earth's surface with an initial velocity of 120 feet per second. What will the height of the object be after 6 seconds?

2-1 Study Guide and Intervention

Relations and Functions

Graph Relations A **relation** can be represented as a set of ordered pairs or as an equation; the relation is then the set of all ordered pairs (x, y) that make the equation true. The **domain** of a relation is the set of all first coordinates of the ordered pairs, and the **range** is the set of all second coordinates.

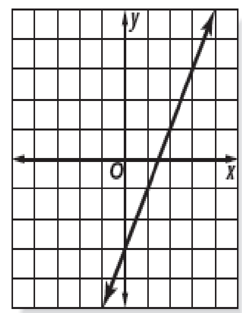
A **function** is a relation in which each element of the domain is paired with exactly one element of the range. You can tell if a relation is a function by graphing, then using the **vertical line test**. If a vertical line intersects the graph at more than one point, the relation is not a function.

Example **Graph the equation $y = 2x - 3$ and find the domain and range. Does the equation represent a function?**

Make a table of values to find ordered pairs that satisfy the equation. Then graph the ordered pairs.

The domain and range are both all real numbers. The graph passes the vertical line test, so it is function.

x	y
−1	−5
0	−3
1	−1
2	1
3	3



Equations of Functions and Relations Equations that represent functions are often written in **functional notation**. For example, $y = 10 - 8x$ can be written as $f(x) = 10 - 8x$. This notation emphasizes the fact that the values of y, the **dependent variable**, depend on the values of x, the **independent variable**.

To evaluate a function, or find a functional value, means to substitute a given value in the domain into the equation to find the corresponding element in the range.

Example **Given the function $f(x) = x^2 + 2x$, find each value.**

a. $f(3)$

$f(x) = x^2 + 2x$ Original function

$f(3) = 3^2 + 2(3)$ Substitute.

$= 15$ Simplify.

b. $f(5a)$

$f(x) = x^2 + 2x$ Original function

$f(5a) = (5a)^2 + 2(5a)$ Substitute.

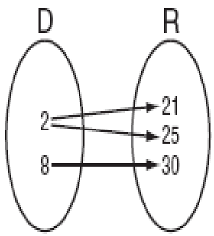
$= 25a^2 + 10a$ Simplify.

2-1 Practice

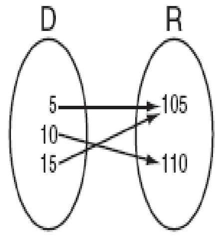
Relations and Functions

Determine whether each relation is a function. Write *yes* or *no*.

1.



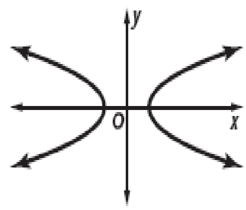
2.



3.

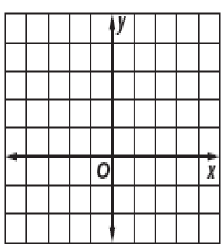
x	y
−3	0
−1	−1
0	0
2	−2
3	4

4.

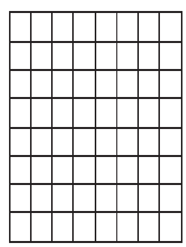


Graph each relation or equation and find the domain and range. Then determine whether the relation or equation is a function.

5. $\{(-4, -1), (4, 0), (0, 3), (2, 0)\}$



6. $y = 2x - 1$



Find each value if $f(x) = \dfrac{5}{x + 2}$ and $g(x) = -2x + 3$.

7. $f(3)$

8. $f(-4)$

9. $g\left(\dfrac{1}{2}\right)$

10. $f(-2)$

11. $g(-6)$

12. $f(m - 2)$

13. MUSIC The ordered pairs (1, 16), (2, 16), (3, 32), (4, 32), and (5, 48) represent the cost of buying various numbers of CDs through a music club. Identify the domain and range of the relation. Is the relation a function?

14. COMPUTING If a computer can do one calculation in 0.0000000015 second, then the function $T(n) = 0.0000000015n$ gives the time required for the computer to do n calculations. How long would it take the computer to do 5 billion calculations?

2-2 Study Guide and Intervention

Linear Equations

Identify Linear Equations and Functions A **linear equation** has no operations other than addition, subtraction, and multiplication of a variable by a constant. The variables may not be multiplied together or appear in a denominator. A linear equation does not contain variables with exponents other than 1. The graph of a linear equation is a line.

A **linear function** is a function whose ordered pairs satisfy a linear equation. Any linear function can be written in the form $f(x) = mx + b$, where m and b are real numbers.

If an equation is linear, you need only two points that satisfy the equation in order to graph the equation. One way is to find the x-intercept and the y-intercept and connect these two points with a line.

Example 1 **Is $f(x) = 0.2 - \frac{x}{5}$ a linear function? Explain.**

Yes; it is a linear function because it can be written in the form
$f(x) = -\frac{1}{5}x + 0.2$.

Example 2 **Is $2x + xy - 3y = 0$ a linear function? Explain.**

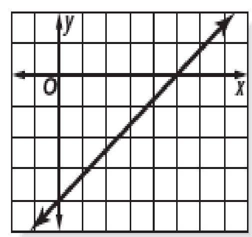
No; it is not a linear function because the variables x and y are multiplied together in the middle term.

Example 3 **Find the x-intercept and the y-intercept of the graph of $4x - 5y = 20$. Then graph the equation.**

The x-intercept is the value of x when $y = 0$.

$4x - 5y = 20$	Original equation
$4x - 5(0) = 20$	Substitute 0 for y.
$x = 5$	Simplify.

So the x-intercept is 5. Similarly, the y-intercept is -4.



Standard Form The **standard form** of a linear equation is $Ax + By = C$, where A, B, and C are integers whose greatest common factor is 1.

Example **Write each equation in standard form. Identify A, B, and C.**

a. $y = 8x - 5$

$y = 8x - 5$	Original equation
$-8x + y = -5$	Subtract $8x$ from each side.
$8x - y = 5$	Multiply each side by -1.

So $A = 8$, $B = -1$, and $C = 5$.

b. $14x = -7y + 21$

$14x = -7y + 21$	Original equation
$14x + 7y = 21$	Add $7y$ to each side.
$2x + y = 3$	Divide each side by 7.

So $A = 2$, $B = 1$, and $C = 3$.

2-2 Practice

Linear Equations

State whether each equation or function is linear. Write *yes* or *no*. If no, explain your reasoning.

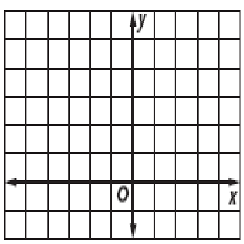
1. $h(x) = 23$
2. $y = \frac{2}{3}x$
3. $y = \frac{5}{x}$
4. $9 - 5xy = 2$

Write each equation in standard form. Identify *A*, *B*, and *C*.

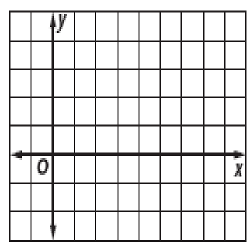
5. $y = 7x - 5$
6. $y = \frac{3}{8}x + 5$
7. $3y - 5 = 0$
8. $x = -\frac{2}{7}y + \frac{3}{4}$

Find the *x*-intercept and the *y*-intercept of the graph of each equation. Then graph the equation.

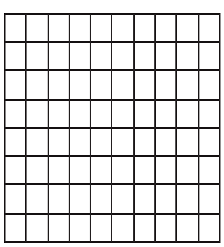
9. $y = 2x + 4$



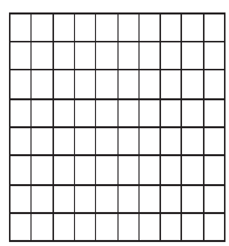
10. $2x + 7y = 14$



11. $y = -2x - 4$



12. $6x + 2y = 6$



13. **MEASURE** The equation $y = 2.54x$ gives the length in centimeters corresponding to a length x in inches. What is the length in centimeters of a 1-foot ruler?

LONG DISTANCE For Exercises 14 and 15, use the following information.

For Meg's long-distance calling plan, the monthly cost C in dollars is given by the linear function $C(t) = 6 + 0.05t$, where t is the number of minutes talked.

2-3 Study Guide and Intervention

Slope

Slope

Slope m of a Line	For points (x_1, y_1) and (x_2, y_2), where $x_1 \neq x_2$, $m = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$

Example 1 **Determine the slope of the line that passes through (2, −1) and (−4, 5).**

$m = \frac{y_2 - y_1}{x_2 - x_1}$ Slope formula

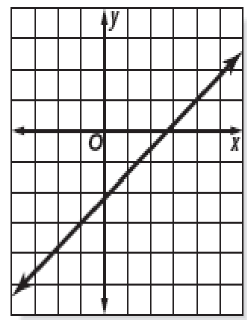
$= \frac{5 - (-1)}{-4 - 2}$ $(x_1, y_1) = (2, -1), (x_2, y_2) = (-4, 5)$

$= \frac{6}{-6} = -1$ Simplify.

The slope of the line is −1.

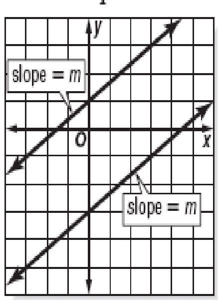
Example 2 **Graph the line passing through (−1, −3) with a slope of $\frac{4}{5}$.**

Graph the ordered pair (−1, −3). Then, according to the slope, go up 4 units and right 5 units. Plot the new point (4,1). Connect the points and draw the line.

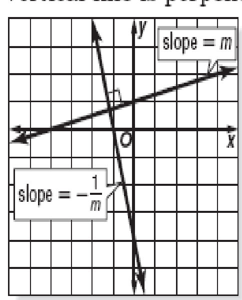


Parallel and Perpendicular Lines

In a plane, nonvertical lines with the same slope are **parallel**. All vertical lines are parallel.



In a plane, two oblique lines are **perpendicular** if and only if the product of their slopes is −1. Any vertical line is perpendicular to any horizontal line.



Example **Are the line passing through (2, 6) and (−2, 2) and the line passing through (3, 0) and (0, 4) parallel, perpendicular, or neither?**

Find the slopes of the two lines.

The slope of the first line is $\frac{6 - 2}{2 - (-2)} = 1$.

The slope of the second line is $\frac{4 - 0}{0 - 3} = -\frac{4}{3}$.

The slopes are not equal and the product of the slopes is not −1, so the lines are neither parallel nor perpendicular.

2-3 Skills Practice

Slope

Find the slope of the line that passes through each pair of points.

1. (1, 5), (−1, −3)

2. (0, 2), (3, 0)

3. (1, 9), (0, 6)

4. (8, −5), (4, −2)

5. (−3, 5), (−3, −1)

6. (−2, −2), (10, −2)

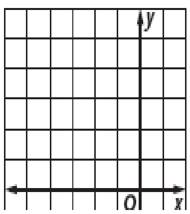
7. (4, 5), (2, 7)

8. (−2, −4), (3, 2)

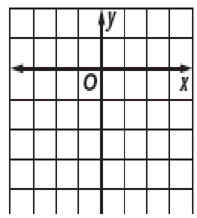
9. (5, 2), (−3, 2)

Graph the line passing through the given point with the given slope.

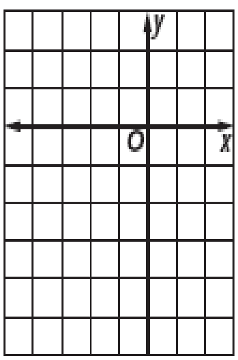
10. (0, 4), $m = 1$



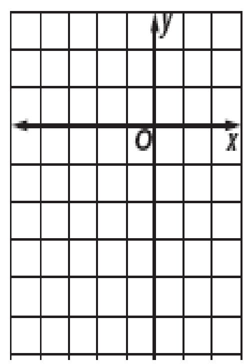
11. (2, −4), $m = -1$



12. (−3, −5), $m = 2$

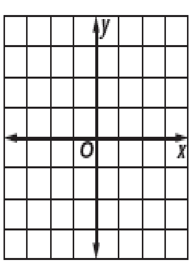


13. (−2, −1), $m = -2$

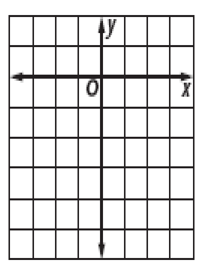


Graph the line that satisfies each set of conditions.

14. passes through (0, 1), perpendicular to a line whose slope is $\frac{1}{3}$



15. passes through (0, −5), parallel to the graph of $y = 1$



16. HIKING Naomi left from an elevation of 7400 feet at 7:00 A.M. and hiked to an elevation of 9800 feet by 11:00 A.M. What was her rate of change in altitude?

2-4 Study Guide and Intervention

Writing Linear Equations

Forms of Equations

Slope-Intercept Form of a Linear Equation	$y = mx + b$, where m is the slope and b is the y-intercept
Point-Slope Form of a Linear Equation	$y - y_1 = m(x - x_1)$, where (x_1, y_1) are the coordinates of a point on the line and m is the slope of the line

Example 1 **Write an equation in slope-intercept form for the line that has slope −2 and passes through the point (3, 7).**

Substitute for m, x, and y in the slope-intercept form.

$y = mx + b$	Slope-intercept form
$7 = (-2)(3) + b$	$(x, y) = (3, 7)$, $m = -2$
$7 = -6 + b$	Simplify.
$13 = b$	Add 6 to both sides.

The y-intercept is 13. The equation in slope-intercept form is $y = -2x + 13$.

Example 2 **Write an equation in slope-intercept form for the line that has slope $\frac{1}{3}$ and x-intercept 5.**

$y = mx + b$	Slope-intercept form
$0 = \left(\frac{1}{3}\right)(5) + b$	$(x, y) = (5, 0)$, $m = \frac{1}{3}$
$0 = \frac{5}{3} + b$	Simplify.
$-\frac{5}{3} = b$	Subtract $\frac{5}{3}$ from both sides.

The y-intercept is $-\frac{5}{3}$. The slope-intercept form is $y = \frac{1}{3}x - \frac{5}{3}$.

Parallel and Perpendicular Lines

Use the slope-intercept or point-slope form to find equations of lines that are parallel or perpendicular to a given line. Remember that parallel lines have equal slope. The slopes of two perpendicular lines are negative reciprocals, that is, their product is −1.

Example 1 **Write an equation of the line that passes through (8, 2) and is perpendicular to the line whose equation is $y = -\frac{1}{2}x + 3$.**

The slope of the given line is $-\frac{1}{2}$. Since the slopes of perpendicular lines are negative reciprocals, the slope of the perpendicular line is 2.

Use the slope and the given point to write the equation.

$y - y_1 = m(x - x_1)$	Point-slope form
$y - 2 = 2(x - 8)$	$(x_1, y_1) = (8, 2)$, $m = 2$
$y - 2 = 2x - 16$	Distributive Prop.
$y = 2x - 14$	Add 2 to each side.

An equation of the line is $y = 2x - 14$.

Example 2 **Write an equation of the line that passes through (−1, 5) and is parallel to the graph of $y = 3x + 1$.**

The slope of the given line is 3. Since the slopes of parallel lines are equal, the slope of the parallel line is also 3.

Use the slope and the given point to write the equation.

$y - y_1 = m(x - x_1)$	Point-slope form
$y - 5 = 3(x - (-1))$	$(x_1, y_1) = (-1, 5)$, $m = 3$
$y - 5 = 3x + 3$	Distributive Prop.
$y = 3x + 8$	Add 5 to each side.

An equation of the line is $y = 3x + 8$.

2-4 Practice

Writing Linear Equations

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

1. $y = 8x + 12$

2. $y = 0.25x - 1$

3. $y = -\frac{3}{5}x$

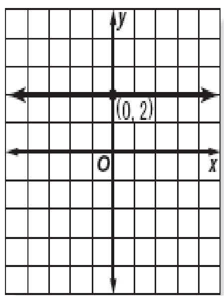
4. $3y = 7$

5. $3x = -15 + 5y$

6. $2x - 3y = 10$

Write an equation in slope-intercept form for each graph.

7.



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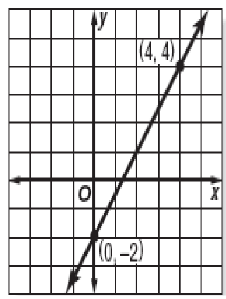
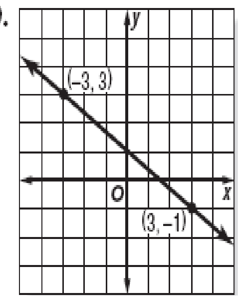


9.



Write an equation in slope-intercept form for the line that satisfies each set of conditions.

10. slope -5, passes through $(-3, -8)$

11. slope $\frac{4}{5}$, passes through $(10, -3)$

12. slope 0, passes through $(0, -10)$

13. slope $-\frac{2}{3}$, passes through $(6, -8)$

14. passes through $(3, 11)$ and $(-6, 5)$

15. passes through $(7, -2)$ and $(3, -1)$

16. x-intercept 3, y-intercept 2

17. x-intercept -5, y-intercept 7

18. passes through $(-8, -7)$, perpendicular to the graph of $y = 4x - 3$

19. RESERVOIRS The surface of Grand Lake is at an elevation of 648 feet. During the current drought, the water level is dropping at a rate of 3 inches per day. If this trend continues, write an equation that gives the elevation in feet of the surface of Grand Lake after x days.

20. BUSINESS Tony Marconi's company manufactures CD-ROM drives. The company will make \$150,000 profit if it manufactures 100,000 drives, and \$1,750,000 profit if it manufactures 500,000 drives. The relationship between the number of drives manufactured and the profit is linear. Write an equation that gives the profit P when n drives are manufactured.

2-7 Study Guide and Intervention

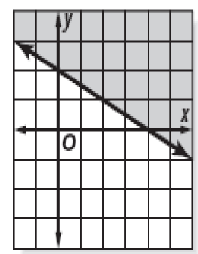
Graphing Inequalities

Graph Linear Inequalities. A **linear inequality**, like $y \geq 2x - 1$, resembles a linear equation, but with an inequality sign instead of an equals sign. The graph of the related linear equation separates the coordinate plane into two half-planes. The line is the boundary of each half-plane.

To graph a linear inequality, follow these steps.

1. Graph the boundary, that is, the related linear equation. If the inequality symbol is $\leq$ or $\geq$, the boundary is solid. If the inequality symbol is $<$ or $>$, the boundary is dashed.
2. Choose a point not on the boundary and test it in the inequality. (0, 0) is a good point to choose if the boundary does not pass through the origin.
3. If a true inequality results, shade the half-plane containing your test point. If a false inequality results, shade the other half-plane.

Example **Graph $x + 2y \geq 4$.**



The boundary is the graph of $x + 2y = 4$.

Use the slope-intercept form, $y = -\frac{1}{2}x + 2$, to graph the boundary line.

The boundary line should be solid.

Now test the point (0, 0).

$0 + 2(0) \overset{?}{\geq} 4$ $\quad (x, y) = (0, 0)$

$0 \geq 4$ $\quad$ false

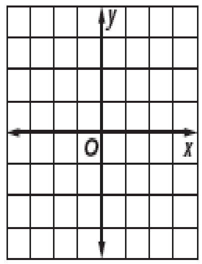
Shade the region that does *not* contain (0, 0).

2-7 Skills Practice

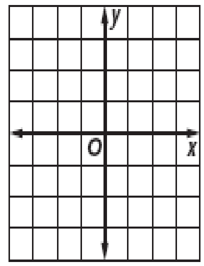
Graphing Inequalities

Graph each inequality.

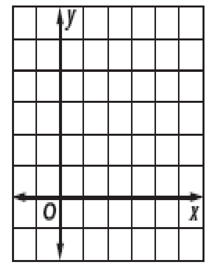
1. $y > 1$



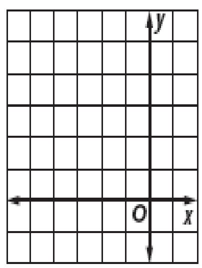
2. $y \leq x + 2$



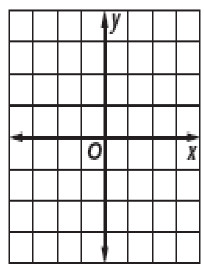
3. $x + y \leq 4$



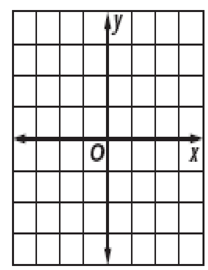
4. $x + 3 < y$



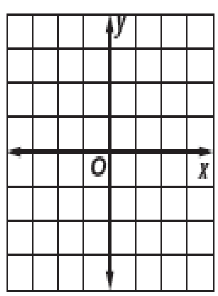
5. $2 - y < x$



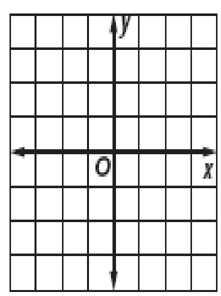
6. $y \geq -x$



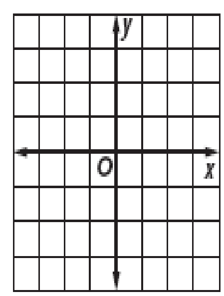
7. $x - y > -2$



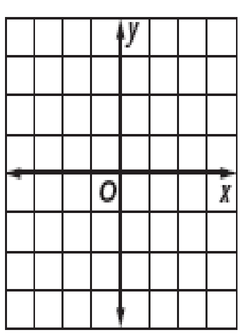
8. $9x + 3y - 6 \leq 0$



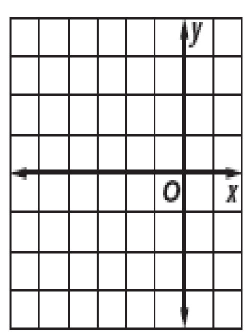
9. $y + 1 \geq 2x$



10. $y - 7 \leq -9$



11. $x > -5$

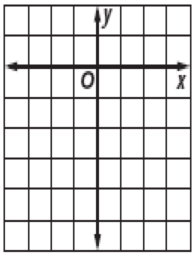


2-7 Practice

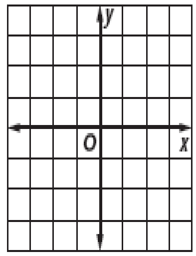
Graphing Inequalities

Graph each inequality.

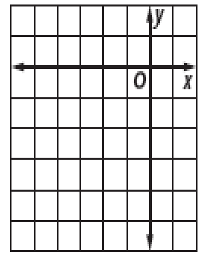
1. $y \leq -3$



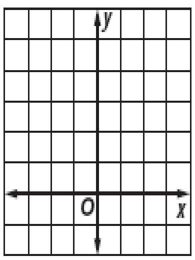
2. $x > 2$



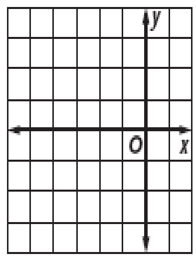
3. $x + y \leq -4$



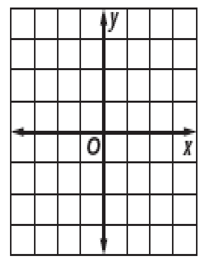
4. $y < -3x + 5$



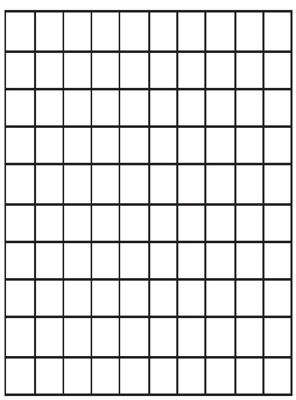
5. $y < \frac{1}{2}x + 3$



6. $y - 1 \geq -x$



7. $x - 3y \leq 6$



A school system is buying new computers. They will buy desktop computers costing $1000 per unit, and notebook computers costing $1200 per unit. The total cost of the computers cannot exceed $80,000.

10. Write an inequality that describes this situation.

11. Graph the inequality.

12. If the school wants to buy 50 of the desktop computers and 25 of the notebook computers, will they have enough money?