Table of Contents

Test Taking 101

As you begin to prepare for taking college tests, please know that having the right attitude can make a huge difference in the outcome. Here are a few tips to help you in the process:

1. Prepare properly for the exam. This might include reviewing your homework / review, studying in small blocks of time, or preparing with another student.
2. Get plenty of rest, eat before testing, and relax.
3. Use the allotted time wisely, try not to rush through calculations, and check over your work.
4. Learn the concepts, rather than memorizing.
5. Read the directions carefully, and then read each question carefully.
6. Do the questions you understand first, and if you come to one you are not sure of the answer, come back to that question.
7. If there are formulas or facts you want to jot down to refer to later, do that as you first receive the test.
8. Take deep breaths. If you are anxious, stop and get control, then calmly proceed.
9. Be confident in your work, answer all questions, do your best!

Additionally, whenever given a multiple choice test, it is important to use a variety of skills. If you come to a test question that you have no real idea about, use one or more of the following techniques:

- Eliminate any answers you know are incorrect.
- Work the problem on scratch paper first, then look for your answer among the given choices.
- Try substituting the given answers back into the question to help eliminate answers.

Solving Linear Equations in One Variable

One of the basic concepts of algebra is learning to solve equations. Equations differ from expressions because equations have an equal sign, expressions do not. Linear equations can be simple equations that are easy to solve or reason out in our head. They can also be much more complicated equations that require multiple steps. To solve linear equations we will use the distributive property, addition property of equality, and the multiplication property of equality.

First, let's determine if 5 is a solution for the following equations.

1. $3x + 1 = 16$

   Solution? "yes" or "no" _____

2. $4x - 5 = 14$

   Solution? "yes" or "no" _____

The Addition Property of Equality states that a, b, and c are numbers. So

if $a = b$ then $a + c =$ _______ and are equivalent equations.	Also, if $a = b$ then $a - c =$ _______ and are equivalent equations.

The Multiplication Property of Equality states that a, b, and c are numbers and $c \neq 0$. So

if $a = b$ then $a \cdot c =$ _______ and are equivalent equations.	Also, if $a = b$ then $\frac{a}{c} =$ _______ and are equivalent equations.

Now let's look at solving equations using both the addition property of equality and the multiplication property of equality.

1. $19x - 7 = 5 + 15x$

2. $5x + 5 = -5 + 3x + 24$

3. $6(x+3)=3(x-2)$

4. $8-2(a+1)=9+a$

5. $\frac{5}{6}x-\frac{1}{2}=2$

6. $\frac{7}{8}x+\frac{1}{2}=\frac{3}{4}x$

7. $4(3x+9)=12x+36$

8. $3x-7=3(x+1)$

T^2 To Try - Solve each of the following using both the addition property of equality and the multiplication property of equality.

a. $21x-7=9+17x$

b. $7x+6=-5+5x+27$

c. $9(x-2)=2(3x+6)$

d. $6-8(a+1)=7+a$

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

f. $\frac{5}{6}x+\frac{1}{2}=\frac{2}{3}x$

g. $3(5x+4)=15x+12$

h. $5x-6=5(x+2)$

Solving Linear Inequalities

After reviewing the fundamental properties for solving equations, it is a normal transition to study inequalities next. There are a few rules to remember:

$<$ means ________________________________

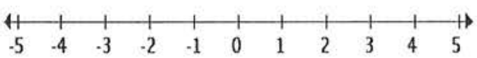
$>$ means ________________________________

$\leq$ means ________________________________

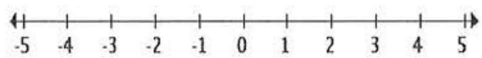
$\geq$ means ________________________________

Solve and graph each of the following. Write the solution in interval notation.

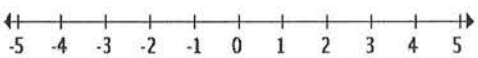
1. $3x + 2 > 8$



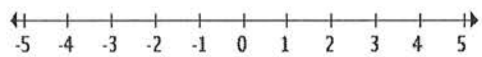
2. $5x - 6 < 14$



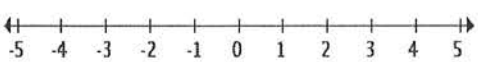
3. $12x \geq 36$



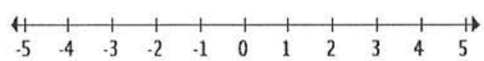
4. $-19x \leq 38$



5. $3(x + 1) > -6$



6. $4(3 - x) \geq 28$

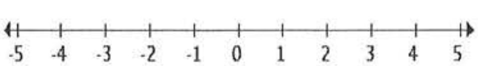


After reviewing these inequalities and the steps used to solve them, restate the rule to remember when multiplying or dividing both sides of an inequality by the same negative number.

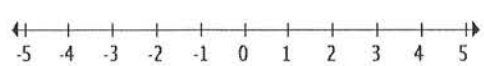
____

T^2 To Try - Solve each inequality. Graph the solution set and write it in interval notation.

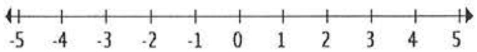
a. $4x + 4 > 20$



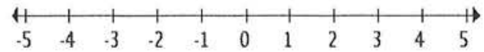
b. $7x - 6 < 15$



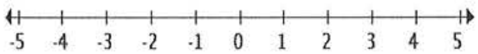
c. $17x \geq 34$



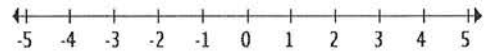
d. $-9x \leq 45$



e. $4(x + 1) > 8$



f. $5(2 - x) \geq 20$



Compound Inequalities

Next we will look at two inequalities joined by "and" ($\cap$) or "or" ($\cup$). These are know as compound inequalities.

The intersection ($\cap$) of two sets is the set ______________________________

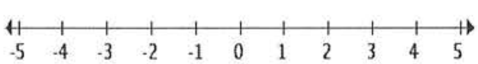
____

The union ($\cup$) of two sets is the set ______________________________

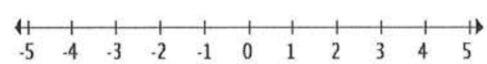
____

Let's look at how $\cap$ and $\cup$ affect the solution set for the following. Graph each and write the solution set in interval notation.

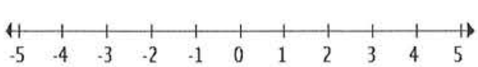
1. $x < 3$ and $x > -2$



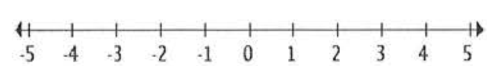
2. $x \leq -1$ and $x \geq 1$



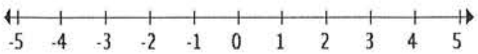
3. $x < -3$ and $x \leq 4$



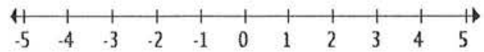
4. $x > -4$ or $x > 5$



5. $x \leq -3$ or $x \geq 2$

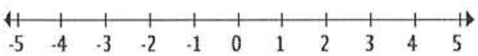


6. $x > 0$ or $x < 3$

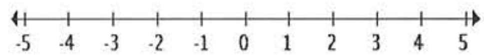


T^2 To Try - Solve each compound inequality. Graph the solution set and write it in interval notation.

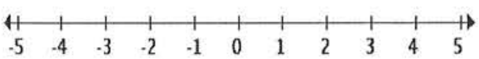
a. $x < 4$ and $x > -1$



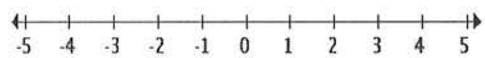
b. $x \leq -2$ and $x \geq 2$



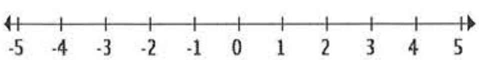
c. $x < -2$ and $x \leq 5$



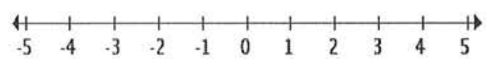
d. $x > -3$ or $x > 0$



e. $x \leq -2$ or $x \geq 3$



f. $x > 1$ or $x < 4$



Absolute Value Equations

Now let's look at solving absolute value equations of the form $|X| = a$. If a is a positive number, then $|X| = a$ is equivalent to $X =$ _____ and $X =$ _____.

Let's solve the following absolute value equations.

1. $|x| = 7$

2. $|2x - 5| = 9$

3. $|2x| + 9 = 17$

4. $|4x + 1| + 3 = 1$

$\boxed{T^2}$ To Try - Solve each absolute value equation.

a. $|x| = 5$

b. $|2x + 6| = 4$

c. $|3x| + 5 = 14$

d. $|3x - 2| + 8 = 1$

Absolute Value Inequalities

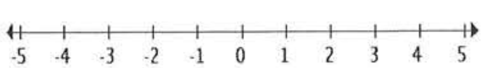
We will use the following rules for solving absolute value inequalities:

Solving absolute value inequalities of the the $|X| < a$
If a is a positive number, then $|X| < a$ is equivalent to ______________________________.

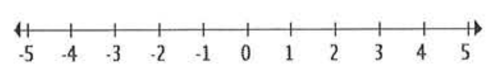
Solving absolute value inequalities of the the $|X| > a$
If a is a positive number, then $|X| > a$ is equivalent to ______________________________.

Let's look at the following examples. We will solve each inequality, graph the solution set, and then write the solution set in interval notation.

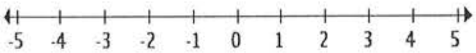
1. $|x| \leq 4$



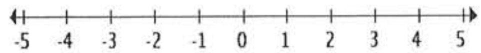
2. $|x| > 3$



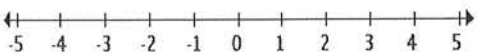
3. $|3x-1|<-5$



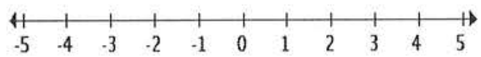
4. $|5x|>-4$



5. $|x-6|-7\leq -1$

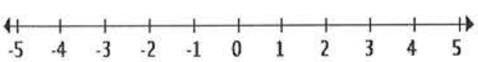


6. $|6x-8|+3\geq 7$

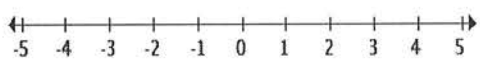


T^2 To Try - Solve each absolute value inequality. Graph the solution set then write the solution set in interval notation.

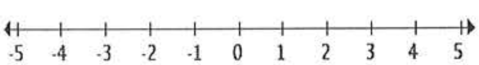
a. $|x|\leq 2$



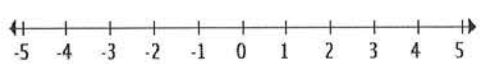
b. $|x|>1$



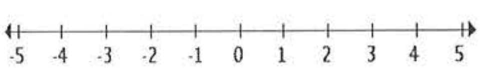
c. $|8x-3|<-2$



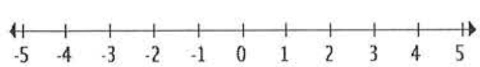
d. $|2x|>-6$



e. $|x+2|-7\leq -3$



f. $|2x-1|+2>7$



P^2 - I Practice Plus

Complete the table with your outside commitments and time per day spent with each activity.

Activity	# of hours per day
work	
sleep	
eat	
school (in class)	
school (study/homework)	
family	
extra curricular	
other:	
other:	
other:	

Total hours per day committed: ______________

1. Now that you have totaled your daily commitments, reflect on one or more ways you could adjust your schedule when unexpected things arise.

   a. ______________________________

   b. ______________________________

2. List 3 test taking strategies you plan to use.

   a. ______________________________

   b. ______________________________

   c. ______________________________

Solve each of the following using both the addition property of equality and the multiplication property of equality.

3. $18x - 7 = 5 + 12x$

4. $4x + 7 = -7 + 2x + 24$

5. $4(x + 2) = 2(x - 8)$

6. $6 - 4(a + 1) = 7 + a$

7. $\frac{11}{12}x - \frac{1}{4} = 8$

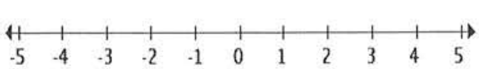
8. $\frac{9}{10}x + \frac{1}{2} = \frac{4}{5}x$

9. $3(7x + 6) = 21x + 18$

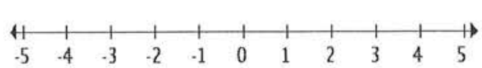
10. $4x - 3 = 4(x + 1)$

Solve and graph each of the following. Write the solution in interval notation.

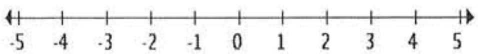
11. $3x + 6 > 15$



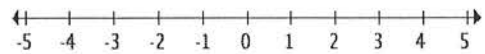
12. $-7x \leq 21$



13. $3x + 5 \leq 17$

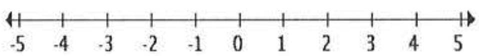


14. $-4(x + 2) > 3x + 20$

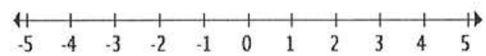


Graph each and write the solution set in interval notation.

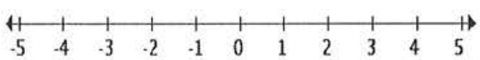
15. $x < 2$ and $x > -4$



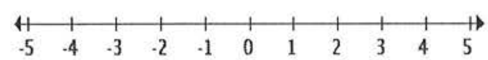
16. $x \leq -4$ and $x \geq 4$



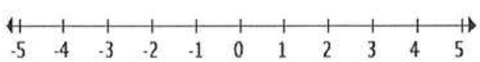
17. $x < -2$ and $x \leq 0$



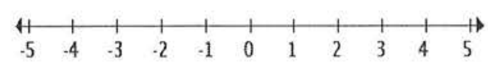
18. $x > -3$ or $x > 1$



19. $x \leq -1$ or $x \geq 3$



20. $x > -2$ or $x < 4$



Solve each absolute value equation.

21. $|x| = 9$

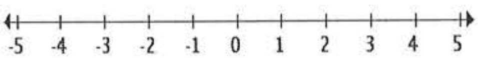
22. $|2x - 7| = 15$

23. $|5x| - 1 = 14$

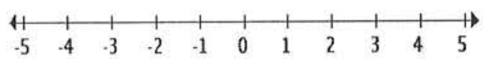
24. $|4x - 3| + 7 = 1$

Solve each absolute value inequality. Graph the solution set then write the solution set in interval notation.

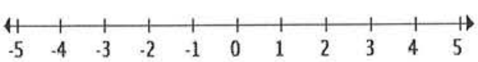
25. $|x| \leq 5$



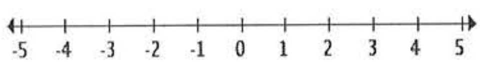
26. $|x| > 2$



27. $|x + 2| < 3$



28. $|x + 1| > 4$



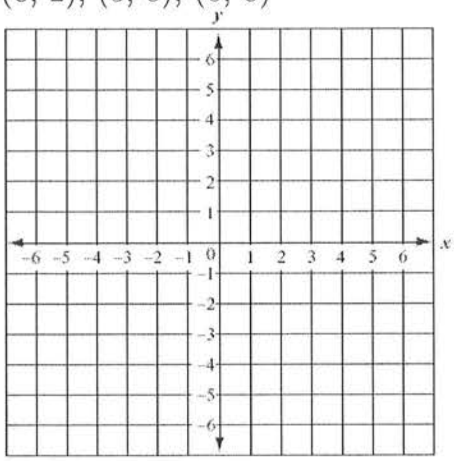
M^2 - II Math Module II - Graphs and Functions

When graphing, recall the horizontal axis is the x-axis, and the vertical axis is the y-axis. Ordered pairs are written and graphed as (x, y).

Let's graph the following ordered pairs together:

$(3, 2)$, $(-4, 5)$, $(6, -1)$, $(-4, -5)$,

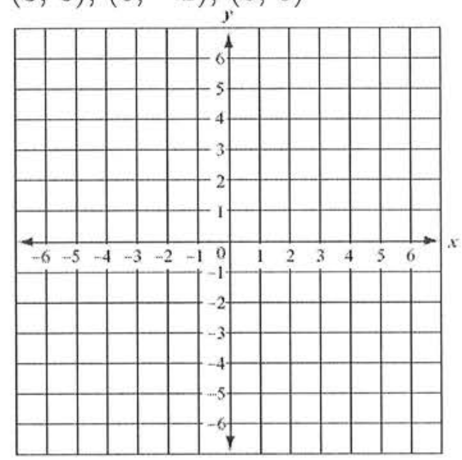
$(0, 2)$, $(5, 0)$, $(0, 0)$



T^2 - **To Try** - Graph the following ordered pairs.

$(5, 1)$, $(-3, 2)$, $(4, -5)$, $(-1, -4)$,

$(3, 0)$, $(0, -2)$, $(0, 0)$



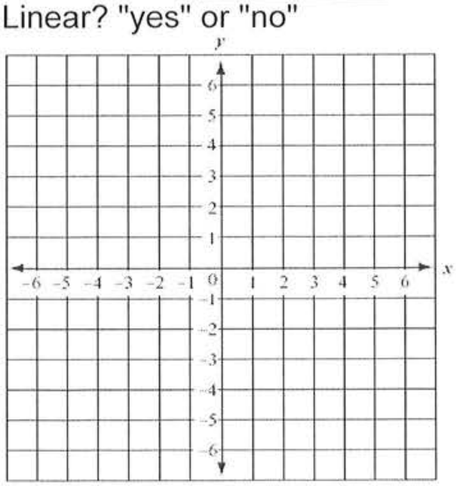
Next we will determine whether an equation is linear or not. We will then graph the equation by finding and plotting ordered pair solutions.

Remember a linear equation in two variables is an equation that can be written in the form ______________________ where A and B are not both 0. An equation written in this form is called ___________________________.

1. $y = 3x$

x	y
-2	
-1	
0	
1	
2	

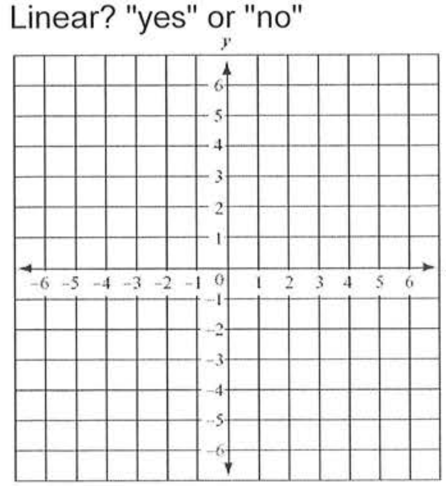
Linear? "yes" or "no"



2. $y = |x| + 3$

x	y
-2	
-1	
0	
1	
2	

Linear? "yes" or "no"

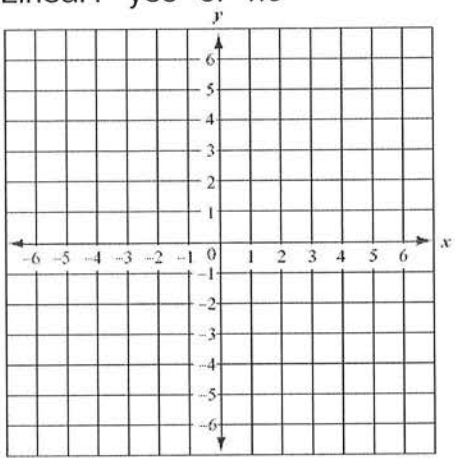


T² - **To Try** - Determine whether each equation is linear or not. Then graph each equation by finding and plotting ordered pair solutions.

a. $y = 2x + 2$

x	y
-2	
-1	
0	
1	
2	

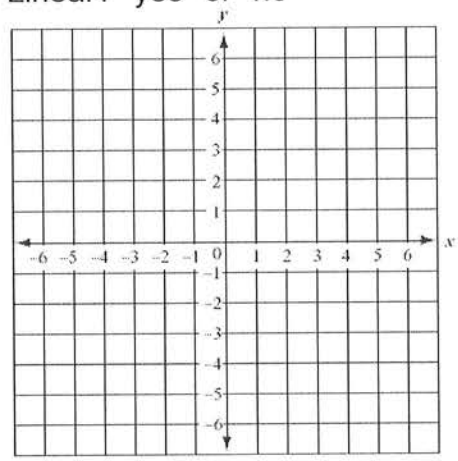
Linear? "yes" or "no"



b. $y = x^2$

x	y
-2	
-1	
0	
1	
2	

Linear? "yes" or "no"



An Introduction to Functions

First let's review some definitions:

Relation: ______________________________

Domain: ______________________________

Range: ______________________________

Function: ______________________________

Now let's find the domain and the range of the following relation. Also, we'll determine whether or not the relation is a function.

$\{(2, 1), (-3, 6), (5, 4), (8, -9)\}$

Domain: ______________ Range: ______________ Function? "yes" or "no"

T² - **To Try** - Find the domain and range of the following relation. Then determine whether or not the relation is a function.

$\{(3, -2), (1, 7), (-4, 5), (3, 8)\}$

Domain: ______________ Range: ______________ Function? "yes" or "no"

Function Notation and Function Values

To designate the y is a function of x, we can write: $y = f(x)$ (Read "f of x.")
For example, to use function notation with the function $y = 2x + 3$, we would write the equation as $f(x) = 2x + 3$.

Now let's find the function value for each of the following.

1. $f(x) = 6x - 4$

Find: $f(0)$

$f(-1)$

$f(2)$

2. $g(x) = 3x^2 - 2x + 1$

Find: $g(0)$

$g(-1)$

$g(2)$

T² - **To Try** - Find the function value for each of the following.

a. $f(x) = 3x - 2$

Find: $f(0)$

$f(1)$

$f(-2)$

b. $g(x) = 5x^2 + 2x - 1$

Find: $g(0)$

$g(1)$

$g(-2)$

The Slope of a Line

In mathematics, the steepness or slant of a line is referred to as slope. We can measure the slope of a line by comparing the vertical change (rise) to the horizontal change (run) when moving from one fixed point to another on the same line. To calculate the slope of a line, we use a ratio that compares the vertical change in y (rise) to the horizontal change in x (run).

The letter m is commonly used to represent slope and we use the following formula to calculate a line's slope:

$$m = \frac{\text{change in } y \text{ (rise)}}{\text{change in } x \text{ (run)}} = \frac{y_2 - y_1}{x_2 - x_1}$$

Let's use this formula to calculate the slope of a line passing through two given points.

1. $(2, 7)$ and $(-3, 10)$

2. $(-2, 6)$ and $(1, 8)$

T^2 - To Try - Find the slope of a line that passes through the given points.

a. $(2, 5)$ and $(-4, 6)$

b. $(-3, 3)$ and $(6, 7)$

A linear equation that is solved for y is in what we refer to as slope-intercept form. This is because the slope and the y-intercept can be immediately determined from the equation. The coefficient of x is the line's slope and the constant is the y-intercept. The general form of a line written in slope-intercept form is $y = mx + b$, where m is the slope and $(0, b)$ is the y-intercept.

Let's identify the slope and the y-intercept of the following lines. Be sure to write the y-intercept as an ordered pair.

1. $y = 3x + 5$

   $m =$ ________

   y-intercept: ________

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

   $m =$ ________

   y-intercept: ________

3. $-2x + y = 3$

   $m =$ ________

   y-intercept: ________

4. $3x - 4y = 8$

   $m =$ ________

   y-intercept: ________

T^2 **- To Try** - Find the slope and the y-intercept of each of the following lines.

a. $y = 6x + 3$

$m =$ ________

y-intercept: ________

b. $y = \frac{3}{5}x - 2$

$m =$ ________

y-intercept: ________

c. $-5x + y = 1$

$m =$ ________

y-intercept: ________

d. $2x - 3y = 12$

$m =$ ________

y-intercept: ________

Slope is sometimes used to determine whether two lines are parallel or perpendicular. Lines are said to be parallel if they do not intersect. Parallel lines will also have identical slopes. Lines are said to be perpendicular if they intersect at a right angle ($90°$). Perpendicular lines have slopes whose product equals -1. You might also say that the slopes of perpendicular lines are negative reciprocals of each other.

Let's look at some examples of how to determine whether two lines are parallel or perpendicular to each other.

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

2. $x + y = 7$
   $4x + y = 7$

3. $2x + 3y = 9$
   $6y = -4x - 6$

T^2 **- To Try** - Determine whether each pair of lines is parallel, perpendicular, or neither.

a. $x + y = 5$
   $2x + y = 5$

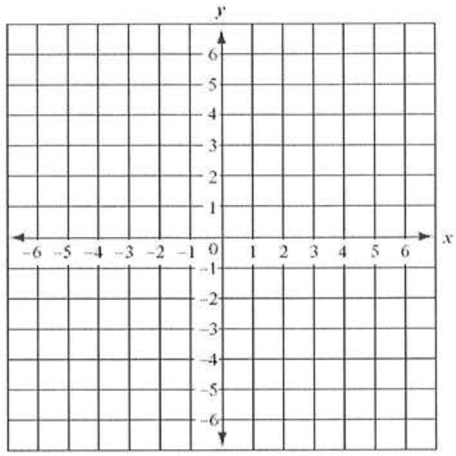
b. $5y = 2x - 10$
   $5x + 2y = 2$

c. $y = 2x + 1$
   $4x - 2y = 8$

Graphing with Slope-Intercept

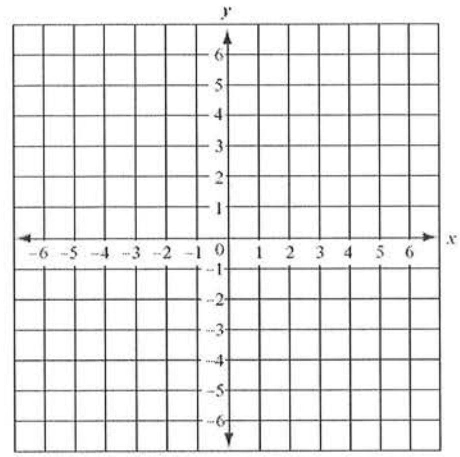
1. $y = 2x - 4$

$m =$ ______ y-intercept: (____, ____)



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

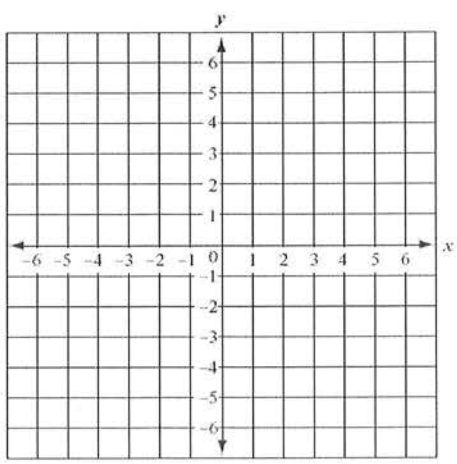
$m =$ ______ y-intercept: (____, ____)



T² - **To Try** - Graph the following linear equations using slope intercept.

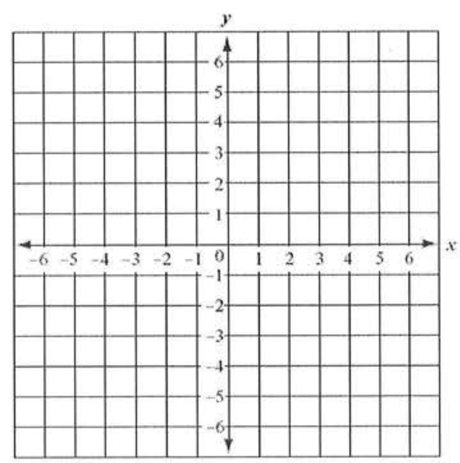
a. $y = 3x - 5$

$m =$ ______ y-intercept: (____, ____)



b. $y = -\frac{3}{4}x + 2$

$m =$ ______ y-intercept: (____, ____)



Using Point-Slope Form

When the slope of a line and a point on that line are known, the equation of the line can also be found by using the following formula:

$y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is the point on the line.

Let's try some examples together.

Find an equation of the line with the given slope and containing the given point. Write the equation in slope-intercept form.

1. Slope $= 4$, passing through $(3, 2)$

2. Slope $= -3$, passing through $(2, 5)$

3. Slope $= -2$, passing through $(1, -3)$

T^2 - To Try - Find an equation of the line with the given slope and containing the given point. Write the equation in slope-intercept form.

a. Slope $= 3$, passing through $(1, 2)$

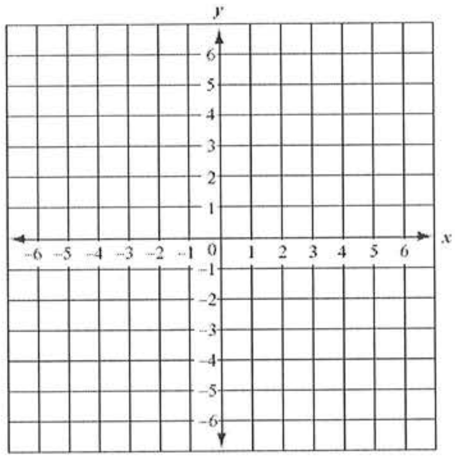
b. Slope $= -2$, passing through $(6, 5)$

c. Slope $= -4$, passing through $(2, -4)$

P^2 - II Practice Plus

Graph the following ordered pairs.

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

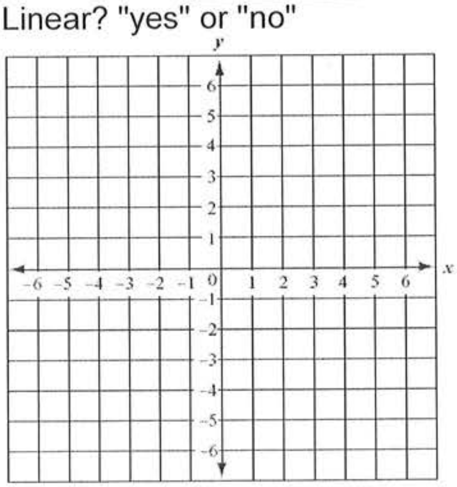


Determine whether each equation is linear or not. Then graph each equation by finding and plotting ordered pair solutions.

2. $y = 2x - 1$

x	y
-2	
-1	
0	
1	
2	

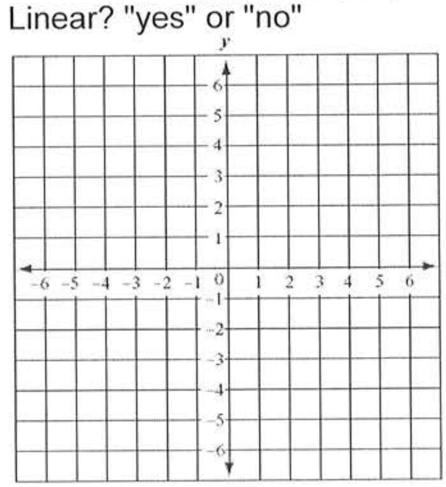
Linear? "yes" or "no"



3. $y = |x| - 2$

x	y
-2	
-1	
0	
1	
2	

Linear? "yes" or "no"



4. Find the domain and range of the following relation. Then determine whether or not the relation is a function.

$$\{(6,\ -1),\ (-4.3),\ (-1,\ 6),\ (2,\ 3)\}$$

Domain: ________________ Range: ________________ Function? "yes" or "no"

Find the function value for each of the following.

5. $f(x) = 3x + 3$

Find: $f(4)$

$f(-1)$

6. $g(x) = 4x^2 - 6x + 3$

Find: $g(0)$

$g(-1)$

Find the slope of a line that passes through the given points.

7. $(1, -5)$ and $(6, -2)$

Find the slope and the y-intercept of each of the following lines.

8. $-2x + y = -5$

$m =$ ________

y-intercept: ________

9. $2x - 5y = 10$

$m =$ ________

y-intercept: ________

Determine whether each pair of lines is parallel, perpendicular, or neither.

10. $-x + 2y = -6$
$4y = 2x - 8$

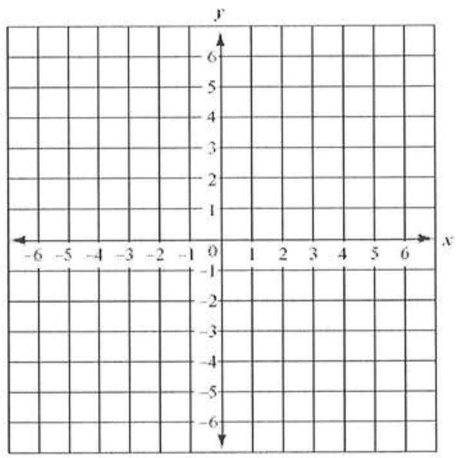
11. $5y = 3x + 10$
$5x + 3y = 9$

Rewrite the given equation in slope-intercept form. Identify the slope and the y-intercept, then graph the equation.

12. $x - 3y = 9$

Equation: ______________________

$m =$ _____ y-intercept: (___, ___)



Find an equation of the line with the given slope and containing the given point. Write the equation in slope-intercept form.

13. Slope $= 5$, passing through $(1, 3)$

14. Slope $= -2$, passing through $(4, -2)$

M² - III Math Module III - Exponents and Polynomials

Let's do a quick refresher on the rules for exponents. Looking at the rules listed on the left side of the chart below, use those rules to complete the rest of the chart.

Product Rule	$a^m \cdot a^n = a^{m+n}$	$x^5 \cdot x^3 =$ ____	$3x^2 \cdot 7x^9 =$ ____	$x^4 \cdot x^2 \cdot x =$ ____
Zero Exponent	$a^0 = 1,\ a \neq 0$	$5^0 =$ ____	$(-8)^0 =$ ____	$-3^0 =$ ____
Quotient Rule	$\dfrac{a^m}{a^n} = a^{m-n},\ a \neq 0$	$\dfrac{y^7}{y^4} =$ ____	$\dfrac{15x^{11}}{3x^3} =$ ____	$\dfrac{125x^8}{5x^4} =$ ____
Negative Exponent	$a^{-n} = \dfrac{1}{a^n},\ a \neq 0$	$6^{-2} =$ ____	$\left(\dfrac{2}{3}\right)^{-3} =$ ____	$\dfrac{x^{-3}}{x^2} =$ ____
Power Rules	$(a^m)^n = a^{m \cdot n}$ $(ab)^m = a^m b^m$ $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n},\ b \neq 0$	$(9^4)^3 =$ ____	$(5y)^4 =$ ____	$\left(\dfrac{7x^{-2}}{x^5}\right)^3 =$ ____

T² To Try - Use the rules for exponents to solve each of the following.

a. $y^6 \cdot y^4$

b. $4x^3 \cdot 6x^7$

c. $x^5 \cdot x \cdot x^9$

d. $(-12)^0$

e. -10^0

f. $-5x^0$

g. $\frac{y^{14}}{y^9}$

h. $\frac{18x^{12}}{6x^3}$

i. $\frac{7x^3}{14x^2}$

j. 7^{-2}

k. $\left(\frac{3}{5}\right)^{-2}$

l. $\frac{x^{-7}}{x^3}$

m. $(y^3)^8$

n. $(4y)^3$

o. $(x^5y^3)^{-3}$

p. $\left(\frac{3x^{-2}}{x^4}\right)^3$

A **polynomial** is a single term or the sum of two or more terms containing variables with exponents. Recall that a **term** is a number or the product of a number and a variable raised to a power.

Here are some examples of polynomials:

$-4x^5$ $\quad$ $3x^3 - 7x^2$ $\quad$ $5y^5 - 9y^4 + 12y^2$ $\quad$ $12m^4n^2 + 7mn - 3m + 10n$

There are some polynomials that have special names. A **monomial** is a polynomial with exactly one term. A **binomial** is a polynomial with exactly two terms, and a **trinomial** is a polynomial with exactly three terms.

Polynomials can be simplified by combining like terms. Recall that like terms are terms with the exact same variables raised to the exact same powers.

Let's try a few examples together.

1. $(5x^3 + 7x^2 - 4) + (2x^3 - 4x^2 + 9)$

2. $(-8y^2 + 15y - 6) + (4y^2 - 3y - 7)$

3. $(-3x^3 + 7x^2 - 4) + (3x^2 - 9x)$

4. $(9x + 5) - (3x + 2)$

5. $(8x^2 - x) - (-2x^2 + 6x)$

6. $(2y^2 + 6y - 10) - (4y^2 - 8y - 3)$

T^2 **To Try** - Simplify each of the following polynomials by combining like terms.

a. $(7x^3 + 9x^2 - 3) + (5x^3 - 2x^2 + 1)$

b. $(-6y^2 + 12y - 4) + (3y^2 - 2y - 8)$

c. $(-10x^3 + 3x^2 - 7) + (5x^2 - x)$

d. $(7x + 6) - (2x + 4)$

e. $(4x^2 - x) - (-x^2 + 2x)$

f. $(14y^2 + 3y - 4) - (9y^2 - 6y - 7)$

We will now be using the rules of exponents to multiply polynomials. When multiplying a monomial times a polynomial, remember to use the distributive property and simplify when possible.

Let's look at some examples:

1. $3x(6x-2) = 3x(6x) + 3x(-2) =$ ____________________

You may instead choose to do the distributive work in your head and move directly to the answer.

2. $-2x^2(5x^2+3x-4) =$ ____________________

3. $ab(6a^2b+2ab-15) =$ ____________________

T^2 To Try - Use the distributive property to multiply the following polynomials.

a. $5x(3x-7)$

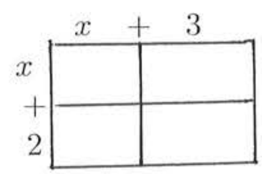
b. $-2y(3y-12)$

c. $-3a(6a^2+5a-9)$

d. $xy(4xy^2+2x^2y-9)$

When multiplying two binomials, you can use the distributive property, the FOIL method, or the BOX method. You may not recall the first method you were taught, or you may want to see all the methods to determine which is easiest for you.

Let's look at all the methods together:

Distributive Property	F O I L Method	B O X Method
$(x+3)(x+2)$	$(x+3)(x+2)$	$(x+3)(x+2)$
$x(x+2)+3(x+2)$	F O I L	
= ____________	____ ____ ____ ____	
= ____________	= ____________	= ____________

Now try the method you prefer.

1. $(x-4)(x-5)$

2. $(x-7)(x+2)$

Another type of multiplication with polynomials is a binomial times a trinomial. When multiplying a binomial and a trinomial you can use the distributive property, the vertical method, or the BOX method.

Let's look at these methods together.

Distributive Property	Vertical Method	B O X Method
$(x+2)(x^2+3x-7)$	$(x+2)(x^2+3x-7)$	$(x+2)(x^2+3x-7)$
$x(x^2+3x-7)+2(x^2+3x-7)$	x^2+3x-7 $\times \quad x+2$	$x^2 \quad + \quad 3x \quad - \quad 7$ x $+$ 2
= ____________________		
= ____________________	= __________________	= __________________

Now try the method you prefer.

1. $(x+4)(x^2+3x-5)$

2. $(x-3)(x^2+8x+2)$

T² **To Try** - Multiply the following polynomials by the method of your choice.

a. $(x+9)(x+3)$

b. $(4y-3)(3y-5)$

c. $(3x+2)(2x-5)$

d. $(2x-3)(5x+4)$

e. $(3x+5)(3x-5)$

f. $(2y+5)^2$

g. $(x-2)(x^2+5x+6)$

h. $(5x+4)(x^2-x+4)$

P^2 - III Practice Plus

Simplify each of the following expressions. Write each answer using positive exponents only.

1. $m^7 \cdot m^8$

2. $3x^2 \cdot 5x^{10}$

3. $x^{10} \cdot x^3 \cdot x$

4. $(-7)^0$

5. -14^0

6. $25x^0$

7. $\dfrac{y^{16}}{y^7}$

8. $\dfrac{24x^{10}}{8x^6}$

9. $\dfrac{6x^5}{18x^4}$

10. 8^{-2}

11. $\left(\frac{2}{7}\right)^{-2}$

12. $\frac{x^{-9}}{x^4}$

13. $(y^3)^{10}$

14. $(5y)^3$

15. $(x^7y^4)^{-3}$

16. $\left(\frac{4x^{-5}}{x^4}\right)^3$

Simplify each of the following polynomials by combining like terms.

17. $(8x^3 + 4x^2 - 3) + (2x^3 - 2x^2 + 9)$

18. $(-12x^3 + 4x^2 - 3) + (5x^2 - x)$

19. $(6x^2 - x) - (-2x^2 + 5x)$

20. $(8y^2 + 6y - 4) - (5y^2 - 4y - 8)$

Use the distributive property to multiply the following polynomials.

21. $2x(3x - 7)$

22. $-4a(6a^2 + 3a - 4)$

Multiply the following polynomials by the method of your choice.

23. $(x+7)(x+6)$

24. $(2y-4)(3y-5)$

25. $(2x+1)(3x-5)$

26. $(4x-3)(3x+7)$

27. $(x+2)(x-2)$

28. $(4x+7)(4x-7)$

29. $(y+8)^2$

30. $(2x+9)^2$

31. $(x-3)(x^2+6x+7)$

32. $(4x+5)(2x^2-x+3)$

M^2 - IV Math Module IV - Factoring

Factoring is the reverse of multiplying. To review the many types of factoring, let's look at the following chart.

Greatest Common Factor	$3x^2 + 18x$	$7x^4 - 21x^3 + 28x^2$
Factor by Grouping	$x^3 + 4x^2 + 3x + 12$	$ab - 3a - 5b + 15$
Trinomials $x^2 + bx + c$	$x^2 + 7x + 6$	$x^2 - 2x - 15$
Trinomials $ax^2 + bx + c$	$9x^2 - 18x + 5$	$5x^2 - 18x - 8$
Special Products	$a^2 + 16$	$4x^2 + 49y^2$
	$9x^2 - 25$	$100 - y^2$
	$x^4 - 16$	$x^4 - 81$
	$a^3 + 27$	$8x^3 - 125$

Becoming proficient with factoring takes lots of time and practice. You may need to just review and refresh, or you may need to dedicate a good amount of time to mastering this skill. If you are struggling with the procedures and there are answers listed, you can always multiply the polynomials together to find the correct factored form.

$\boxed{T^2}$ **To Try** - Completely factor each polynomial.

a. $5x + 45$

b. $x^2 + 2x - 24$

c. $3x^2 + 14x + 8$

d. $x^2 + 25$

e. $10x^3 + 15x^2$

f. $x^2 + 5x + 6$

g. $2x^2 + 7x + 3$

h. $x^3 - 64$

i. $x^2 - 12x + 36$

j. $xy + 6y + 2x + 12$

k. $2x^2 + 16x + 30$

l. $4x^2 - 23x + 15$

m. $y^2 - 64$

n. $x^2 - 5x - 24$

o. $3x^2 - 27$

p. $16x^2 + 8x - 6$

q. $x^3 - 2x^2 + 7x - 14$

r. $4x^2 - 16x + 12$

s. $x^3 + 125$

t. $3x^2 + 8x - 16$

Now that we have reviewed factoring, let's move to solving equations by factoring.

The following are polynomial equations in standard form because one side of each equation is zero:

$x^3 + 5x^2 - x - 5 = 0$ $x^2 - 5x - 36 = 0$ $3.2x + 6.4 = 0$

A <u>quadratic equation</u> is a polynomial equation with a <u>degree of 2</u>. The degree of 2 tells us the equation can have at most 2 solutions but may have 1 solution, or no solution. The <u>zero factor property</u> can be used to solve quadratic equations that are factorable.

To check with a graphing calculator, place the equation in the $y =$ screen and graph. The graph will show x-intercept(s) or solution(s).

Let's look at a few quadratic equations and their solutions.

Example: $4x^2 - 8x = 0$ (standard form, set = to zero)
$4x(x-2) = 0$ (factored form)
$4x = 0$ $x - 2 = 0$ (set factors = to zero)
$x = 0$ $x = 2$ (solutions)

1. $5x^2 + 19x - 4 = 0$ (standard form, set = to zero)
$(5x-1)(x+4) = 0$(factored form)

__________ __________ (set factors = to zero)

__________ __________ (solutions)

2. $x^2 - 6x + 9 = 0$ (standard form, set = to zero)
$(x-3)(x-3) = 0$ (factored form)

__________ __________ (set factors = to zero)

__________ __________ (solutions)

For an equations like $x^3 + 4x^2 - x - 4 = 0$, we will look for a possible 3 solutions because the degree of the equations is 3.

3. $x^3 + 4x^2 - x - 4 = 0$ (standard form, set = to zero)
$(x+1)(x-1)(x+4) = 0$ (factored form)

__________ __________ __________ (set factors = to zero)

__________ __________ __________ (solutions)

T^2 To Try - Solve the following quadratic equations.

a. $x^2 - 5x - 36 = 0$

b. $x^2 - 8x + 16 = 0$

c. $5x^2 + 15x = 0$

d. $x^2 - 3x - 40 = 0$

e. $4x^2 + 9x + 2 = 0$

f. $x^3 + 7x^2 - x - 7 = 0$

P² - IV Practice Plus

Completely factor each polynomial.

1. $4x + 28$

2. $y^2 - 81$

3. $x^2 + 3x - 18$

4. $x^3 + 8$

5. $3x^2 + 16x - 12$

6. $4x^2 + 24x + 32$

7. $x^3 - 3x^2 + 6x - 18$

8. $3x^2 + 7x + 2$

9. $x^2 - 14x + 49$

10. $x^2 + 16$

11. $8x^3 + 12x^2$

12. $5x^2 - 20x + 15$

13. $2x^2 - 50$

14. $4x^2 + 11x + 6$

15. $x^2 + 9x + 14$

16. $15x^2 - 3x + 9$

17. $x^2 - 6x - 7$

18. $5x^2 - 23x + 12$

19. $x^3 - 125$

20. $xy + 5y + 2x + 10$

Solve the following quadratic equations.

21. $x^2 - 12x + 27 = 0$

22. $x^2 + 3x - 54 = 0$

23. $2x^2 - 11x + 12 = 0$

24. $5x^2 - 14x - 3 = 0$

M² - V Math Module V - Rational Expressions and Rational Equations

Rational Expressions

When asked to find the domain of a rational expression, remember that when any denominator is 0, it is **undefined**.

Let's find the domain for each of the following rational expressions.

1. $f(x) = \dfrac{4x^2 + 11x + 6}{-4}$ 2. $g(x) = \dfrac{5x^2 - 2}{3x}$ 3. $h(x) = \dfrac{3x - 5}{x^2 - 3x + 2}$

Domain: ______________ Domain: ______________ Domain: ______________

T² To Try - Find the domain for each of the following rational expressions.

a. $f(x) = \dfrac{3x^2 + 2x + 5}{6}$ b. $g(x) = \dfrac{9x^2 + 1}{7x}$ c. $h(x) = \dfrac{5x - 2}{x^2 + 3x - 18}$

Domain: ______________ Domain: ______________ Domain: ______________

Now let's look at simplifying rational expressions. When simplifying rational expressions, it is important to be proficient with factoring.

Simplify the following rational expressions.

1. $\dfrac{6y - 18}{7y - 21}$ 2. $\dfrac{x^2 - 16}{x - 4}$

3. $\dfrac{x^2 + 11x + 28}{x + 4}$ 4. $\dfrac{x^2 + 7x - 18}{x^2 - 3x + 2}$

T^2 To Try - Simplify the following rational expressions.

a. $\dfrac{5y-20}{8y-32}$

b. $\dfrac{x^2-49}{x-7}$

c. $\dfrac{x^2+9x+20}{x+5}$

d. $\dfrac{x^2-4x-5}{x^2+5x+4}$

Multiply or divide the following rational expressions. Make sure all answers are simplified.

1. $\dfrac{x+3}{x-3} \cdot \dfrac{4x-12}{9x+27}$

2. $\dfrac{x-2}{x+8} \cdot \dfrac{x^2+5x-24}{x^2-2x}$

3. $\dfrac{x^2+13x+40}{x^2+11x+24} \cdot \dfrac{x^2-9}{x^2-25}$

4. $\dfrac{2x}{5} \div \dfrac{4x+12}{5x+15}$

5. $\dfrac{x^2-10x+21}{x^2-9} \div \dfrac{x^2-3x-28}{5x^2+17x+6}$

T² To Try - Multiply or divide the following rational expressions. Make sure all answers are simplified.

a. $\frac{x+6}{x-6} \cdot \frac{2x-12}{5x+30}$

b. $\frac{x-4}{x+7} \cdot \frac{x^2+5x-14}{x^2-4x}$

c. $\frac{x^2+12x+32}{x^2+6x+8} \cdot \frac{x^2-4}{x^2-64}$

d. $\frac{3x}{7} \div \frac{9x+18}{7x+14}$

e. $\frac{x^2-15x+54}{x^2-36} \div \frac{x^2-11x+18}{2x^2+15x+18}$

Next we will find function values for rational expressions.

1. If $f(x) = \frac{x+7}{2x-3}$,

find : $f(2)$ $f(0)$ $f(-3)$

T² To Try - Find the following function values using the give rational expression.

a. If $g(x) = \frac{x^2+3}{x-5}$,

find : $g(2)$ $g(0)$ $g(-3)$

When adding or subtracting rational expressions, you must first fin the least common denominator (LCD). First let's practice finding the LCD for each of the following fractions.

1. $\frac{1}{4}, \frac{3}{7}$

2. $\frac{1}{9}, \frac{2}{3}, \frac{1}{5}$

3. $\frac{2}{7}, \frac{3}{5x}$

4. $\frac{2}{5x^2y}, \frac{9}{2xy^3}$

5. $\frac{8}{z+1}, \frac{z}{z-1}$

6. $\frac{x}{x^2-9}, \frac{5}{x+3}$

Now let's add or subtract the following fractions and rational expressions. Remember to find an LCD if necessary.

1. $\frac{x}{x-7} + \frac{3}{x-7}$

2. $\frac{x^2}{x+9} - \frac{81}{x+9}$

3. $\frac{4}{5x} + \frac{2}{3x}$

4. $\frac{7}{4y^2} - \frac{5}{3y}$

5. $\frac{5}{6x-6} + \frac{2}{5x-5}$

6. $\frac{9x}{x^2-4} - \frac{2}{x+2}$

$\boxed{T^2}$ To Try - Add or subtract the following fractions and rational expressions. Remember to find an LCD if necessary.

a. $\dfrac{x}{x-5} + \dfrac{1}{x-5}$

b. $\dfrac{x^2}{x+10} - \dfrac{100}{x+10}$

c. $\dfrac{5}{8x} + \dfrac{3}{5x}$

d. $\dfrac{3}{4y^2} - \dfrac{4}{3y}$

e. $\dfrac{7}{5x-10} + \dfrac{3}{2x-4}$

f. $\dfrac{8x}{x^2-9} - \dfrac{3}{x+3}$

Rational Equations

To solve a rational equation it is easiest to first clear the fractions from the equation. This is done by multiplying both sides of the equation by the LCD. Each side of the equation will then need to be simplified to determine which type of equation you are solving. The solution(s) you find should always be checked or verified to make sure they do in fact satisfy the original equation.

Let's look at a few rational equations and solve them.

1. $\dfrac{x}{2} - \dfrac{3}{4} = \dfrac{6x}{8}$

2. $\dfrac{3}{x} + \dfrac{1}{5} = \dfrac{1}{2}$

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

4. $\dfrac{7x-4}{5x} = \dfrac{9}{5} - \dfrac{4}{x}$

5. $\frac{1}{x-2} = \frac{3}{x+2}$

6. $\frac{5}{x+6} = \frac{3}{x-6}$

T^2 To Try - Solve the following rational equations.

a. $\frac{x}{5} - \frac{1}{2} = \frac{x}{6}$

b. $\frac{3}{x} + \frac{1}{3} = \frac{5}{x}$

c. $\frac{4}{x-3} = \frac{2}{x+3}$

d. $\frac{7}{x+6} = \frac{3}{x-6}$

P^2 - V Practice Plus

Find the domain for each of the following rational expressions.

1. $f(x) = \dfrac{5x-7}{4}$

Domain: ________________

2. $g(x) = \dfrac{3x^2+2}{5x}$

Domain: ________________

Simplify the following rational expressions.

3. $\dfrac{5y-45}{7y-63}$

4. $\dfrac{x^2-49}{x-7}$

5. $\dfrac{x^2+6x-40}{x+10}$

6. $\dfrac{2x^2-7x-4}{x^2-5x+4}$

Multiply or divide the following rational expressions. Make sure all answers are simplified.

7. $\dfrac{x+8}{x-8} \cdot \dfrac{3x-24}{5x+40}$

8. $\dfrac{x-6}{x+7} \cdot \dfrac{x^2+4x-21}{x^2-6x}$

9. $\dfrac{5x}{8} \div \dfrac{5x+10}{8x+16}$

10. $\dfrac{x^2-6x+9}{x^2-x-6} \div \dfrac{x^2-9}{4}$

Find the following function values using the give rational expression.

11. If $f(x) = \dfrac{x+8}{2x-1}$,

find : $f(2)$ $\quad$ $f(0)$ $\quad$ $f(-1)$

Add or subtract the following rational expressions. Remember to find an LCD if necessary.

12. $\dfrac{x}{x-9} + \dfrac{4}{x-9}$

13. $\dfrac{x^2}{x+5} - \dfrac{25}{x+5}$

14. $\dfrac{10}{7x} + \dfrac{5}{2x}$

15. $\dfrac{3}{2y^2} - \dfrac{2}{7y}$

16. $\dfrac{3}{2x+10} + \dfrac{8}{3x+15}$

Solve the following rational equations.

17. $\dfrac{2}{x} + \dfrac{1}{2} = \dfrac{5}{x}$

18. $\dfrac{x}{2} - \dfrac{x}{3} = 12$

19. $\dfrac{6}{x+3} = \dfrac{4}{x-4}$

20. $\dfrac{8}{x+2} = \dfrac{6}{x+4}$

M^2 - VI Math Module VI - Rational Exponents and Radicals

Knowing your squares and cubes along with their roots will be helpful as you work with radicals. Fill in the following charts to help refresh your memory.

Squares	Cubes
$1^2 = 1$	$1^3 = 1$
$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 =$
$4^2 =$	$4^3 =$
$5^2 =$	$5^3 =$
$6^2 =$	
$7^2 =$	
$8^2 =$	
$9^2 =$	
$10^2 =$	
$11^2 =$	
$12^2 =$	
$13^2 =$	
$14^2 =$	
$15^2 =$	

Square Roots	Cube Roots
$\sqrt{1} = 1$	$\sqrt[3]{1} = 1$
$\sqrt{4} = 2$	$\sqrt[3]{8} = 2$
$\sqrt{9} =$	$\sqrt[3]{27} =$
$\sqrt{16} =$	$\sqrt[3]{64} =$
$\sqrt{25} =$	$\sqrt[3]{125} =$
$\sqrt{36} =$	
$\sqrt{49} =$	
$\sqrt{64} =$	
$\sqrt{81} =$	
$\sqrt{100} =$	
$\sqrt{121} =$	
$\sqrt{144} =$	
$\sqrt{169} =$	
$\sqrt{196} =$	
$\sqrt{225} =$	

Simplify the following square roots. Assume that all variables represent positive numbers.

1. $\sqrt{64}$

2. $\sqrt{\dfrac{0}{8}}$

3. $\sqrt{\dfrac{25}{49}}$

4 $\sqrt{0.16}$

5. $\sqrt{x^{10}}$

6. $\sqrt{4x^4}$

7. $-\sqrt{81}$

8. $\sqrt{-36}$

T^2 To Try - Simplify. Assume that all variables represent positive numbers.

a. $\sqrt{49}$

b. $\sqrt{\dfrac{0}{1}}$

c. $\sqrt{\dfrac{16}{81}}$

d $\sqrt{0.25}$ e. $\sqrt{x^8}$ f. $\sqrt{9x^6}$

g. $-\sqrt{4}$ h. $\sqrt{-64}$

Now let's find each of the following cube roots.

1. $\sqrt[3]{-8}$
2. $\sqrt[3]{1}$
3. $\sqrt[3]{\frac{64}{27}}$
4. $\sqrt[3]{x^{15}}$
5. $\sqrt[3]{-125x^3}$

$\boxed{T^2}$ To Try - Simplify each cube root.

a. $\sqrt[3]{-1}$ b. $\sqrt[3]{27}$ c. $\sqrt[3]{\frac{8}{125}}$

d. $\sqrt[3]{x^{12}}$ e. $\sqrt[3]{64x^9}$

Simplify each of the following expressions. Assume that all variables represent positive numbers.

1. $\sqrt[4]{81}$
2. $\sqrt[5]{-32}$
3. $-\sqrt{25}$
4. $\sqrt[4]{-16}$
5. $\sqrt[3]{27x^{21}}$
6. $\sqrt{(-3)^2}$

$\boxed{T^2}$ **To Try** - Simplify each of the following expressions. Assume that all variables represent positive numbers.

a. $\sqrt[4]{256}$

b. $\sqrt[5]{-243}$

c. $-\sqrt{49}$

d. $\sqrt[4]{-36}$

e. $\sqrt[3]{64x^{15}}$

f. $\sqrt{(-10)^2}$

Now let's look at function values involving radicals.

If $f(x) = \sqrt{x-4}$, find each function value.

1. $f(8)$

2. $f(-5)$

3. $f(4)$

4. $f(5)$

$\boxed{T^2}$ **To Try** - Find the following function values for $f(x) = \sqrt{2x+3}$

a. $f(3)$

b. $f(2)$

c. $f(-1)$

d. $f(-3)$

When working with rational exponents, let's recall a few definitions:

$a^{\frac{1}{n}} =$ ______________ as long as n is a positive integer and $\sqrt[n]{a}$ is a real number.

$a^{\frac{m}{n}} =$ ______________ as long as m and n are positive integers greater than 1 and $\sqrt[n]{a}$ is a real number.

$a^{-\frac{m}{n}} =$ ______________ as long as $a^{\frac{m}{n}}$ is a nonzero real number.

For all other exponent rules, refer back to M^2 - III on page 24 in this booklet.

Now let's try a few problems together. Use radical notation to write each expression. Simplify the result if possible.

1. $49^{\frac{1}{2}}$ 2. $27^{\frac{1}{3}}$ 3. $(-32)^{\frac{1}{5}}$

4. $-16^{\frac{1}{4}}$ 5. $2x^{\frac{1}{3}}$ 6. $\left(\frac{1}{16}\right)^{\frac{1}{4}}$

T² **To Try** - Use radical notation to write each expression. Simplify the result if possible.

a. $64^{\frac{1}{3}}$ b. $81^{\frac{1}{4}}$ c. $(-8)^{\frac{4}{3}}$

d. $-9^{\frac{3}{2}}$ e. $5x^{\frac{1}{3}}$ f. $\left(\frac{1}{4}\right)^{\frac{1}{2}}$

When simplifying radical expressions, you will be working with the following rules:

Product Rule for Radicals

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers, then $\sqrt[n]{a} \cdot \sqrt[n]{b} =$ ____________________

Quotient Rule for Radicals

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers and $\sqrt[n]{b}$ is not zero, then $\sqrt[n]{\frac{a}{b}} =$ ____________

Let's try a few examples. Use the product rule or quotient rule as needed to simplify.

1. $\sqrt{5} \cdot \sqrt{3}$ 2. $\sqrt[3]{4} \cdot \sqrt[3]{9}$ 3. $\sqrt[3]{\frac{3}{64}}$

4. $\sqrt{40}$

5. $3\sqrt{75}$

6. $\dfrac{\sqrt{x^5y^3}}{\sqrt{xy}}$

7. $-\sqrt{32a^9b^6}$

8. $\sqrt[3]{16y^{11}}$

9. $\dfrac{\sqrt{20}}{\sqrt{5}}$

$\boxed{T^2}$ **To Try** - Use the product rule or quotient rule as needed to simplify.

a. $\sqrt{7} \cdot \sqrt{2}$

b. $\sqrt[3]{10} \cdot \sqrt[3]{5}$

c. $\sqrt{\dfrac{6}{49}}$

d. $\sqrt{32}$

e. $3\sqrt{8}$

f. $\dfrac{\sqrt{x^7y^6}}{\sqrt{x^3y^2}}$

g. $-\sqrt{20ab^6}$

h. $\sqrt[3]{40y^{10}}$

i. $\dfrac{\sqrt{45}}{\sqrt{9}}$

Now we will review adding, subtracting, and multiplying radical expressions. Remember we can add and subtract radical expressions only if they are like radicals. Like radicals are radicals with the same _______________ and the same _______________.

Some examples or like radicals are:

$4\sqrt{11}$ and $8\sqrt{11}$ $\qquad$ $5\sqrt[3]{3x}$ and $7\sqrt[3]{3x}$

Let's try a few examples together. Add or subtract as indicated.

1. $3\sqrt{5} + 9\sqrt{5}$

2. $-\sqrt{75} + \sqrt{12} - 3\sqrt{3}$

3. $\sqrt{9b^3} - \sqrt{25b^3} + \sqrt{49b^3}$

4. $7\sqrt{25} - 8 + \sqrt{2}$

5. $5y\sqrt{8y} + 2\sqrt{50y^3}$

6. $3\sqrt{50} - 3\sqrt{125} + \sqrt{98}$

T^2 **To Try** - Add or subtract as indicated.

a. $3\sqrt{17} + 5\sqrt{17}$

b. $\sqrt{8} - \sqrt{32}$

c. $\sqrt{75x} - 3\sqrt{27x} + \sqrt{12x}$

d. $\sqrt{24} - 7 + 3\sqrt{54}$

e. $2y\sqrt{12y} + 7\sqrt{75y^3}$

f. $2\sqrt{48} - 2\sqrt{32} + \sqrt{27}$

Multiply the following radical expressions and then simplify.

1. $\sqrt{3}\left(\sqrt{5} + \sqrt{7}\right)$

2. $\left(\sqrt{7} - \sqrt{2}\right)^2$

3. $5\left(\sqrt{3}-3\right)$

4. $\left(3-\sqrt{2}\right)\left(5-2\sqrt{2}\right)$

T^2 **To Try** - Multiply the following radical expressions and then simplify.

a. $\sqrt{7}\left(\sqrt{5}+\sqrt{3}\right)$

b. $\left(\sqrt{5}-\sqrt{3}\right)^2$

c. $6\left(\sqrt{2}-2\right)$

d. $\left(7-\sqrt{3}\right)\left(2-2\sqrt{3}\right)$

Rationalizing denominators of radical expressions will mean writing an equivalent expression without ____.

Rationalize the denominator of each of the following expressions.

1. $\dfrac{7}{\sqrt{3}}$

2. $\dfrac{\sqrt{2}}{\sqrt{5}}$

3. $\sqrt{\dfrac{3x}{5y}}$

4. $\sqrt[3]{\dfrac{3}{5}}$

5. $\dfrac{6}{2-\sqrt{7}}$

6. $\dfrac{\sqrt{3}-\sqrt{5}}{\sqrt{3}+\sqrt{5}}$

$\boxed{T^2}$ **To Try** - Rationalize the denominator of each of the following expressions.

a. $\dfrac{2}{\sqrt{5}}$

b. $\dfrac{\sqrt{3}}{\sqrt{2}}$

c. $\sqrt{\dfrac{13x}{2y}}$

d. $\sqrt[3]{\dfrac{7}{10}}$

e. $\dfrac{3}{\sqrt{7}-4}$

f. $\dfrac{\sqrt{2}-\sqrt{3}}{\sqrt{2}+\sqrt{3}}$

Next we will look at solving radical equations. The steps for solving a radical equation are:

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

Use these steps to solve the following radical equations.

1. $\sqrt{x-3}=2$

2. $\sqrt{x-3}-1=0$

3. $\sqrt[3]{x-2}-3=0$

4. $\sqrt{3y+6}=\sqrt{7y-6}$

T^2 To Try - Solve the following radical equations.

a. $\sqrt{x+1}=5$

b. $\sqrt{4x-3}-5=0$

c. $\sqrt[3]{2x-6}-4=0$

d. $\sqrt{x+4}=\sqrt{2x-5}$

P^2 - VI Practice Plus

Simplify the following expressions.

1. $-\sqrt{36}$

2. $\sqrt{(-49)^2}$

Find the following cube root.

3. $\sqrt[3]{\dfrac{64}{125}}$

Simplify. Assume that all variables represent positive real numbers.

4. $\sqrt{25x^4y^8}$

For problems #5 - 6, find the following function values.

5. $f(x) = \sqrt{2x-1}$; find: $f(5)$

6. $g(x) = \sqrt[3]{x-27}$; find: $g(0)$

Function value for $f(5)$: _________

Function value for g(0): _________

Use radical notation to rewrite the following expression. Simplify if possible.

7. $(-64)^{\frac{2}{3}}$

Use the product rule to multiply.

8. $\sqrt{3} \cdot \sqrt{5}$

Use the quotient rule to simplify.

9. $\sqrt{\frac{7}{81}}$

For problems #10 - 11, simplify. Assume all variables represent positive real numbers.

10. $\sqrt{27}$

11. $\sqrt[3]{32x^3y^2}$

Add as indicated. You will first need to simplify terms to identify the like radicals.

12. $\sqrt{20} + \sqrt{45}$

Multiply and simplify.

13. $\left(3 - \sqrt{2}\right)\left(5 - 2\sqrt{2}\right)$

For problems #14 - 15, rationalize each denominator. Simplify if possible.

14. $\frac{3\sqrt{2}}{\sqrt{7}}$

15. $\frac{7}{\sqrt{5} - 1}$

Solve and check the following radical equation.

16. $\sqrt{5x - 4} - 1 = 3$

M^2 - VII Math Module VII - Complex Numbers

The Imaginary Unit

The imaginary unit, written i, ____.

$i^2 = -1$ and i=$\sqrt{-1}$

Write the following in i notation.

1. $\sqrt{-9}$ 2. $\sqrt{-3}$ 3. $-\sqrt{-24}$

T^2 **To Try** - Write the following in i notation.

a. $\sqrt{-64}$ b. $\sqrt{-15}$ c. $-\sqrt{-12}$

Complex Numbers

A complex number is a number that can be written in the form ____________________

____

Complex numbers can be added or subtracted by adding or subtracting their real parts and then adding or subtracting their imaginary parts. Let's write a rule for the sum or difference of complex numbers:

If $a + bi$ and $c + di$ are complex numbers,

their sum is ____

their difference is ____________________________________

Let's add or subtract the following complex numbers. Remember the sum or difference must be written in $a + bi$ form.

1. $(2 - 6i) + (-3 + i)$ 2. $3i - (2 - i)$

3. $(-8 - 4i) - (-6)$

$\boxed{T^2}$ **To Try** - Add or subtract the complex numbers. Write the sum or difference in the form $a + bi$.

a. $(3 - 5i) + (-6 + i)$

b. $4i - (3 - i)$

c. $(-5 - 2i) - (-8)$

Now let's multiply complex numbers. We will write the product in the form $a + bi$, remembering that $i^2 = -1$.

1. $-2i \cdot 5i$

2. $7i(6 - i)$

3. $(5 - 2i)(3 + i)$

4. $(9 - i)^2$

5. $(6 + 2i)(6 - 2i)$

$\boxed{T^2}$ **To Try** - Multiply the complex numbers. Write the product in the form $a + bi$.

a. $-7i \cdot 3i$

b. $3i(2 - i)$

c. $(2 - 5i)(4 + i)$

d. $(2 - i)^2$

e. $(7 + 3i)(7 - 3i)$

When dividing complex numbers, we will work with complex conjugates.

The complex numbers $(a+bi)$ and $(a-bi)$ are called ______________ ______________ and $(a+bi)(a-bi) =$ ________________.

Let's try some examples. Remember to write the quotient in the form $a+bi$.

1. $\dfrac{2}{3+i}$

2. $\dfrac{4-i}{3+i}$

T² **To Try** - Divide the complex numbers. Write the quotient in the form $a+bi$.

a. $\dfrac{5}{4-i}$

b. $\dfrac{6-i}{2+i}$

Powers of i have a pattern that is helpful to know:

$i^1 =$ _____ $i^5 =$ _____

$i^2 =$ _____ $i^6 =$ _____

$i^3 =$ _____ $i^7 =$ _____

$i^4 =$ _____ $i^8 =$ _____

Now let's find the following powers of i using the pattern above.

1. i^{11}

2. i^{20}

3. i^{14}

4. i^{49}

T² **To Try** - Find the following powers of i.

a. i^{13}

b. i^{23}

c. i^{16}

d. i^{34}

P^2 - VII Practice Plus

Write the following in i notation.

1. $\sqrt{-25}$

2. $\sqrt{-11}$

3. $-\sqrt{-18}$

Add or subtract the complex numbers. Write the sum or difference in the form $a + bi$.

4. $(4 - 2i) + (-9 + i)$

5. $5i - (4 - i)$

6. $(-6 - 3i) - (-9)$

Multiply the complex numbers. Write the product in the form $a + bi$.

7. $8i(3 - i)$

8. $(3 - 5i)(2 + i)$

9. $(4 - i)^2$

10. $(5 + 2i)(5 - 2i)$

Divide the complex numbers. Write the quotient in the form $a + bi$.

11. $\dfrac{7}{3 - i}$

12. $\dfrac{2 + i}{1 - i}$

Find the following powers of i.

13. i^9

14. i^{46}

M^2 - VIII Math Module VIII - Quadratic Equations

In M^2- IV we solved quadratic equations by factoring using the zero factor theorem. Recall that a quadratic equation is an equation written in the form $ax^2 + bx + c = 0$. We will now look at other methods of solving quadratic equations.

The first method we will look at called the square root property. Let's solve a few examples together.

1. $x^2 = 49$

2. $x^2 - 7 = 0$

3. $x^2 = 72$

4. $3x^2 - 18 = 0$

5. $(x+7)^2 = 32$

6. $(x-5)^2 = -16$

T^2 To Try - Use the square root property to solve each equation.

a. $x^2 = 25$

b. $x^2 - 3 = 0$

c. $x^2 = 18$

d. $3x^2 - 30 = 0$

e. $(x+4)^2 = 27$

f. $(x-2)^2 = -9$

Another method of solving quadratic equations is called completing the square. Let's list the steps for solving a quadratic equation by completing the square.

1. ______________________________

2. ______________________________

3. ______________________________

____

4. ______________________________

5. ______________________________

Now let's try solving the following quadratic equations by completing the square.

1. $x^2 + 8x = -15$

2. $x^2 + 6x + 2 = 0$

3. $x^2 - 6x + 3 = 0$

4. $x^2 + 8x + 1 = 0$

T^2 **To Try** - Solve each equation by completing the square.

a. $x^2 + 6x = -8$

b. $x^2 + 2x - 5 = 0$

c. $x^2 - 10x + 2 = 0$

d. $x^2 + 4x - 3 = 0$

Quadratic Formula

A third method for solving quadratic equations is to use the quadratic formula.

A quadratic equation written in the form ______________________ has the solutions

$x =$

Let's try solving a few quadratic equations by using the quadratic formula.

1. $x^2 + 11x - 12 = 0$

2. $x^2 - 5x - 13 = 0$

3. $3x^2 - 7x = 3$

4. $4x^2 - 9x = 2$

T^2 **To Try** - Solve each equation by using the quadratic formula.

a. $x^2 + 5x - 6 = 0$

b. $3x^2 - 5x - 4 = 0$

c. $2x^2 - 3x = 1$

d. $3x^2 - 7x = -1$

In the quadratic formula, the radicand _______________ is known as the discriminant and can be used to determine the number and type of solutions of a quadratic equation of the form $ax^2 + bx + c = 0$.

Let's fill in the following table:

Discriminant	Number and type of solutions
Positive	
Zero	
Negative	

Now let's use the discriminant to determine the number and type of solutions to the following quadratic equations.

1. $3x^2 - 8x + 7 = 0$

Discriminant: ____________________

Number and type of solutions: ____________________

2. $2x^2 - 6x - 9 = 0$

Discriminant: ____________________

Number and type of solutions: ____________________

3. $x^2 - 6x + 9 = 0$

Discriminant: ____________________

Number and type of solutions: ____________________

T^2 **To Try** - Use the discriminant to determine the number and type of solutions to the following quadratic equations.

a. $2x^2 - 7x - 4 = 0$

Discriminant: ____________________

Number and type of solutions: ____________________

b. $9x^2 - 6x + 1 = 0$

Discriminant: ____________________

Number and type of solutions: ____________________

c. $2x^2 - 4x + 3 = 0$

Discriminant: ____________________

Number and type of solutions: ____________________

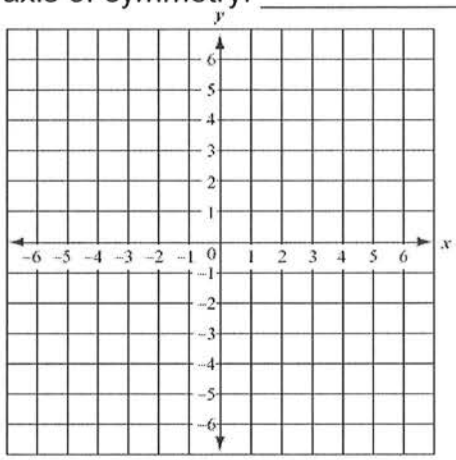
Next we will look at quadratic functions and their graphs.
Find and label the vertex and the axis of symmetry of each quadratic function. Determine whether the graph opens "upward" or "downward", find any intercepts, and sketch the graph.

1. Vertex formula: The graph of $f(x) = ax^2 + bx + c$ is a parabola with vertex $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$
2. Opens upward if ax^2 is positive, opens downward if ax^2 is negative.
3. To find x-intercepts, set function $= 0$ then factor or use the quadratic formula.
4. To find y-intercept, substitute 0 into the function itself.
5. You may use a calculator to check your work.

Let's try a couple of examples together.

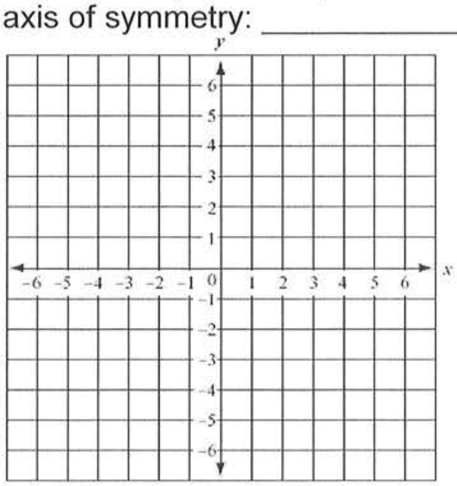
1. $f(x) = x^2 - 2x - 3$

   Vertex: (____ , ____)
   opens "upward" or "downward"?
   x-intercepts: (____ , ____) and (____ , ____)
   y-intercept: (____ , ____)
   axis of symmetry: ________________



2. $f(x) = -x^2 - 4x - 3$

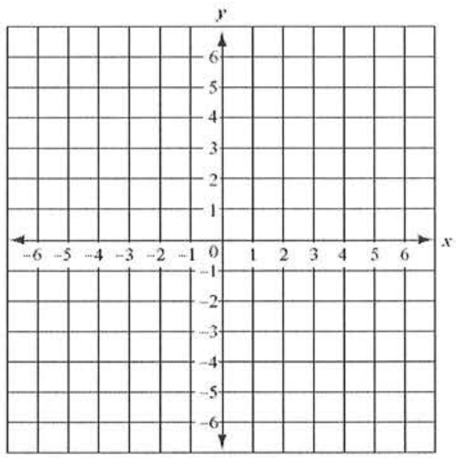
   Vertex: (____ , ____)
   opens "upward" or "downward"?
   x-intercepts: (____ , ____) and (____ , ____)
   y-intercept: (____ , ____)
   axis of symmetry: ________________



T^2 **To Try** - Find and label the vertex and the axis of symmetry of each quadratic function. Determine whether the graph opens "upward" or "downward", find any intercepts, and sketch the graph.

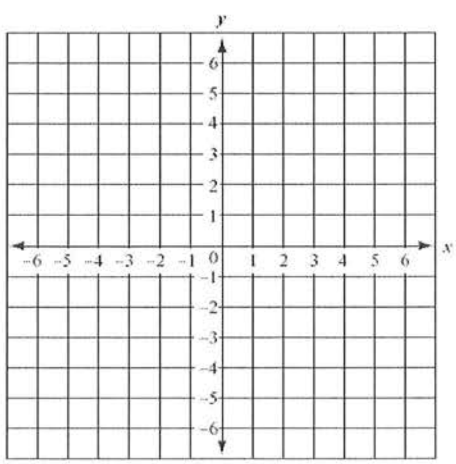
a. $f(x) = x^2 + 2x - 3$

Vertex: (____ , ____)
opens "upward" or "downward"?
x-intercepts: (____ , ____) and (____ , ____)
y-intercept: (____ , ____)
axis of symmetry: ________________



b. $f(x) = -x^2 + 6x - 5$

Vertex: (____ , ____)
opens "upward" or "downward"?
x-intercepts: (____ , ____) and (____ , ____)
y-intercept: (____ , ____)
axis of symmetry: ________________



P^2 - VIII Practice Plus

Use the square root property to solve each equation. If possible, simplify radicals.

1. $x^2 = 64$

2. $x^2 = 45$

3. $x^2 - 5 = 0$

4. $(x-2)^2 = 13$

Solve each quadratic equation by completing the square.

5. $x^2 + 6x = -4$

6. $x^2 + 8x = 5$

Solve each equation using the quadratic formula. Simplify solutions, if possible.

7. $x^2 + 7x + 10 = 0$

8. $2x^2 - 3x - 1 = 0$

Find the discriminant. Then determine the number and type of solutions for the given equation.

9. $9x^2 - 12x + 4 = 0$

a) Discriminant: ____________________

b) Number and type of solutions: ____________________

Find and label the vertex and the axis of symmetry of the quadratic function. Determine whether the graph opens upward or downward, find any intercepts, and sketch the graph.

10. $f(x) = x^2 - 4x + 3$

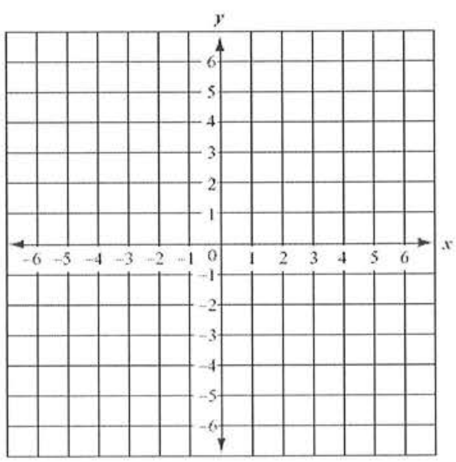
Vertex: (___ , ___)

opens "upward" or "downward"?

x-intercepts: (___ , ___) and (___ , ___)

y-intercept: (___ , ___)

axis of symmetry: ____________________



P² Practice Plus Answer Key

P² - I

Activity table - answers will vary

1. Schedule adjustments - answers will vary.

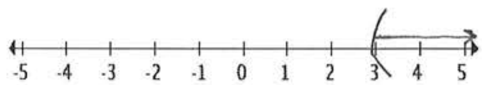
2. Test taking strategies - answers will vary.

3. $x = 2$ 4. $x = 5$ 5. $x = -12$

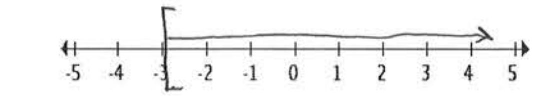
6. $a = -1$ 7. $x = 9$ 8. $x = -5$

9. all real numbers 10. $\emptyset$

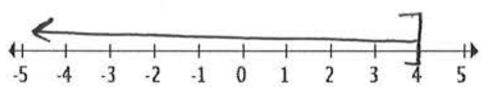
11. $x > 3$, $(3, \infty)$



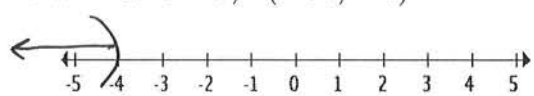
12. $x \geq -3$, $[-3, \infty)$



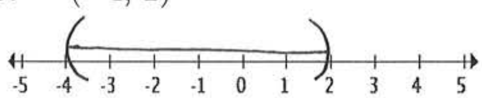
13. $x \leq 4$, $(-\infty, 4]$



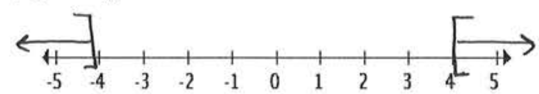
14. $x < -4$, $(-\infty, -4)$



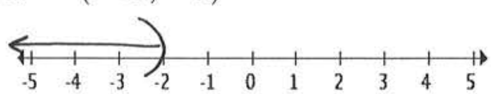
15. $(-4, 2)$



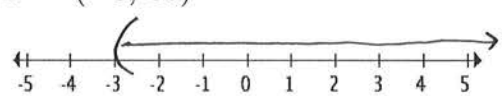
16. $\emptyset$



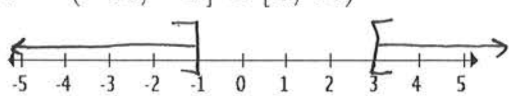
17. $(-\infty, -2)$



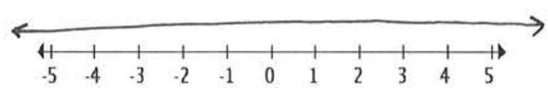
18. $(-3, \infty)$



19. $(-\infty, -1] \cup [3, \infty)$



20. $(-\infty, \infty)$



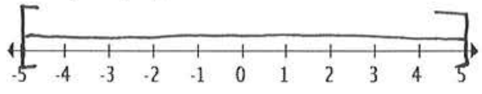
21. $-9, 9$

22. $-4, 11$

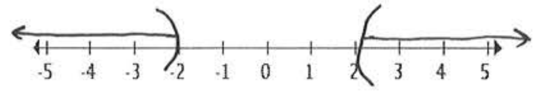
23. $-3, 3$

24. $\emptyset$

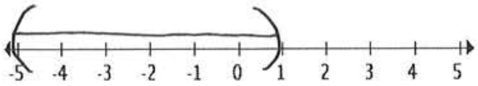
25. $[-5, 5]$



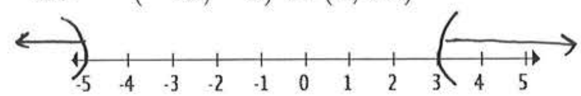
26. $(-\infty, -2) \cup (2, \infty)$



27. $(-5,\ 1)$

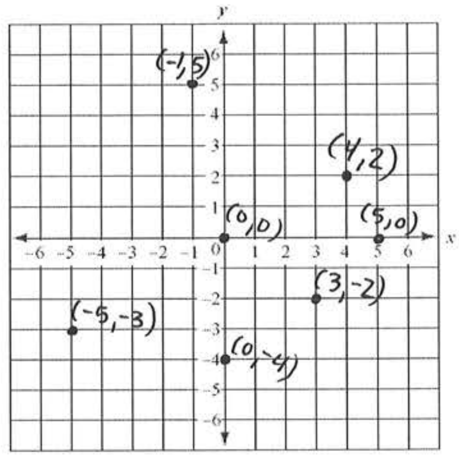


28. $(-\infty,\ -5) \cup (3,\ \infty)$



P^2 - II

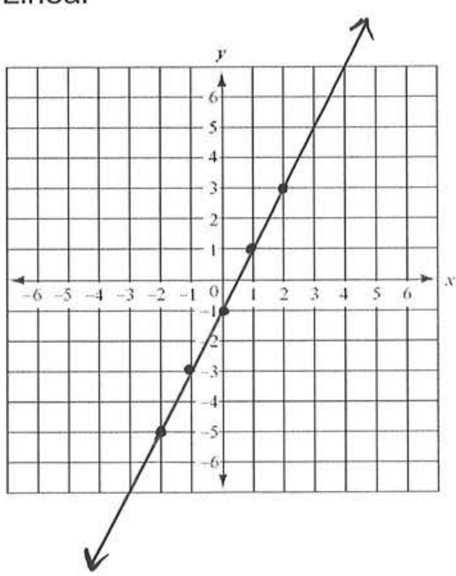
1.



2.

x	y
-2	-5
-1	-3
0	-1
1	1
2	3

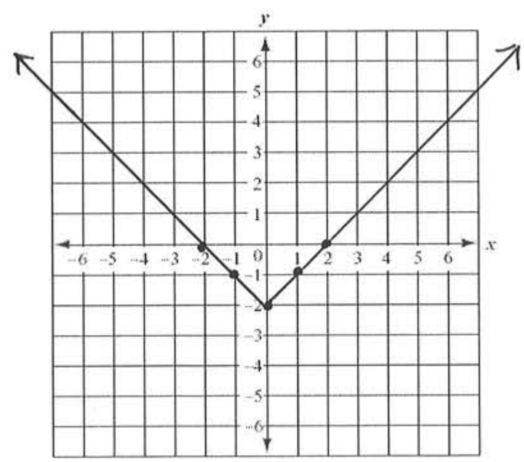
Linear



3.

x	y
-2	0
-1	-1
0	-2
1	-1
2	0

Not Linear



4. Domain: $\{-4, -1, 2, 6\}$ Range: $\{-1, 3, 6\}$ yes, is a function

5. $15, 0$

6. $3, 13$

7. $\frac{3}{5}$

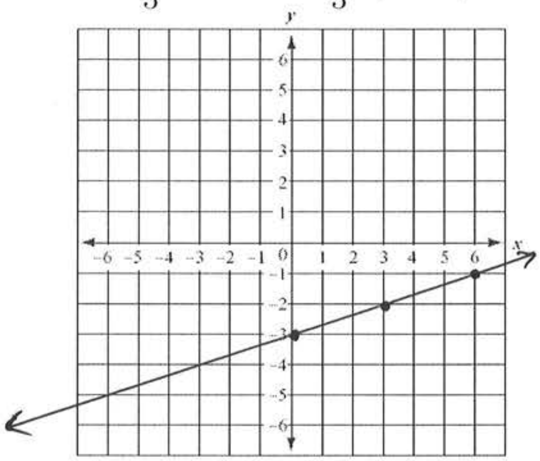
8. $m = 2, (0, -5)$

9. $m = \frac{2}{5}, (0, -2)$

10. parallel ($\parallel$)

11. perpendicular ($\perp$)

12. $y = \frac{1}{3}x - 3, m = \frac{1}{3}, (0, -3)$



13. $y = 5x - 2$

14. $y = -2x + 6$

P² - III

1. m^{15}

2. $15x^{12}$

3. x^{14}

4. 1

5. -1

6. 25

7. y^9

8. $3x^4$

9. $\frac{x}{3}$

10. $\frac{1}{64}$

11. $\frac{49}{4}$

12. $\frac{1}{x^{13}}$

13. y^{30}

14. $125y^3$

15. $\frac{1}{x^{21}y^{12}}$

16. $\frac{64}{x^{27}}$

17. $10x^3 + 2x^2 + 6$

18. $-12x^3 + 9x^2 - x - 3$

19. $8x^2 - 6x$

20. $3y^2 + 10y + 4$

21. $6x^2 - 14x$

22. $-24a^3 - 12a^2 + 16a$

23. $x^2 + 13x + 42$

24. $6y^2 - 22y + 20$

25. $6x^2 - 7x - 5$

26. $12x^2 + 19x - 21$

27. $x^2 - 4$

28. $16x^2 - 49$

29. $y^2 + 16y + 64$

30. $4x^2 + 36x + 81$

31. $x^3 + 3x^2 - 11x - 21$

32. $8x^3 + 6x^2 + 7x + 15$

P^2 - IV

1. $4(x+7)$

2. $(y+9)(y-9)$

3. $(x+6)(x-3)$

4. $(x+2)(x^2-2x+4)$

5. $(3x-2)(x+6)$

6. $4(x+4)(x+2)$

7. $(x^2+6)(x-3)$

8. $(3x+1)(x+2)$

9. $(x-7)^2$

10. prime

11. $4x^2(2x+3)$

12. $5(x-3)(x-1)$

13. $2(x+5)(x-5)$

14. $(4x+3)(x+2)$

15. $(x+7)(x+2)$

16. $3(5x^2-x+3)$

17. $(x-7)(x+1)$

18. $(5x-3)(x-4)$

19. $(x-5)(x^2+5x+25)$

20. $(x+5)(y+2)$

21. $3, 9$

22. $-9, 6$

23. $\frac{3}{2}, 4$

24. $-\frac{1}{5}, 3$

P^2 - V

1. all real numbers

2. $x \neq 0$

3. $\frac{5}{7}$

4. $x+7$

5. $x-4$

6. $\frac{2x+1}{x-1}$

7. $\frac{3}{5}$

8. $\frac{x-3}{x}$

9. x

10. $\frac{4}{(x+2)(x+3)}$

11. $\frac{10}{3}, -8, -\frac{7}{3}$

12. $\frac{x+4}{x-9}$

13. $x-5$

14. $\frac{55}{14x}$

15. $\frac{21-4y}{14y^2}$

16. $\frac{25}{6(x+5)}$

17. $x=6$

18. $x=72$

19. $x=18$

20. $x=22$

P^2 - VI

1. -6

2. 49

3. $\frac{4}{5}$

4. $5x^2y^4$

5. 3

6. -3

7. 16

8. $\sqrt{15}$

9. $\frac{\sqrt{7}}{9}$

10. $3\sqrt{3}$

11. $2x\sqrt[3]{4y^2}$

12. $5\sqrt{5}$

13. $19-11\sqrt{2}$

14. $\frac{3\sqrt{14}}{7}$

15. $\frac{7\sqrt{5}+7}{4}$

16. $x=4$

P^2 - VII

1. $5i$

2. $i\sqrt{11}$

3. $-3i\sqrt{2}$

4. $-5-i$

5. $-4+6i$

6. $3-3i$

7. $8+24i$

8. $11-7i$

9. $15-8i$

10. $29+0i$

11. $\frac{21}{10}+\frac{7}{10}i$

12. $\frac{1}{2}+\frac{3}{2}i$

13. i

14. -1

P^2 - VIII

1. $-8, 8$

2. $-3\sqrt{5}, 3\sqrt{5}$

3. $-\sqrt{5}, \sqrt{5}$

4. $2-\sqrt{13}, 2+\sqrt{13}$

5. $-3-\sqrt{5}, -3+\sqrt{5}$

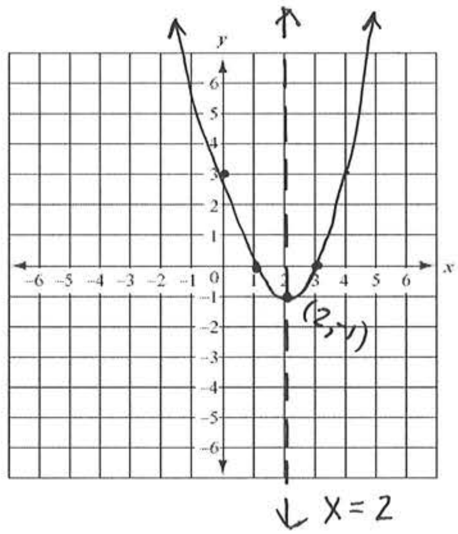
6. $-4-\sqrt{21}, -4+\sqrt{21}$

7. $-5, -2$

8. $\frac{3-\sqrt{17}}{4}, \frac{3+\sqrt{17}}{4}$

9. 0, one real solution

10. Vertex: $(2, -1)$
opens upward
x-intercepts: $(1, 0)$ and $(3, 0)$
y-intercept: $(0, 3)$
axis of symmetry: $x = 2$



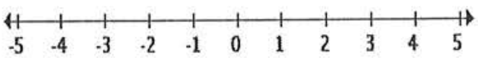
Solve the linear equation.

1. $2(4x+7)=5x+44$

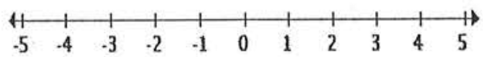
2. $x+7=-2(x+8)$

Solve the following linear inequality. Write your solution in <u>interval notation</u>. Then graph the solution on the given number line.

3. $3(2x-7)-4x>-(x+6)$

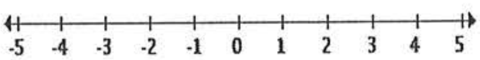


4. $-6x+1\geq -5x+4$

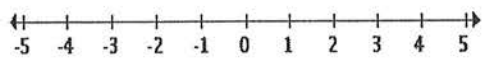


Solve each compound inequality. Graph each solution set and write the solution in <u>interval notation</u>.

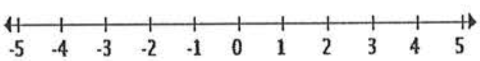
5. $x\leq 0$ and $x\geq -2$



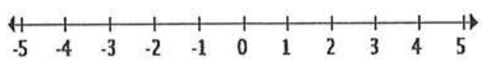
6. $x<2$ and $x>4$



7. $x\geq -2$ or $x\leq 2$



8. $x\geq -3$ or $x\leq -4$



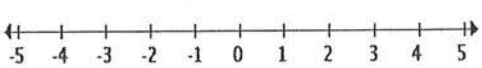
Solve the following absolute value equation.

9. $|2x-3|=5$

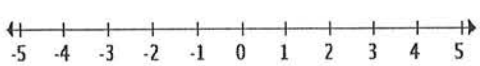
10. $|7x|+1=22$

Solve the following absolute value inequality. Graph the solution set and write it in <u>interval notation</u>.

11. $|x|+6\leq 7$



12 $|x|-1>3$

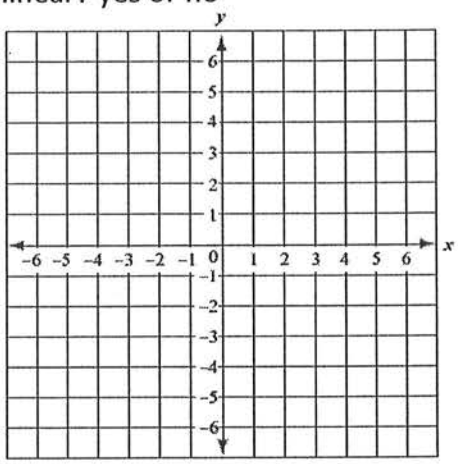


Determine whether each equation is linear or not. Then graph the equation by finding and plotting ordered pair solutions.

13. $y = |x| - 4$

x	y
-2	
-1	
0	
1	
2	

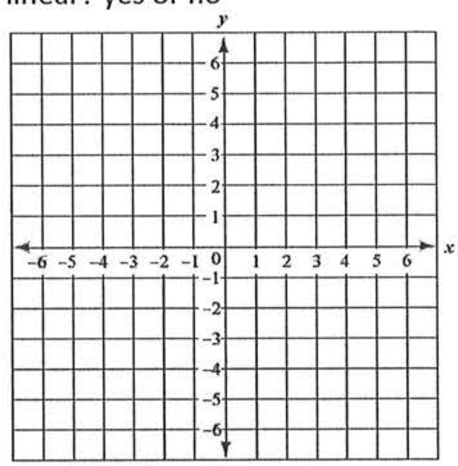
linear? yes or no



14. $y = 2x + 2$

x	y
-2	
-1	
0	
1	
2	

linear? yes or no



Find the indicated function value.

15. $g(x) = -3x,\ g(-3)$

16. $h(x) = 4x^2 - 2x + 5,\ h(-2)$

Find the slope of the line that goes through the given points.

17. $(-7, -4)$ and $(-3, 6)$

18. $(2, 8)$ and $(6, -4)$

For problems #19 - 20, a. Rewrite the given equation in slope-intercept for by solving for y.
b. Identify the slope and the y-intercept.
c. Use the slope and the y-intercept to graph the equation.

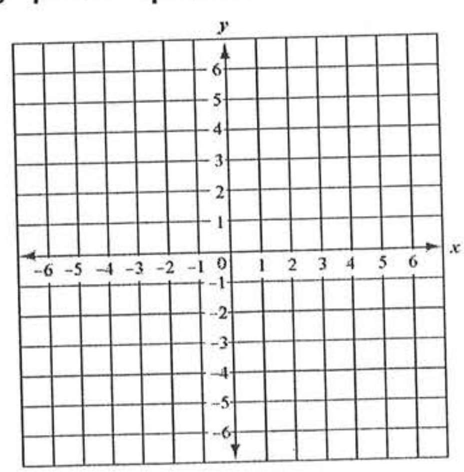
19. $2x + y = 6$

a. ______________________________

b. $m =$ ______________________

y-intercept: (____, ____)

c.



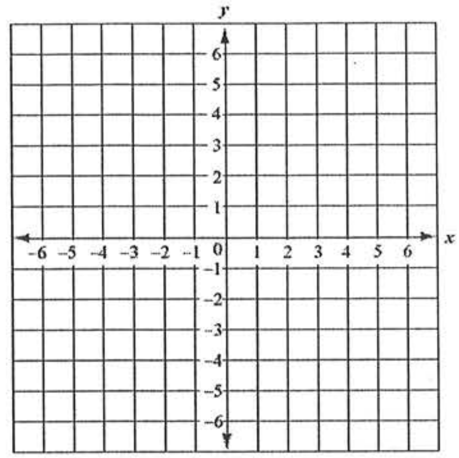
20. $-x + y = 4$

a. ____________________

b. $m =$ ____________________

y-intercept: (___ , ___)

c.



Find an equation of the line with the given slope and containing the given point. Write the equation in slope-intercept form.

21. Slope $= \frac{2}{3}$, passing through $(3, -2)$

22. Slope $= -3$, passing through $(-4, 0)$

Simplify each expression. Write each answer using positive exponents only.

23. $(4xy)(-5x)$

24. $5a^{-4}$

25. $(3x^2y^3)^2$

26. $(x^7)^{-9}$

Multiply.

27. $-3b(2b - 8)$

28. $(4x + 8)(2x - 1)$

Factor completely.

29. $2x^3 - 7x^2 - 9x$

30. $16 - y^4$

31. $x^3 + 27y^3$

32. $ab - 8b + 4a - 32$

Use factoring to solve each equation.

33. $8x^2 + 10x - 3 = 0$

34. $x^2 + x = 2$

Find the domain of each rational function.

35. $h(x) = \dfrac{x^2 - 1}{2x}$

36. $g(x) = \dfrac{4x}{x^2 + x - 6}$

Multiply or divide and simplify.

37. $\dfrac{4x + 8y}{3} \cdot \dfrac{9}{5x + 10y}$

38. $\dfrac{x^2 - 6x + 9}{2x^2 - 18} \cdot \dfrac{4x + 12}{5x - 15}$

39. $\dfrac{3x^2 - 12}{x^2 + 2x - 8} \div \dfrac{6x + 18}{x + 4}$

40. $\dfrac{x^2 - 6x + 9}{x^2 - x - 6} \div \dfrac{x^2 - 9}{4}$

Use the rational function $f(x) = \dfrac{x + 4}{2x - 3}$ to find each function value.

41. $f(-3)$

42. $f(1)$

Perform the indicated operation. Simplify each result, if possible.

43. $\dfrac{7}{5x - 15} - \dfrac{2}{3x - 9}$

44. $\dfrac{3x}{x^2 - 16} + \dfrac{2}{x + 4}$

Solve and check the following equations.

45. $\dfrac{3}{x} + \dfrac{1}{3} = \dfrac{5}{x}$

46. $\dfrac{6}{x + 3} = \dfrac{4}{x - 3}$

Simplify. Assume all variables represent positive real numbers.

47. $\sqrt{60a^2b^5}$

48. $\sqrt[3]{16a^4b^7}$

Add as indicated. You will first need to simplify terms to identify the like radicals.

49. $\sqrt{20} + \sqrt{45}$

50. $x\sqrt{75x} - \sqrt{27x^3}$

Rationalize each denominator.

51. $\dfrac{8}{\sqrt{2} - 1}$

52. $\dfrac{6}{4 - i}$

Solve and check the following radical equations.

53. $\sqrt{3x-2}=5$

54. $\sqrt{2x-3}-2=1$

Perform the indicated operations.

55. $(2+5i)-(7-6i)$

56. $2i\,(4+7i)$

Use the square root property to solve each equation. If possible, simplify radicals.

57. $y^2=144$

58. $x^2=18$

Solve each quadratic equation by completing the square.

59. $x^2+2x+5=0$

60. $x^2+4x-2=0$

Solve each equation using the quadratic formula.

61. $x^2+8x+18=0$

62. $3x^2+3x=5$

Sketch the graph of each quadratic function. Label the vertex and sketch and label the axis of symmetry. Determine whether the graph opens upward or downward, find any intercepts, and sketch the graph.

63. $f(x)=x^2-2x-3$

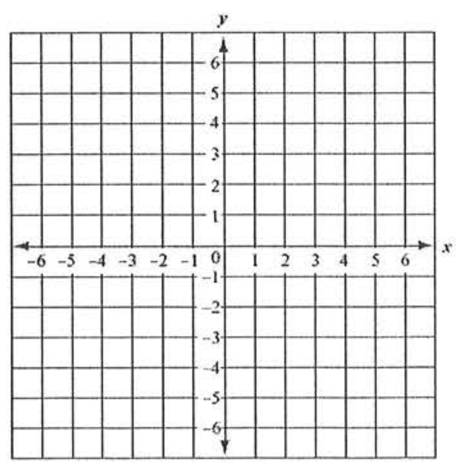
vertex: (____, ____)

axis of symmetry: ________________

opens "upward" or "downward"?

x-intercepts: (____, ____) and (____, ____)

y-intercept: (____, ____)



64. $f(x) = -x^2 - 2x + 3$

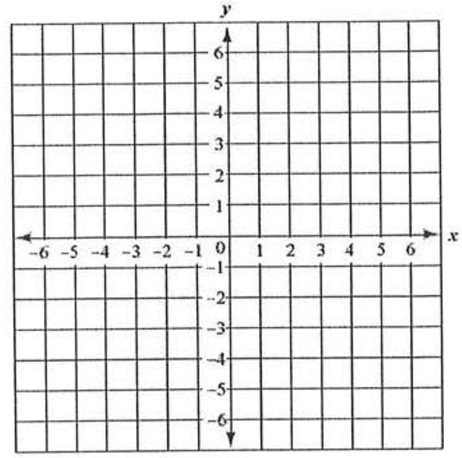
vertex: (____ , ____)

axis of symmetry: ____________________

opens "upward" or "downward"?

x-intercepts: (____ , ____) and (____ , ____)

y-intercept: (____ , ____)

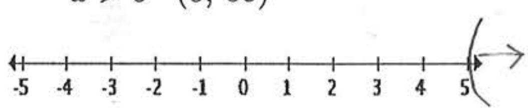


ANSWER KEY

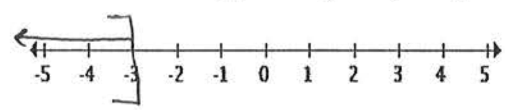
1. $x = 10$

2. $x = -\dfrac{23}{3}$

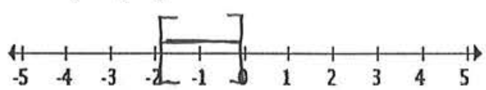
3. $x > 5 \quad (5, \infty)$



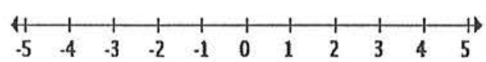
4. $x \leq -3 \quad (-\infty, -3]$



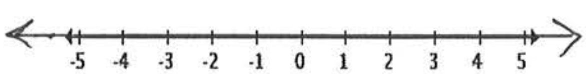
5. $[-2, 0]$



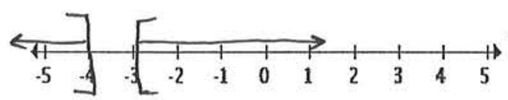
6. $\emptyset$



7. $(-\infty, \infty)$



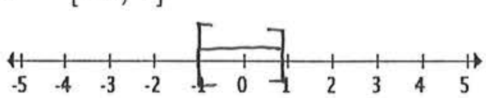
8. $(-\infty, -4] \cup [-3, \infty)$



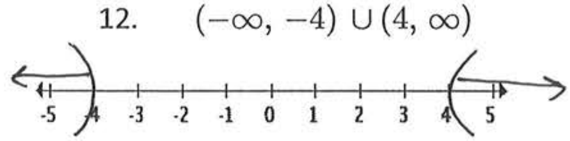
9. $-1, 4$

10. $-3, 3$

11. $[-1, 1]$

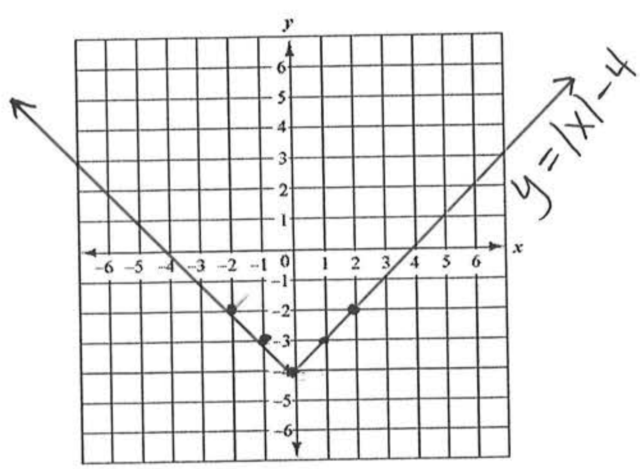


12. $(-\infty, -4) \cup (4, \infty)$



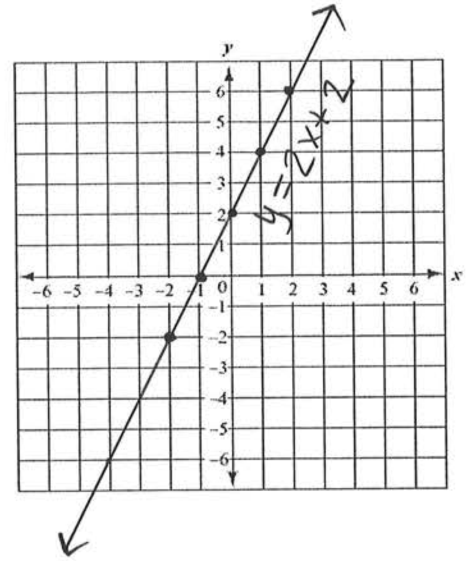
13. $y = |x| - 4$ not linear

x	y
-2	-2
-1	-3
0	-4
1	-3
2	-2



14. $y = 2x + 2$ linear

x	y
-2	-2
-1	0
0	2
1	4
2	6



15. $g(-3) = 9$

16. $h(-2) = 25$

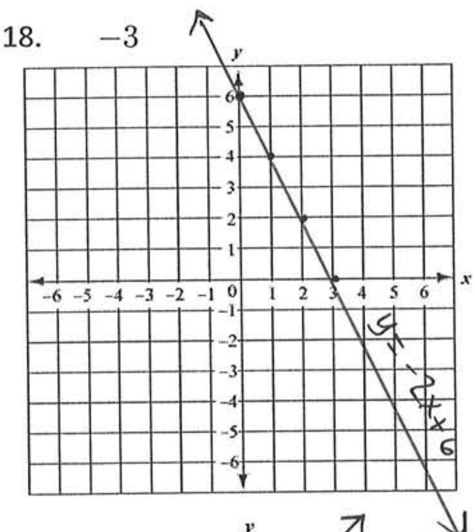
17. $\frac{5}{2}$

18. -3

19. a. $y = -2x + 6$

b. $m = -2$
y-intercept: $(0, 6)$

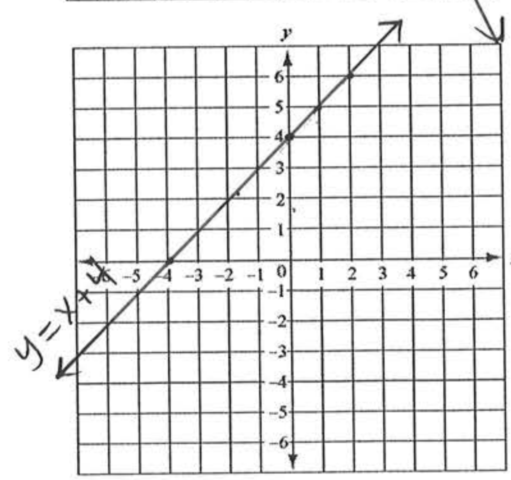
c.



20. a. $y = x + 4$

b. $m = 1$
y-intercept: $(0, 4)$

c.



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

22. $y = -3x - 12$

23. $-20x^2y$

24. $\dfrac{5}{a^4}$

25. $9x^4y^6$

26. $\dfrac{1}{x^{63}}$

27. $-6b^2+24b$

28. $8x^2+12x-8$

29. $x(2x-9)(x+1)$

30. $(4+y^2)(2+y)(2-y)$

31. $(x+3y)(x^2-3xy+9y^2)$

32. $(a-8)(b+4)$

33. $\dfrac{1}{4}, -\dfrac{3}{2}$

34. $-2, 1$

35. $\{x \mid x \text{ is a real number and } x \neq 0\}$

36. $\{x \mid x \text{ is a real number and } x \neq -3,\ x \neq 2\}$

37. $\dfrac{12}{5}$

38. $\dfrac{2}{5}$

39. $\dfrac{x+2}{2(x+3)}$

40. $\dfrac{4}{(x+2)(x+3)}$

41. $f(-3) = -\dfrac{1}{9}$

42. $f(1) = -5$

43. $\dfrac{11}{15(x-3)}$

44. $\dfrac{5x-8}{(x+4)(x-4)}$

45. $x = 6$

46. $x = 15$

47. $2ab^2\sqrt{15b}$

48. $2ab^2\sqrt[3]{2ab}$

49. $5\sqrt{5}$

50. $2x\sqrt{3x}$

51. $8\sqrt{2}+8$

52. $\frac{24}{17} + \frac{6}{17}i$

53. $x = 9$

54. $x = 6$

55. $-5 + 11i$

56. $-14 + 8i$

57. $y = 12, -12$

58. $x = 3\sqrt{2}, -3\sqrt{2}$

59. $x = -1 + 2i, -1 - 2i$

60. $x = -2 + \sqrt{6}, -2 - \sqrt{6}$

61. $x = -4 + i\sqrt{2}, -4 - i\sqrt{2}$

62. $x = \frac{-3 + \sqrt{69}}{6}, \frac{-3 - \sqrt{69}}{6}$

63. $f(x) = x^2 - 2x - 3$

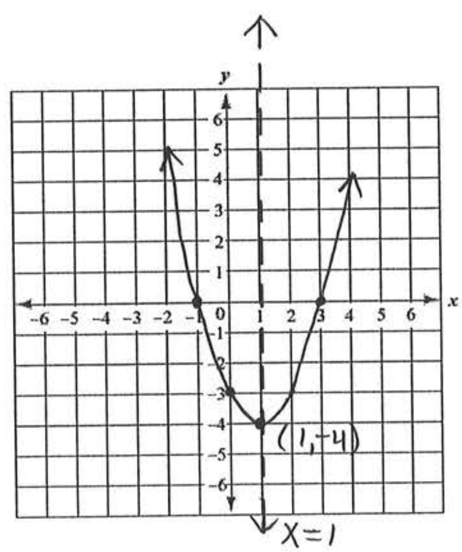
vertex: $(1, -4)$

axis of symmetry: $x = 1$

opens upward

x-intercepts: $(-1, 0)$ and $(3, 0)$

y-intercept: $(0, -3)$



64. $f(x) = -x^2 - 2x + 3$

vertex: $(-1, 4)$

axis of symmetry: $x = -1$

opens downward

x-intercepts: $(-3, 0)$ and $(1, 0)$

y-intercept: $(0, 3)$