Algebra 1 Skills Needed to be Successful in Algebra 2

A. Simplifying Polynomial Expressions

Objectives: The student will be able to:

- Apply the appropriate arithmetic operations and algebraic properties needed to simplify an algebraic expression.
- Simplify polynomial expressions using addition and subtraction.
- Multiply a monomial and polynomial.

B. Solving Equations

Objectives: The student will be able to:

- Solve multi-step equations.
- Solve a literal equation for a specific variable, and use formulas to solve problems.

C. Rules of Exponents

Objectives: The student will be able to:

- Simplify expressions using the laws of exponents.
- Evaluate powers that have zero or negative exponents.

D. Binomial Multiplication

Objectives: The student will be able to:

- Multiply two binomials.

E. Factoring

Objectives: The student will be able to:

- Identify the greatest common factor of the terms of a polynomial expression.
- Express a polynomial as a product of a monomial and a polynomial.
- Find all factors of the quadratic expression $ax^2 + bx + c$ by factoring and graphing.

F. Radicals

Objectives: The student will be able to:

- Simplify radical expressions.

G. Graphing Lines

Objectives: The student will be able to:

- Identify and calculate the slope of a line.
- Graph linear equations using a variety of methods.
- Determine the equation of a line.

H. Regression and Use of the Graphing Calculator

Objectives: The student will be able to:

- Draw a scatter plot, find the line of best fit, and use it to make predictions.
- Graph and interpret real-world situations using linear models.

A. Simplifying Polynomial Expressions

I. Combining Like Terms

- You can add or subtract terms that are considered "like", or terms that have the same variable(s) with the same exponent(s).

Ex. 1: 5x - 7y + 10x + 3y

5x - 7y + 10x + 3y

15x - 4y

Ex. 2: $-8h^2 + 10h^3 - 12h^2 - 15h^3$

$-8h^2 + 10h^3 - 12h^2 - 15h^3$

$-20h^2 - 5h^3$

II. Applying the Distributive Property

- Every term inside the parentheses is multiplied by the term outside of the parentheses.

Ex. 1: $3(9x-4)$

$3 \cdot 9x - 3 \cdot 4$

$27x - 12$

Ex. 2: $4x^2(5x^3+6x)$

$4x^2 \cdot 5x^3 + 4x^2 \cdot 6x$

$20x^5 + 24x^3$

III. Combining Like Terms AND the Distributive Property (Problems with a Mix!)

- Sometimes problems will require you to distribute AND combine like terms!!

Ex. 1: $3(4x-2)+13x$

$3 \cdot 4x - 3 \cdot 2 + 13x$

$12x - 6 + 13x$

$25x - 6$

Ex. 2: $3(12x-5)-9(-7+10x)$

$3 \cdot 12x - 3 \cdot 5 - 9(-7) - 9(10x)$

$36x - 15 + 63 - 90x$

$-54x + 48$

PRACTICE SET 1

Simplify.

1. $8x - 9y + 16x + 12y$

2. $14y + 22 - 15y^2 + 23y$

3. $5n - (3 - 4n)$

4. $-2(11b - 3)$

5. $10q(16x + 11)$

6. $-(5x - 6)$

7. $3(18z - 4w) + 2(10z - 6w)$

8. $(8c + 3) + 12(4c - 10)$

9. $9(6x - 2) - 3(9x^2 - 3)$

10. $-(y - x) + 6(5x + 7)$

B. Solving Equations

I. Solving Two-Step Equations

A couple of hints:

1. To solve an equation, UNDO the order of operations and work in the reverse order.
2. REMEMBER! Addition is "undone" by subtraction, and vice versa. Multiplication is "undone" by division, and vice versa.

$$
\begin{aligned}
Ex.1:\ 4x - 2 &= 30 \\
+2 \quad &\ +2 \\
4x &= 32 \\
\div 4 \quad &\ \div 4 \\
x &= 8
\end{aligned}
\qquad\qquad
\begin{aligned}
Ex.2:\ 87 &= -11x + 21 \\
-21 \quad &\qquad\ -21 \\
66 &= -11x \\
\div -11 \quad &\ \div -11 \\
-6 &= x
\end{aligned}
$$

II. Solving Multi-step Equations With Variables on Both Sides of the Equal Sign

- When solving equations with variables on both sides of the equal sign, be sure to get all terms with variables on one side and all the terms without variables on the other side.

$$
\begin{aligned}
Ex.3:\ 8x + 4 &= 4x + 28 \\
-4 \quad &\qquad -4 \\
8x &= 4x + 24 \\
-4x \quad &\ -4x \\
4x &= 24 \\
\div 4 \quad &\ \div 4 \\
x &= 6
\end{aligned}
$$

III. Solving Equations that need to be simplified first

- In some equations, you will need to combine like terms and/or use the distributive property to simplify each side of the equation, and then begin to solve it.

$$
\begin{aligned}
Ex.4:\ 5(4x - 7) &= 8x + 45 + 2x \\
20x - 35 &= 10x + 45 \\
-10x \qquad &\ -10x \\
10x - 35 &= 45 \\
+35 \quad &\ +35 \\
10x &= 80 \\
\div 10 \quad &\ \div 10 \\
x &= 8
\end{aligned}
$$

PRACTICE SET 2

Solve each equation. You must show all work.

1. $5x - 2 = 33$
2. $140 = 4x + 36$
3. $8(3x - 4) = 196$
4. $45x - 720 + 15x = 60$
5. $132 = 4(12x - 9)$
6. $198 = 154 + 7x - 68$
7. $-131 = -5(3x - 8) + 6x$
8. $-7x - 10 = 18 + 3x$
9. $12x + 8 - 15 = -2(3x - 82)$
10. $-(12x - 6) = 12x + 6$

IV. Solving Literal Equations

- A literal equation is an equation that contains more than one variable.
- You can solve a literal equation for one of the variables by getting that variable by itself (isolating the specified variable).

Ex. 1: $3xy = 18$, Solve for x.

$$\frac{3xy}{3y} = \frac{18}{3y}$$

$$x = \frac{6}{y}$$

Ex. 2: $5a - 10b = 20$, Solve for a.

$$+10b \quad = +10b$$

$$5a = 20 + 10b$$

$$\frac{5a}{5} = \frac{20}{5} + \frac{10b}{5}$$

$$a = 4 + 2b$$

PRACTICE SET 3

Solve each equation for the specified variable.

1. $Y + V = W$, for V

2. $9wr = 81$, for w

3. $2d - 3f = 9$, for f

4. $dx + t = 10$, for x

5. $P = (g - 9)180$, for g

6. $4x + y - 5h = 10y + u$, for x

C. Rules of Exponents

Multiplication: Recall $(x^m)(x^n)=x^{(m+n)}$ *Ex:* $(3x^4y^2)(4xy^5)=(3\cdot 4)(x^4\cdot x^1)(y^2\cdot y^5)=12x^5y^7$

Division: Recall $\frac{x^m}{x^n}=x^{(m-n)}$ *Ex:* $\frac{42m^5j^2}{-3m^3j}=\left(\frac{42}{-3}\right)\left(\frac{m^5}{m^3}\right)\left(\frac{j^2}{j^1}\right)=-14m^2j$

Powers: Recall $(x^m)^n = x^{(m\cdot n)}$ *Ex:* $(-2a^3bc^4)^3 = (-2)^3(a^3)^3(b^1)^3(c^4)^3 = -8a^9b^3c^{12}$

Power of Zero: Recall $x^0 = 1, x \neq 0$ *Ex:* $5x^0y^4 = (5)(1)(y^4) = 5y^4$

PRACTICE SET 4

Simplify each expression.

1. $(c^5)(c)(c^2)$

2. $\frac{m^{15}}{m^3}$

3. $(k^4)^5$

4. d^0

5. $(p^4q^2)(p^7q^5)$

6. $\frac{45y^3z^{10}}{5y^3z}$

7. $(-t^7)^3$

8. $3f^3g^0$

9. $(4h^5k^3)(15k^2h^3)$

10. $\frac{12a^4b^6}{36ab^2c}$

11. $(3m^2n)^4$

12. $(12x^2y)^0$

13. $(-5a^2b)(2ab^2c)(-3b)$

14. $4x(2x^2y)^0$

15. $(3x^4y)(2y^2)^3$

D. Binomial Multiplication

I. Reviewing the Distributive Property

The distributive property is used when you want to multiply a single term by an expression.

Ex 1: $8(5x^2 - 9x)$

$8 \cdot 5x^2 + 8 \cdot (-9x)$

$40x^2 - 72x$

II. Multiplying Binomials – the FOIL method

When multiplying two binomials (an expression with <u>two</u> terms), we use the "FOIL" method. The "FOIL" method uses the distributive property <u>twice</u>!

FOIL is the order in which you will multiply your terms.

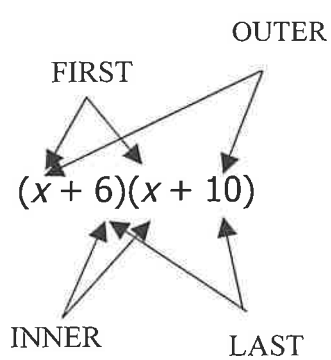
First

Outer

Inner

Last

Ex. 1: (x + 6)(x + 10)



First	$x \cdot x$ ------> x^2
Outer	$x \cdot 10$ -----> $10x$
Inner	$6 \cdot x$ ------> $6x$
Last	$6 \cdot 10$ -----> 60

$x^2 + 10x + 6x + 60$

$x^2 + 16x + 60$
(After combining like terms)

Recall: $4^2 = 4 \cdot 4$

$x^2 = x \cdot x$

Ex. $(x + 5)^2$

$(x + 5)^2 = (x + 5)(x+5)$

Now you can use the "FOIL" method to get a simplified expression.

PRACTICE SET 5

Multiply. Write your answer in simplest form.

1. $(x + 10)(x - 9)$
2. $(x + 7)(x - 12)$
3. $(x - 10)(x - 2)$
4. $(x - 8)(x + 81)$
5. $(2x - 1)(4x + 3)$
6. $(-2x + 10)(-9x + 5)$
7. $(-3x - 4)(2x + 4)$
8. $(x + 10)^2$
9. $(-x + 5)^2$
10. $(2x - 3)^2$

E. Factoring

I. Using the Greatest Common Factor (GCF) to Factor.

- Always determine whether there is a greatest common factor (GCF) first.

Ex. 1 $3x^4 - 33x^3 + 90x^2$

- In this example the GCF is $3x^2$.
- So when we factor, we have $3x^2(x^2 - 11x + 30)$.
- Now we need to look at the polynomial remaining in the parentheses. Can this trinomial be factored into two binomials? In order to determine this make a list of all of the factors of 30.

30		30	
1	30	-1	-30
2	15	-2	-15
3	10	-3	-10
5	6	-5	-6

Since -5 + -6 = -11 and (-5)(-6) = 30 we should choose -5 and -6 in order to factor the expression.

- The expression factors into $3x^2(x-5)(x-6)$

Note: Not all expressions will have a GCF. If a trinomial expression does not have a GCF, proceed by trying to factor the trinomial into two binomials.

II. Applying the difference of squares: $a^2 - b^2 = (a-b)(a+b)$

Ex. 2 $4x^3 - 100x$

$4x(x^2 - 25)$

$4x(x-5)(x+5)$

Since x^2 and 25 are perfect squares separated by a subtraction sign, you can apply the difference of two squares formula.

PRACTICE SET 6

Factor each expression.

1. $3x^2 + 6x$

2. $4a^2b^2 - 16ab^3 + 8ab^2c$

3. $x^2 - 25$

4. $n^2 + 8n + 15$

5. $g^2 - 9g + 20$

6. $d^2 + 3d - 28$

7. $z^2 - 7z - 30$

8. $m^2 + 18m + 81$

9. $4y^3 - 36y$

10. $5k^2 + 30k - 135$

F. Radicals

To simplify a radical, we need to find the greatest perfect square factor of the number under the radical sign (the radicand) and then take the square root of that number.

$Ex.1: \sqrt{72}$

$\sqrt{36} \cdot \sqrt{2}$

$6\sqrt{2}$

$Ex.2: 4\sqrt{90}$

$4 \cdot \sqrt{9} \cdot \sqrt{10}$

$4 \cdot 3 \cdot \sqrt{10}$

$12\sqrt{10}$

$Ex.3: \sqrt{48}$

$\sqrt{16}\sqrt{3}$

$4\sqrt{3}$

OR

$Ex.3: \sqrt{48}$

$\sqrt{4}\sqrt{12}$

$2\sqrt{12}$ ← This is not simplified completely because 12 is divisible by 4 (another perfect square)

$2\sqrt{4}\sqrt{3}$

$2 \cdot 2 \cdot \sqrt{3}$

$4\sqrt{3}$

PRACTICE SET 7

Simplify each radical.

1. $\sqrt{121}$
2. $\sqrt{90}$
3. $\sqrt{175}$
4. $\sqrt{288}$
5. $\sqrt{486}$
6. $2\sqrt{16}$
7. $6\sqrt{500}$
8. $3\sqrt{147}$
9. $8\sqrt{475}$
10. $\sqrt{\frac{125}{9}}$

G. Graphing Lines

I. Finding the Slope of the Line that Contains each Pair of Points.

Given two points with coordinates (x_1, y_1) and (x_2, y_2), the formula for the slope, *m*, of the line containing the points is $m = \dfrac{y_2 - y_1}{x_2 - x_1}$.

Ex. (2, 5) and (4, 1)

$$m = \frac{1-5}{4-2} = \frac{-4}{2} = -2$$

The slope is -2.

Ex. (-3, 2) and (2, 3)

$$m = \frac{3-2}{2-(-3)} = \frac{1}{5}$$

The slope is $\frac{1}{5}$

<u>PRACTICE SET 8</u>

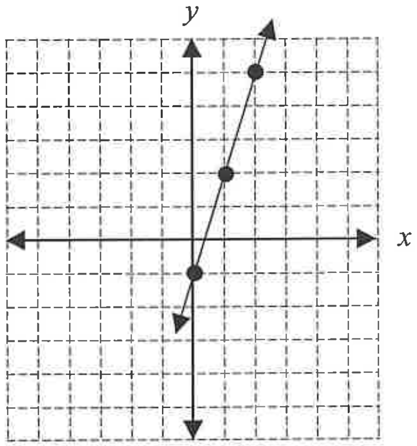
1. (-1, 4) and (1, -2)
2. (3, 5) and (-3, 1)
3. (1, -3) and (-1, -2)
4. (2, -4) and (6, -4)
5. (2, 1) and (-2, -3)
6. (5, -2) and (5, 7)

II. Using the Slope – Intercept Form of the Equation of a Line.

The slope-intercept form for the equation of a line with slope m and y-intercept b is $y = mx + b$.

Ex. $y = 3x - 1$

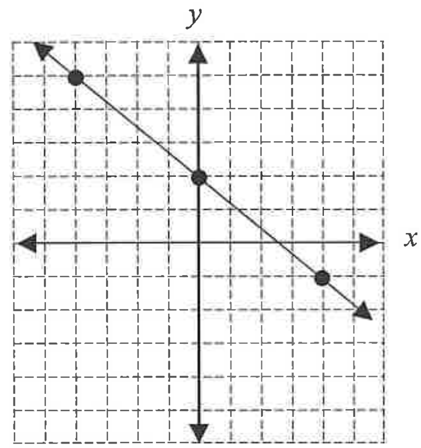
Slope: 3 y-intercept: -1



Place a point on the y-axis at -1.
Slope is 3 or 3/1, so travel up 3 on the y-axis and over 1 to the right.

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

Slope: $-\frac{3}{4}$ y-intercept: 2

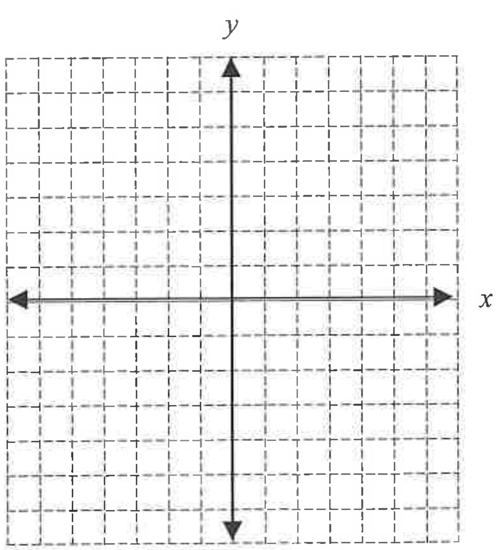


Place a point on the y-axis at 2.
Slope is -3/4 so travel down 3 on the y-axis and over 4 to the right. Or travel up 3 on the y-axis and over 4 to the left.

PRACTICE SET 9

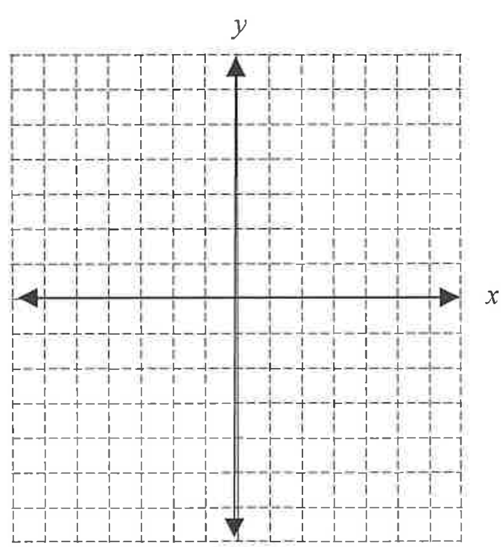
1. $y = 2x + 5$

Slope: _____ y-intercept: _____



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

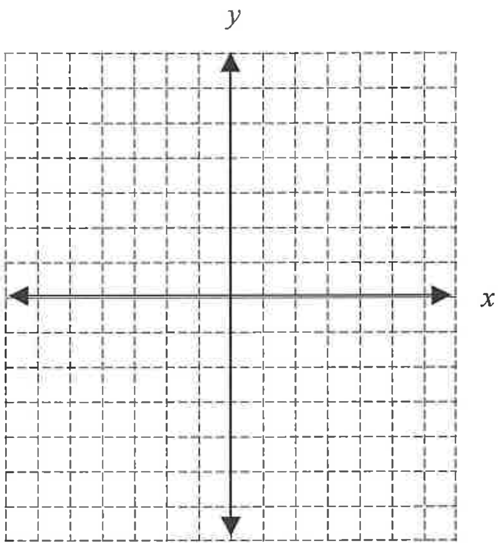
Slope: _____ y-intercept: _____



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

Slope: ______________

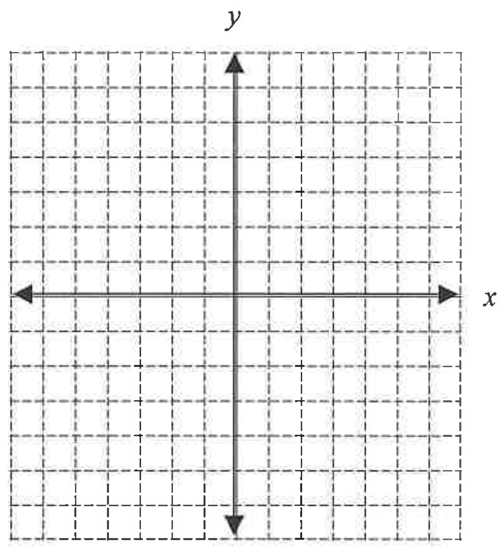
y-intercept: ______________



4. $y = -3x$

Slope: ______________

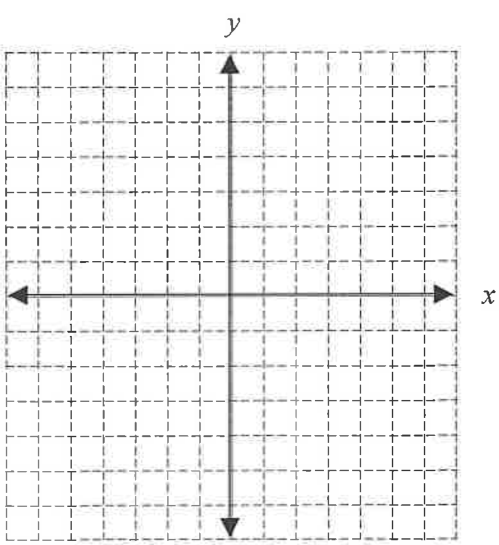
y-intercept ______________



5. $y = -x + 2$

Slope: ______________

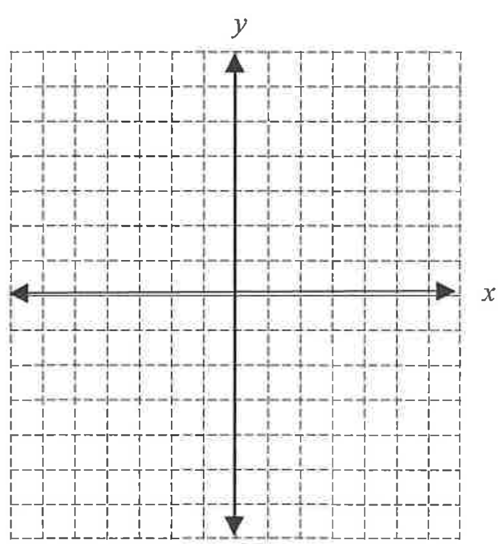
y-intercept: ______________



6. $y = x$

Slope: ______________

y-intercept ______________



III. Using Standard Form to Graph a Line.

An equation in standard form can be graphed using several different methods. Two methods are explained below.

a. Re-write the equation in $y = mx + b$ form, identify the y-intercept and slope, then graph as in Part II above.

b. Solve for the x- and y- intercepts. To find the x-intercept, let $y = 0$ and solve for x. To find the y-intercept, let $x = 0$ and solve for y. Then plot these points on the appropriate axes and connect them with a line.

Ex. $2x - 3y = 10$

a. Solve for y.

$$-3y = -2x + 10$$

$$y = \frac{-2x + 10}{-3}$$

$$y = \frac{2}{3}x - \frac{10}{3}$$

OR

b. Find the intercepts:

let $y = 0$:

$$2x - 3(0) = 10$$

$$2x = 10$$

$$x = 5$$

So x-intercept is (5, 0)

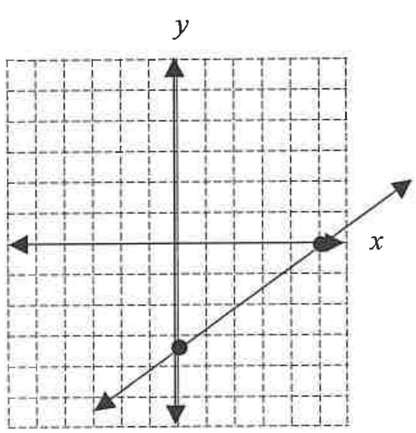
let $x = 0$:

$$2(0) - 3y = 10$$

$$-3y = 10$$

$$y = -\frac{10}{3}$$

So y-intercept is $\left(0, -\frac{10}{3}\right)$



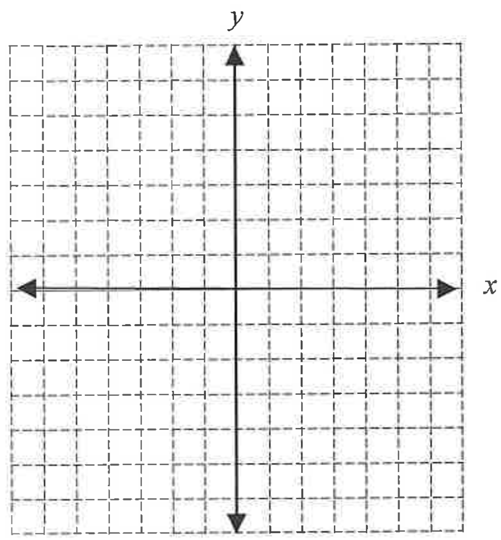
On the x-axis place a point at 5.

On the y-axis place a point at $-\frac{10}{3} = -3\frac{1}{3}$

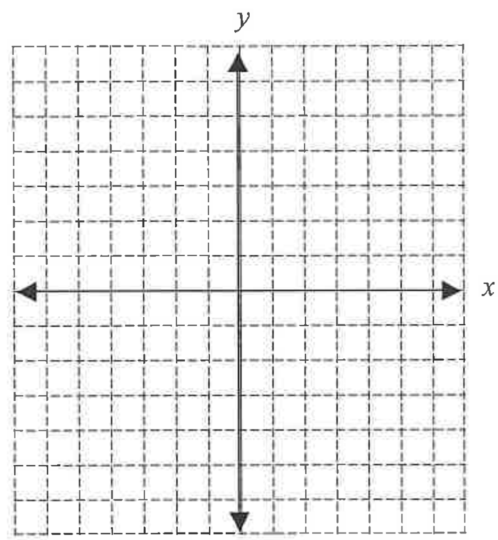
Connect the points with the line.

PRACTICE SET 10

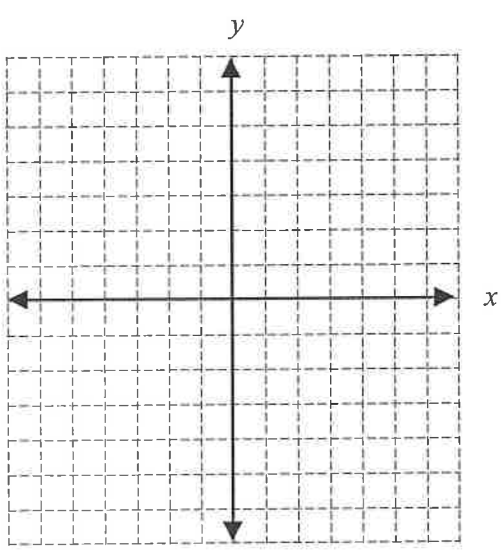
1. $3x + y = 3$



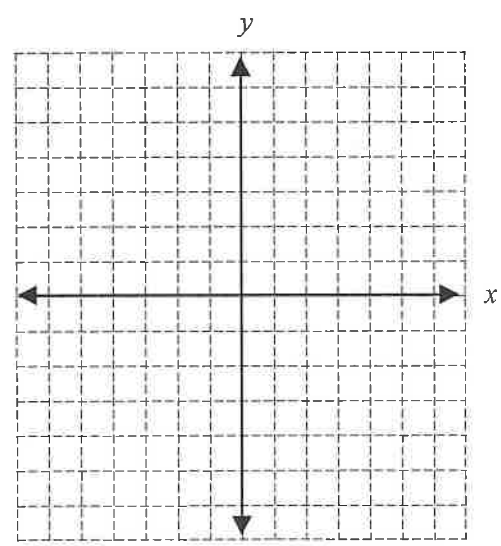
2. $5x + 2y = 10$



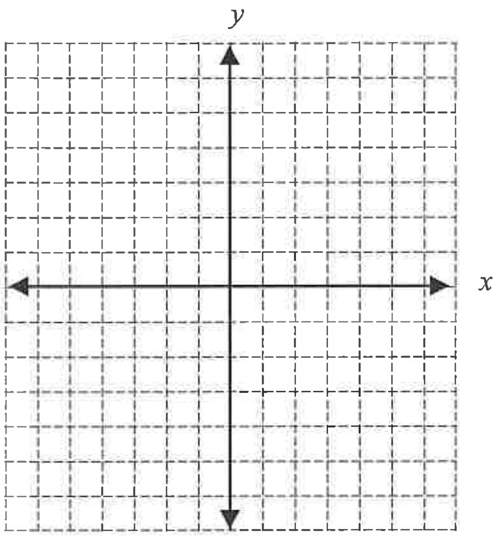
3. $y = 4$



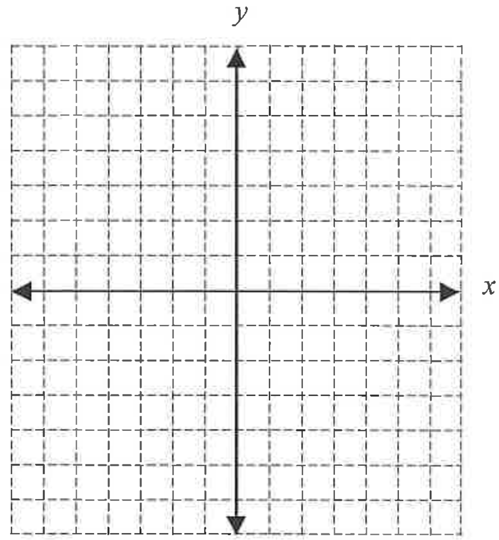
4. $4x - 3y = 9$



5. $-2x+6y=12$



6. $x=-3$



H. Regression and Use of the Graphing Calculator

Note: For guidance in using your calculator to graph a scatterplot and finding the equation of the linear regression (line of best fit), please see the calculator direction sheet included in the back of the review packet.

PRACTICE SET 11

1. The following table shows the math and science test scores for a group of ninth graders.

Math Test Scores	60	40	80	40	65	55	100	90	85
Science Test Scores	70	35	90	50	65	40	95	85	90

Let's find out if there is a relationship between a student's math test score and his or her science test score.

a. Fill in the table below. Remember, the variable quantities are the two variables you are comparing, the lower bound is the minimum, the upper bound is the maximum, and the interval is the scale for each axis.

Variable Quantity	Lower Bound	Upper Bound	Interval

b. Create the scatter plot of the data on your calculator.

c. Write the equation of the line of best fit.

d. Based on the line of best fit, if a student scored an 82 on his math test, what would you expect his science test score to be? Explain how you determined your answer. Use words, symbols, or both.

e. Based on the line of best fit, if a student scored a 53 on his science test, what would you expect his math test score to be? Explain how you determined your answer. Use words, symbols, or both.

2. Use the chart below of winning times for the women's 200-meter run in the Olympics below to answer the following questions.

Year	Time (Seconds)
1964	23.00
1968	22.50
1972	22.40
1976	22.37
1980	22.03
1984	21.81
1988	21.34
1992	21.81

a. Fill in the table below. Remember, the variable quantities are the two variables you are comparing, the lower bound is the minimum, the upper bound is the maximum, and the interval is the scale for each axis.

Variable Quantity	Lower Bound	Upper Bound	Interval

b. Create a scatter plot of the data on your calculator.

c. Write the equation of the regression line (line of best fit) below. Explain how you determined your equation.

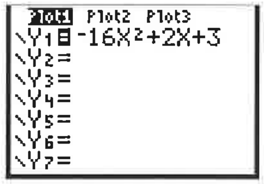
d. The Summer Olympics will be held in London, England, in 2012. According to the line of best fit equation, what would be the winning time for the women's 200-meter run during the 2012 Olympics? Does this answer make sense? Why or why not?

TI-83 Plus/TI-84 Graphing Calculator Tips

How to …

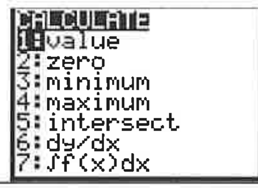
…graph a function

Press the [Y=] key, Enter the function directly using the [X,T,θ,n] key to input x. Press the [GRAPH] key to view the function. Use the [WINDOW] key to change the dimensions and scale of the graph. Pressing [TRACE] lets you move the cursor along the function with the arrow keys to display exact coordinates.



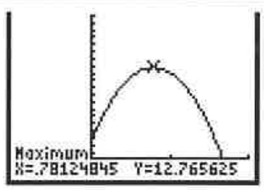
…find the y-value of any x-value

Once you have graphed the function, press **CALC** [2nd] [TRACE] and select **1:value**. Enter the x-value. The corresponding y-value is displayed and the cursor moves to that point on the function.



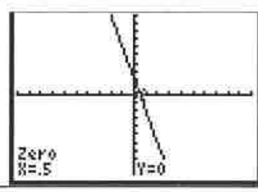
…find the maximum value of a function

Once you have graphed the function, press **CALC** [2nd] [TRACE] and select **4:maximum**. You can set the left and right boundaries of the area to be examined and guess the maximum value either by entering values directly or by moving the cursor along the function and pressing [ENTER]. The x-value and y-value of the point with the maximum y-value are then displayed.



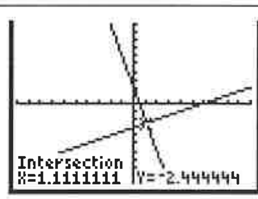
…find the zero of a function

Once you have graphed the function, press **CALC** [2nd] [TRACE] and select **2:zero**. You can set the left and right boundaries of the root to be examined and guess the value either by entering values directly or by moving the cursor along the function and pressing [ENTER]. The x-value displayed is the root.



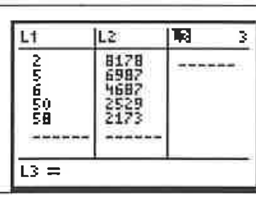
…find the intersection of two functions

Once you have graphed the function, press **CALC** [2nd] [TRACE] and select **5:intersect**. Use the up and down arrows to move among functions and press [ENTER] to select two. Next, enter a guess for the point of intersection or move the cursor to an estimated point and press [ENTER]. The x-value and y-value of the intersection are then displayed.



…enter lists of data

Press the [STAT] key and select **1:Edit**. Store ordered pairs by entering the x coordinates in **L1** and the y coordinates in **L2**. You can calculate new lists. To create a list that is the sum of two previous lists, for example, move the cursor onto the **L3** heading. Then enter the formula **L1+L2** at the **L3** prompt.

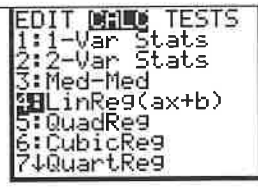


...plot data

Once you have entered your data into lists, press **STAT PLOT** 2nd Y= and select **Plot1**. Select On and choose the type of graph you want, e.g. scatterplot (points not connected) or connected dot for two variables, histogram for one variable. Press ZOOM and select **9:ZoomStat** to resize the window to fit your data. Points on a connected dot graph or histogram are plotted in the listed order.

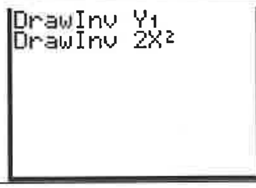
...graph a linear regression of data

Once you have graphed your data, press STAT and move right to select the **CALC** menu. Select **4:LinReg(ax+b).** Type in the parameters **L1, L2, Y1**. To enter **Y1**, press VARS and move right to select the **Y-VARS** menu. Select **1:Function** and then **1:Y1**. Press ENTER to display the linear regression equation and Y= to display the function.



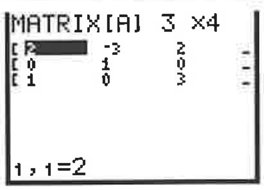
...draw the inverse of a function

Once you have graphed your function, press **DRAW** 2nd PRGM and select **8:DrawInv**. Then enter **Y1** if your function is in **Y1**, or just enter the function itself.



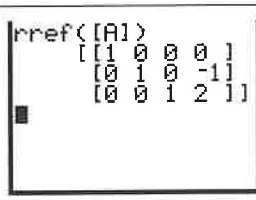
...create a matrix

From the home screen, press 2nd x^{-1} to select **MATRX** and move right to select the **EDIT** menu. **Select 1:[A]** and enter the number of rows and the number of columns. Then fill in the matrix by entering a value in each element. You may move among elements with the arrow keys. When finished, press **QUIT** 2nd MODE to return to the home screen. To insert the matrix into calculations on the home screen, press 2nd x^{-1} to select **MATRX** and select **NAMES** and select **1:[A].**



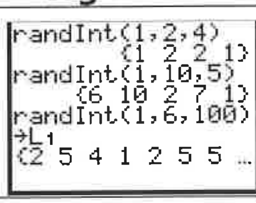
...solve a system of equations

Once you have entered the matrix containing the coefficients of the variables and the constant terms for a particular system, press **MATRX** (2nd x^{-1} , move to **MATH**, and select **B:rref.** Then enter the name of the matrix and press ENTER. The solution to the system of equations is found in the last column of the matrix.



...generate lists of random integers

From the home screen, press MATH and move left to select the **PRB** menu. Select **5:RandInt** and enter the lower integer bound, the upper integer bound, and the number of trials, separated by commas, in that order. Press STO→ and **L1** to store the generated numbers in **List 1**. Repeat substituting **L2** to store a second set of integers in **List 2.**



Part One: Order of Operations

Directions: Simplify each problem in the space provided, circling your final answer. Final answer should have all positive exponents and be in simplest form. No decimal approximations allowed.

Properties

1. Grouping symbols
2. Exponents
3. Multiplication or Division
   In order from left to right
4. Addition or Subtraction
   In order from left to right

Example: $2^3-(4+3*5)$ $=(2*2*2)-(4+3*5)$ $=(8)-(4+15)$ $=8-(19)$ $=-11$	1. $(15 - 8)\times 3+5+48 - 6$	2. $18\div 9\times(5 - 2)+7$
3. $4^3+2+8 - 60\div 3\times 6-3$	4. $(a^2-b)\div 6$, using $a=6, b=12$	5. when $x=-5$
6. $2x^2-2x+24$ when $x=2$	7. $\dfrac{3x^2+5}{12x-4}$, when $x=-1$	8. $\left(a+\sqrt{16}\right)\left(\dfrac{1}{a^2}-\dfrac{a}{3}\right)$ when $a=2$

Part Two: Linear Equations

Directions: Solve each problem in the space provided, circling your final answer. Recall: to find x-intercept set y=0 and to find y-intercept set x=0. To find equation of a line find slope and then use slope and point to solve for y-intercept.

Equations of a Line

- *Slope-intercept form:* $y = mx + b$
- *Point-slope form:* $y - y_1 = m(x = x_1)$
- *Standard form:* $Ax + By = C$
- *Slope:* $m = \frac{y_2 - y_1}{x_2 - x_1}$

Example: Write the equation of a line that has slope $m = -\frac{4}{9}$ and y-intercept $b = -3$. Use $y = mx + b$ then substitute values for ma and b and simplify $y = \frac{-4}{9}x + -3$ $y = -\frac{4}{9}x - 3$	9. Find the slope of the line containing the points $(4,-3)$ and $(-6, 4)$.	10. Write the equation of a line that has slope $m = -\frac{4}{9}$ and passes through the point $(18, -2)$.
11. Write the equation of the line containing the points $(1,3)$ and $(5, 11)$.	12. Write the equation of the line containing the point $(-4, 6)$ and parallel to $3x - 2y = 8$.	13. Write the equation of the line containing the point $(3,56)$ and perpendicular to $3x - 2y = 8$.

Part Three: Rules of Exponents

Directions: Simplify each problem in the space provided, circling your final answer. Final answer should have all positive exponents.

Properties

$a^m \bullet a^n = a^{m+n}$

$(a^m)^n = a^{mn}$

$(ab)^m = a^m b^m$

$a^{-m} = \frac{1}{a^m}, a \neq 0$

$\frac{a^m}{a^n} = a^{m-n}, a \neq 0$

$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$

Example: $(2a)^{-3}$ $= \frac{1}{(2a)^3}$ $= \frac{1}{(2a)} * \frac{1}{(2a)} * \frac{1}{(2a)}$ $= \frac{1}{2^3 a^3} = \frac{1}{8a^3}$	14. $(7x)^{-2}$	15. $(2x^2y)^0(3xy)^3$
16. $\frac{a^3}{a} - \frac{4a^6}{a^4}$	17. $(4x^3)^3$	18. $\left(\frac{5u^2}{2v^2}\right)^2$
19. $(3^{-1}+2^{-1})^2$	20. $\left(\left(\frac{3}{4}\right)^2+1\right)^2$	21. $\left(\frac{x^2y^8z^2}{xy^2z^6}\right)^2$

Part Four: Simplifying Radicals

Directions: Simplify each problem in the space provided, circling your final answer. Final answer should have all positive exponents and be rationalized. No decimal approximations allowed.

Properties

- $\sqrt{ab} = \sqrt{a} \bullet \sqrt{b}$
- $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$
- $a^{\frac{m}{n}} = \sqrt[n]{a^m} \text{ or } \left(\sqrt[n]{a}\right)^m$
- $\sqrt{x^2} = x$

Example: $\sqrt{24}$ $= \sqrt{4*6}$ $= \sqrt{4} * \sqrt{6}$ $= 2\sqrt{6}$	22. $3\sqrt{700}$	23. $\sqrt{\frac{100}{49}}$
24. $3\sqrt{700} + 2\sqrt{7}$	25. $\left(2\sqrt{6}\right) \bullet \left(3\sqrt{15}\right)$	26. $\sqrt{12} - \sqrt{48}$
27. $\sqrt{75x^3} \bullet \sqrt{3x^3}$	28. $\frac{50a}{2\sqrt{25a^2}}$	**BE CAREFUL:** $\sqrt[n]{a+b} \neq \sqrt[n]{a} + \sqrt[n]{b}$ $\sqrt[n]{a-b} \neq \sqrt[n]{a} - \sqrt[n]{b}$ $\sqrt[n]{a^n + b^n} \neq a + b$

Part Five: Simplifying Polynomials

Directions: Simplify each problem in the space provided, circling your final answer. Final answer should have all positive exponents and be in simplest form. No decimal approximations allowed.

Properties

$c(x+y)=cx+cy$

$(a+b)(c+d)=ac+ad+bc+bd$

Example: $(4x^2+7x-12)-(3x^2+5x+2)$ $=4x^2+7x-12-3x^2-5x-2)$ $=4x^2-3x^2+7x-5x-12-2)$ $=x^2-2x-14$	29. $(7x-2y)-(3x+5y)$	30. $-7x(2x-9)$
31. $(-3x+y)+(2x-y)$	32. $(3x+4)(2x-9)$	33. $7(3x^2+10x)-4x$
34. $3x^2+10x-4(x-7)$	35. $(3x^2+5)(2x-3)$	36. $(-3x+y)(2x-y)$

Part Six: Factoring

Directions: Factor each problem completely in the space provided, circling your final answer. Recall: if not factorable, it is "prime".

Strategies

1. GCF
2. Difference of Squares $(a+b)(a-b)=a^2-b^2$
3. Trinomials: factors of ac that add up to b
4. Sum and Difference
   $a^2+2ab+b^2=(a+b)^2$
   $a^2-2ab+b^2=(a-b)^2$
5. Grouping

Example: $3b^2+15b+18$ $=3(b^2+5b+6)$ $=3(b+3)(b+2)$	37. x^2+6x+5	38. x^2+x-6
39. $3x^3+18x^2+24x$	40. $4n^2-24n$	41. $144x^2-36$
42. $2x^2+7x-4$	43. $2x^5+10x^4+12x^3$	44. $2x^3+3x^2-8x-12$

Part Six: Solving

Directions: Solve each problem completely in the space provided, circling your final answer. Recall: For quadratics you may need the zero-product property… if $ab = 0$, then $a = 0$ or $b = 0$.

Strategies

1. Factor out a GCF (if one exists).
2. Quadratic – factor, completing the square or quadratic formula. $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
3. Cubic – try to factor by grouping.
4. Absolute value equations : $|a+b| = c$
   $a+b=c$ or $a+b=-c$
5. Radical equations – raise each side to the root.

45. $3(x-7)+5=-2x-8$	46. $\frac{x+1}{3}=5$	47. $(x+4)(9x-3)=0$
48. $x^2+x-12=0$	49. $x^2+2x-35=0$	50. $x^2+3x=-1$
51. $\lvert 1-4x \rvert=5$	52. $-4x+7\le 5$	53. $2\sqrt{x}-3=5$

Part Seven: Systems of Equations

Directions: Solve each problem completely in the space provided, circling your final answer.

Methods

1. Graphing.
2. Substitution
3. Elimination.

54. $\begin{cases} 3x+2y=2 \\ 9x-8y=-4 \end{cases}$	55. $\begin{cases} y=-3x+1 \\ 6x+2y=10 \end{cases}$	56. $\begin{cases} y=2x-2 \\ 7.5y=15x-15 \end{cases}$

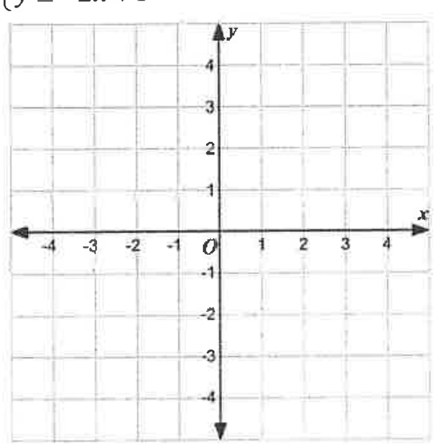
Part Eight: Systems of Inequalities

Directions: Solve each system of inequalities by graphing.

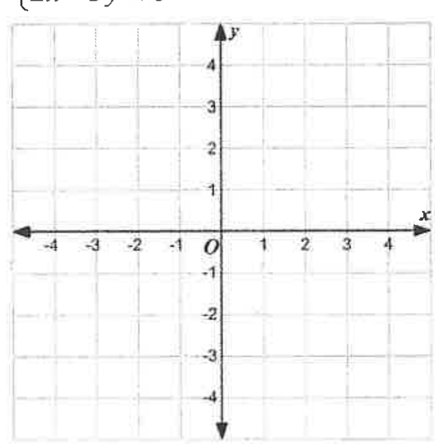
Methods

Graph both inequalities on the same coordinate plane and their intersection (overlapping region) is the solution. $<$ and $>$ are dotted lines, $\leq$ and $\geq$ are solid line.

57. $\begin{cases} y<3x+2 \\ y\leq -2x+1 \end{cases}$



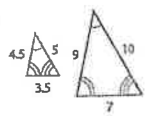
58. $\begin{cases} y>-3x-2 \\ 2x-3y<6 \end{cases}$

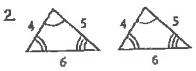


Part Nine: Basic Geometry and Trigonometry

Set One:

Determine whether each pair of figures is *similar, congruent,* or *neither.*

1.


2.


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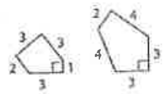

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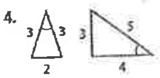
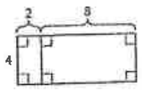


5.


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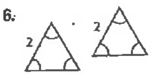
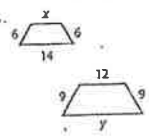


Each pair of polygons is similar. Find the values of x and y.

7.


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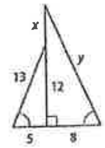

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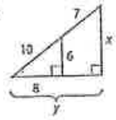
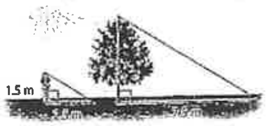


10. **SHADOWS** On a sunny day, Jason measures the length of his shadow and the length of a tree's shadow. Use the figures at the right to find the height of the tree.

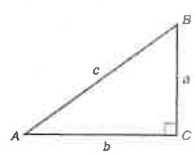


11. **PHOTOGRAPHY** A photo that is 4 inches wide by 6 inches long must be reduced to fit in a space 3 inches wide. How long will the reduced photo be?

12. **SURVEYING** Surveyors use instruments to measure objects that are too large or too far away to measure by hand. They can use the shadows that objects cast to find the height of the objects without measuring them. A surveyor finds that a telephone pole that is 25 feet tall is casting a shadow 20 feet long. A nearby building is casting a shadow 52 feet long. What is the height of the building?

Set Two:

Using the triangle shown, write an equation involving sin, cos, or tan that can be used to find the missing measure. Then solve the equation. Round measures of sides to the nearest tenth.



1. If $A = 20°$ and $c = 32$, find a.

2. If $A = 49°$ and $a = 17$, find b.

3. If $A = 27.3°$ and $a = 7$, find c.

4. If $a = 19.2$ and $A = 63.4°$, find b.

5. If $a = 28$ and $B = 41°$, find c.

Solve each right triangle. Assume that C represents the right angle and c is the hypotenuse. Round measures of sides and angles to the nearest tenth.

6. $a = 12, A = 35°$

7. $b = 25, B = 71°$

8. $a = 4, b = 7$

9. $b = 52, c = 95$