UNIT 5: SHAPES OF ALGEBRA

DAY/DATE	LESSON	HOMEWORK
Day 1: Mon 4/8	Equations of Circles	
Day 2: Tues 4/9	Solving Inequalities	
Day 3: Wed 4/10	Review/*UNIT 5 **QUIZ***	
Day 4: Thurs 4/11	Standard Form	
Day 5: Fri 4/12	Slope/Midpoint	
Day 6: Mon 4/15	Parallel/Perpendicular	
Day 7: Tues 4/16	Intersecting Lines	
Day 8: Wed 4/17	Review	
Day 9: Thurs 4/18	****UNIT 5 TEST****	HW GRADE:

BY THE END OF THE UNIT STUDENTS WILL BE ABLE TO:

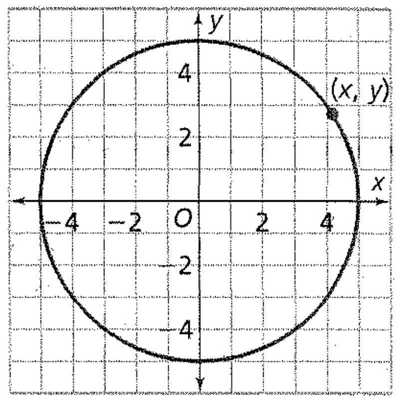
- Use coordinates to prove simple geometric theorems algebraically (E.G. Prove that a quadrilateral created by connecting four points is a parallelogram using the slope criteria and/or distance on the coordinate plane).
- Prove the slope criteria for parallel and perpendicular lines.
- Use the slope criteria to solve geometric problems (E.G. Determine if two lines are parallel, perpendicular, or neither: Find the equation of a lines parallel or perpendicular to a given line that passes through a given point: find the coordinates of a fourth vertex of a quadrilateral given three vertices and its shape).
- Find the midpoint of a segment.
- Solve simple cases of systems of equations by inspection.

DAY 1:
INTRODUCTORY GROUP INVESTIGATION

1.1 Equations for Circles

You can outline the outer circle of a crop circle by using a rope. Anchor one end of the rope where you want the center of the circle. Hold the other end and, with the rope pulled taut, walk around the center point.

To plan the other parts of the design, it helps to draw the circle on a coordinate grid. In this problem, you will find an equation relating the coordinates of the points on a circle.



On the circle above, are there points for which it is easy to find the coordinates?

What mathematical ideas can help you find coordinates of other points on the circle?

Problem 1.1 Equations for Circles

A. 1. The circle above has a radius of 5 units and is centered at the origin. Estimate the missing coordinate for these points on the circle. If there is more than one possible point, give the missing coordinate for each possibility.

a. (0, ■)	**b.** (■, 0)	**c.** (3, ■)
d. (4, ■)	**e.** (■, −3)	**f.** (■, 4)
g. (−2, ■)	**h.** (■, 2)	**i.** (■, 5)

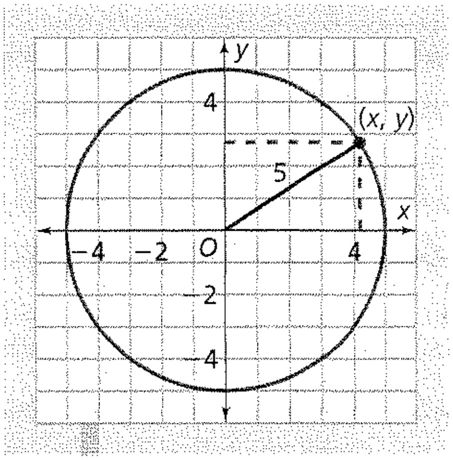
2. Which of your coordinates from part (1) do you think are exactly correct? How do you know?

1

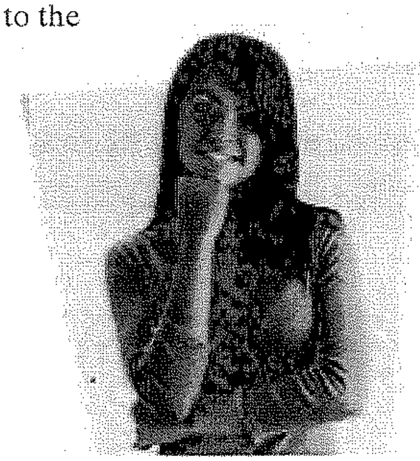
UNIT 1.

INTRODUCTORY GROUP INVESTIGATION

B. Think about a point (x, y) starting at $(5, 0)$ and moving counterclockwise, tracing around the circle.



1. How does the y-coordinate of the point change as the x-coordinate approaches zero and then becomes negative?
2. The radius from the origin $(0, 0)$ to the point (x, y) has a length of 5 units. The diagram shows that you can make two right triangles with the radius as the hypotenuse. How do these triangles change as the point moves around the circle?
3. Use what you know about the relationship among the side lengths of a right triangle to write an equation relating x and y to the radius, 5.
4. Kaitlyn says that the relationship is $x + y = 5$ or $y = 5 - x$. Is she correct? Explain.
5. Does every point on the circle satisfy your equation? Explain.



C. These points are all on the circle. Check that they satisfy the equation you wrote in Question B part (3).

1. $(3, 4)$ **2.** $(-4, 3)$ **3.** $(\sqrt{13}, \sqrt{12})$ **4.** $(0, -5)$

5. Does any point *not* on the circle satisfy the equation? Explain.

D. **1.** Give the coordinates of three points in the interior of the circle. What can you say about the x- and y-coordinates of points inside the circle?

2. Use your equation from Question B to help you write an *inequality* that describes the points in the interior of the circle.

E. How can you change your equation from Question B to represent a circle with a radius of 1, 3, or 10 units?

ACE Homework starts on page 12.

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DAY 1: NOTES (STUDY THESE!)

Equations of Circles

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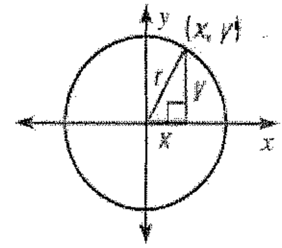
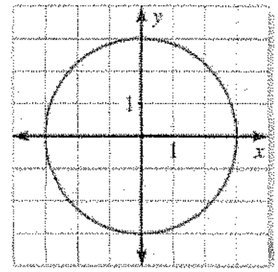
Writing Equations of Circles



- Given any point on a circle with center (0, 0), the Pythagorean Theorem gives us $x^2 + y^2 = r^2$

Example: Write the equation of the circle shown in the graph…

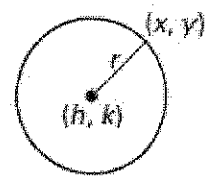


r = __________

Equation = $x^2 + y^2 = r^2$ = ______________

- What if the circle is not centered at (0,0)?

Suppose a circle is centered at point (h, k). Use the distance formula to find r.



$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ distance formula

$r = \sqrt{(x - h)^2 + (y - k)^2}$ substitute

$r^2 = (x - h)^2 + (y - k)^2$ square both sides

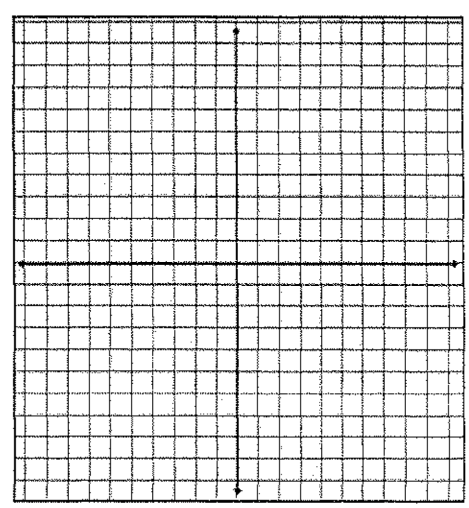
The standard equation for a circle with center (h, k) and radius r is: $(x - h)^2 + (y - k)^2 = r^2$

Examples:

a) Write the standard equation for a circle with center (-2, 5) and radius 7

b) The point (-5, 6) is on a circle with center (-1, 3). Write the equation of the circle.

Graphing Circles



Example: Graph the circle with equation $(x - 4)^2 + (y + 2)^2 = 36$

- Determine center (careful: h, k are subtracted) :_________
- Radius is: __________
- Draw point at center; mark radius units from center; draw circle freehand or with compass

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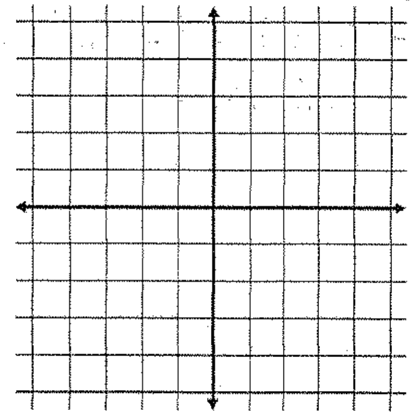
DAY 1: NOTES (STUDY THESE!)

Equations of Circles

Example: Three forest ranger stations are at A(-3, 2), B(2, 2), and C(-1, -1.5). A fire is 2 miles from A, 3 miles from B, and 3.5 miles from C. Find the location of the fire by graphing.

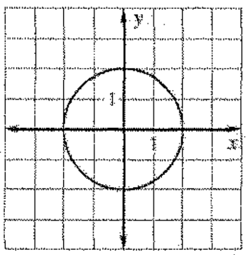


- Draw three circles to represent situation.
- At what point do they intersect? ______________

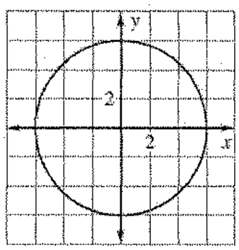
You try:

1) Write an equation for the circles shown:

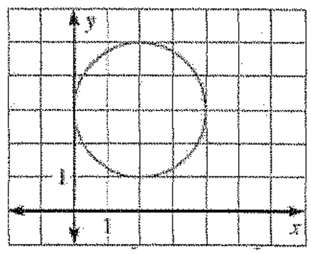
a)



b)



c)



2) Write the standard equation of the circle with the given centers and radii:

a) center: (0, 0); radius: 3

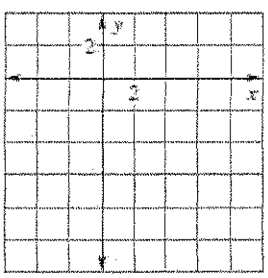
b) center (-2, 5); radius: 7

3) Write the standard equation of a circle with the given center and point on the circle:

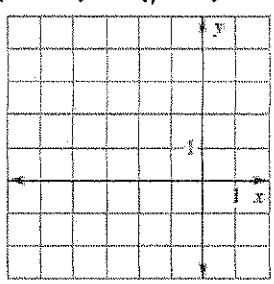
a) center: (1, 4); point (3,4) b) center: (2, 6); point(-1, 2) c) center (-1, 2); point (-3, 4)

4) Graph the circles:

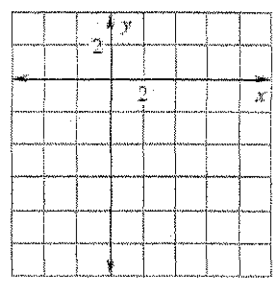
a) $(x - 2)^2 + (y + 3)^2 = 16$



b) $(x + 2)^2 + (y - 1)^2 = 9$

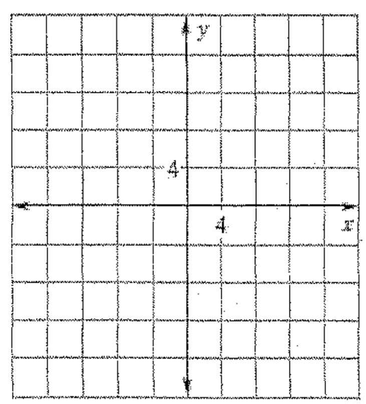


c) $x^2 + (y + 2)^2 = 36$



5) You bury a time capsule and use a grid to write directions for finding it. Use the following measurements to find the burial location of the time capsule:

- The capsule is about 11 feet from the oak tree at A(0,0)
- The capsule is 8 feet from the flagpole at B(0, 8)
- The capsule is 4 feet from the mailbox at C(-12, 8)



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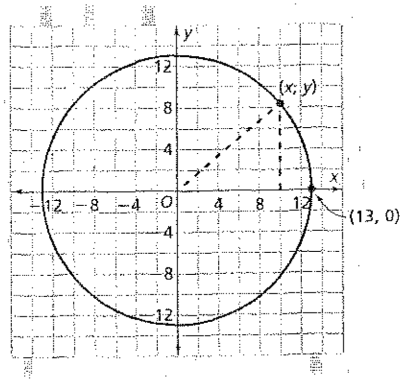
Applications | Connections | Extensions

ACE

Applications

1. a. Write an equation that relates the coordinates x and y for points on the circle.



b. Find the missing coordinates for each of these points on the circle. If there is more than one possible point, give the missing coordinate for each possibility. Show that each ordered pair satisfies the equation.

(0, ■)	(5, ■)	(−4, ■)	(−8, ■)
(■, 10)	(■, −6)	(■, 0)	(■, −2)

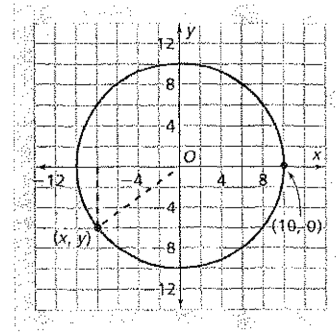
c. Write an inequality that relates the coordinates x and y for points inside the circle.

d. Choose any point in the interior of the circle and confirm that this point is a solution for the inequality you wrote in part (c).

e. Choose any point outside the circle and check that it is not a solution for the inequality you wrote in part (c).

DAY 1: CLASSWORK
*USE PAGES 1 & 2 TO COMPLETE

2. a. Write an equation that relates the coordinates x and y for points on the circle.



b. Find the missing coordinates for each of these points on the circle. If there is more than one possible point, give the missing coordinate for each possibility. Show that each ordered pair satisfies the equation.

(8, ■)	(3, ■)	(−4, ■)	(0, ■)
(■, −4)	(■, −6)	(■, 0)	(■, 2)

c. Write an inequality that describes the points in the interior of the circle.

d. Write an inequality that describes the points outside the circle.

e. Choose one point in the interior of the circle and one point outside the circle and confirm these are solutions for the appropriate inequalities.

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DAY 1: HOMEWORK * USE NOTES ON P. 3 & 4

Categorizing Equations

	Center at (2,1)	Center at (2,−1)	Center at (0,−1)	Center (__, __)
Radius of $\sqrt{5}$				
Radius of $\sqrt{10}$				
Radius of 5				
Radius of 10				

DAY 2: INTRODUCTORY GROUP INVESTIGATION

It is fairly easy to find some solutions to an inequality. However, sometimes it is useful to find all the solutions by solving the inequality symbolically. The following problems will help you develop strategies for solving inequalities.

Problem 2.2 Linear Inequalities

A. For each instruction in parts (1)–(6), start with $q < r$. Tell whether performing the operation on $q < r$ will give an inequality that is still true. If so, explain why. If not, give specific examples to show why the resulting inequality is false.

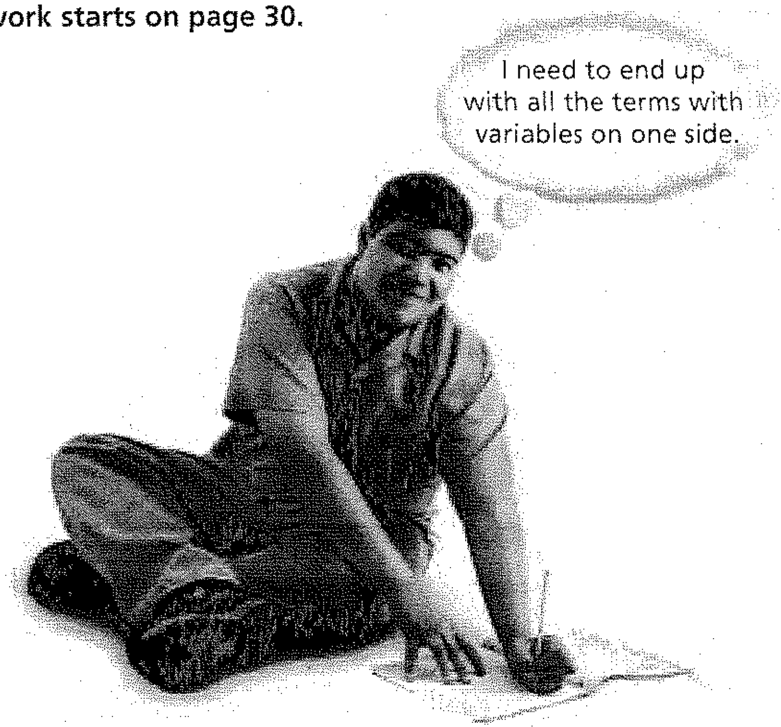
1. Add 23 to both sides.
2. Subtract 35 from both sides.
3. Multiply both sides by 14.
4. Multiply both sides by -6.
5. Divide both sides by 5.
6. Divide both sides by -3.

B. What do your results from Question A suggest about how working with inequalities is similar to and different from working with equations?

C. Solve these equations and inequalities.

1. $3x + 12 = 5x - 4$
2. $3w + 12 < 5w - 4$
3. $q - 5 = 6q + 10$
4. $r - 5 > 6r + 10$

ACE Homework starts on page 30.



DAY 2: INTRODUCTORY GROUP INVESTIGATION CONTINUED

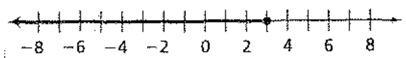
3 Solving Linear Inequalities

Many practical problems require solving linear inequalities. You can reason about inequalities, such as $2x - 4 < 5$ or $2x - 4 > -0.5x + 1$, using both symbolic and graphic methods. Solutions to inequalities with one variable are generally given in the form $x < a$, $x > a$, $x \le a$, or $x \ge a$.

Getting Ready for Problem 2.3

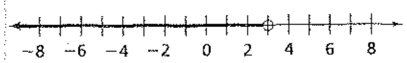
- What are some values that satisfy the inequality $3x + 4 \le 13$?
- Describe all the solutions of the inequality $3x + 4 \le 13$.

All the solutions of $3x + 4 \le 13$ can be displayed in a number-line graph. This graph represents $x \le 3$, all x-values less than or equal to 3.



- Explain why the solutions of $3x + 4 < 13$ do *not* include the value 3.

The number-line graph below represents the solutions of $3x + 4 < 13$. It shows $x < 3$, all x-values strictly less than 3. The open circle shows that 3 is not a solution.



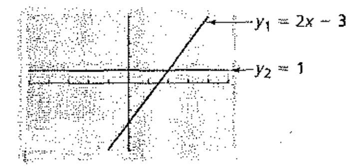
- Make a number-line graph showing the solutions of $2x - 4 < 5$.
- Explain in words what the graph tells about the solutions.

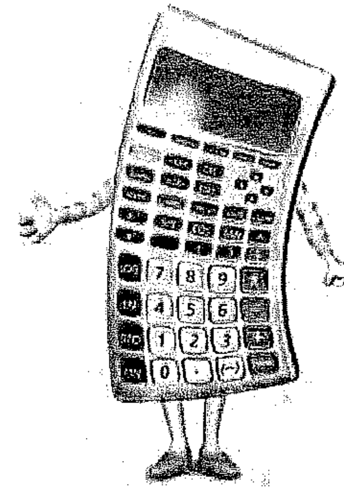
Problem 2.3 Solving Linear Inequalities

A. Use symbolic reasoning to solve each inequality. Then make a number-line graph of the solutions. Be prepared to justify your solution steps and to explain your graphs.

1. $3x + 17 < 47$
2. $43 < 8x - 9$
3. $-6x + 9 < 25$
4. $14x - 23 < 5x + 13$
5. $18 < -4x + 2$
6. $3{,}975 + 6d < 995 + 17.95d$

B. Luisa wants to use her graphing calculator to solve $2x - 3 \le 1$. She graphs the linear functions $y = 2x - 3$ and $y = 1$. She uses an x- and a y-scale of 1.





1. Luisa knows that the solution for $2x - 3 = 1$ is $x = 2$. How does this relate to the graphs of the lines she drew?
2. How do the graphs show that the solution of $2x - 3 \le 1$ is $x \le 2$?
3. How can you use the graph to find the solution of $2x - 3 > 1$? What is the solution?
4. For one of the inequalities in Question A, sketch a graph or use your graphing calculator to find the solution. Check that your solution agrees with the one you found by using symbolic reasoning.

ACE Homework starts on page 30.

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DAY 2: NOTES (STUDY THESE!!)

Name: ______________________________ Block: ________ Date: ______________

Solving Multistep Inequalities

Solving multistep inequalities is THE SAME as solving multistep equalities EXCEPT…

- IF YOU MULTIPLY OR DIVIDE BY A NEGATIVE NUMBER, REVERSE THE INEQUALITY SYMBOL

CAUTION: Just because there is a negative sign somewhere in the inequality does not mean reverse the sign; ONLY REVERSE THE SIGN IF YOU MULTIPLY OR DIVIDE BY A NEGATIVE NUMBER.

Example 1: Solve, check, and graph: $6x + 15 > 9$

Solve:

$6x + 15 > 9$	Our equation
$-15 \quad -15$	Subtract 15 from both sides (subtraction property of inequality)
$6x > -6$	Simplify
$\frac{6x}{6} > \frac{-6}{6}$	Divide both sides by positive 6 (division property of inequality)
$x > -1$	Simplify.

Check:

Pick a number bigger than -1 and plug back in to the original inequality. How about 0?

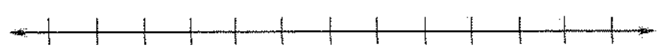
$6(0) + 15 > 9$

$15 > 9$ ✓

Graph: $x > -1$

Example 2: Solve, check, and graph: $10 - 3a \leq 25 + 2a$

Solve: *Check*: *Graph*:



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DAY 2: NOTES (STUDY THESE!!)

Solving Multistep Inequalities

Example 3: Solve, check, and graph: $2(n + 3) < -4$

Solve:

$2(n + 3) < -4$	Original Equation
	Clear parentheses (distribute)
	Addition/Subtraction step
	Multiplication/Division step

Check:

Pick a number in the solution and test.

Graph:

You try:

a) $3x + 4 \leq 31$ Solve: Check: Graph:	b) $y + 1 \geq 4y + 4$ Solve: Check: Graph:	c) $-3(b - 1) > 18$ Solve: Check: Graph:
d) $2n + 5 > 11 - n$ Solve: Check: Graph:	e) $-4 \leq \frac{x}{4} - 6$ Solve: Check: Graph:	f) $\frac{1}{2}(6 - c) > 5$ Solve: Check: Graph:

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DAY 4 NOTES: (STUDY THESE!!)

Name ______________________

Period ____________ Date ____________

WRITING LINEAR EQUATIONS IN STANDARD FORM

What have we learned so far???

List the **different formats** in which you can write a **linear equation** (so far…),

-
-

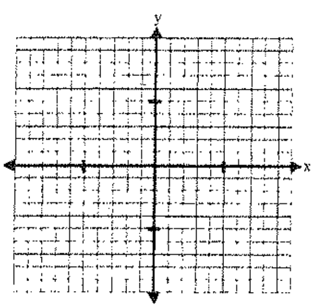
What is our goal for today?

STANDARD FORM:	→	What is Standard Form?

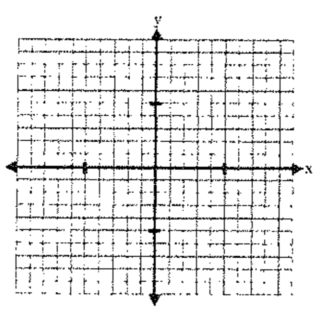
Example #1

Graph each of the following equations.

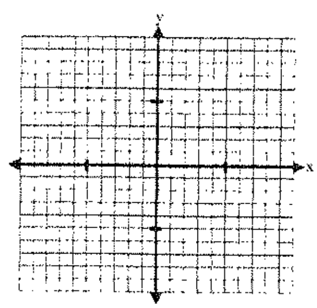
a). $y = \frac{4}{3}x - 2$



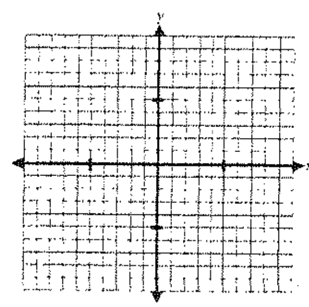
b). $-4x + 3y = -6$



c). $4x - 3y = 6$



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



1. Which, if any, of the equations are equivalent? How do you know?

2. What is the connection between the slope and a) and b) from the standard form?

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Day 4 Notes: (Study these!!)

Understanding Standard Form

Solve the equation below for y.

$Ax + By = C$

Conclusion:

Example #2

Write $y = \frac{2}{5}x - 3$ in standard form with integer coefficients.

Example #3

Write the standard form of an equation of the line passing through $(-7,3)$ with a slope of -4.

Example #4

Write the standard form of an equation

a). of a vertical line

b). of a horizontal line

PRACTICE

Write the following equations in standard form with integer coefficients.

1. $-5x + 11 = \frac{1}{2}y$
2. $3y - 4 = -\frac{1}{2}x$

Write the standard form of an equation that passes through the given point and has the given slope.

3. $(-5,1)$, $m = \frac{3}{4}$
4. $(2,9)$, $m = -\frac{1}{3}$

Write the standard form of the equation

a). of the horizontal line through $(6,-5)$

b). of the vertical line through $(-2,-7)$

★ This will be an exit ticket

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DAY 4 : GROUP ACTIVITY

3.2 Connecting $y = mx + b$ and $ax + by = c$

There are two common forms of a linear equation.

- When the values of one variable depend on those of another, it is most natural to express the relationship as $y = mx + b$. Most of the linear equations you have seen have been in this *slope-intercept* form.
- When it is more natural to combine the values of two variables, the relationship can be expressed as $ax + by = c$. This is the *standard form* of a linear equation. The equations in Problem 3.1 were in standard form.

Getting Ready for Problem 3.2

It is easy to graph a linear equation of the form $y = mx + b$ on a calculator.

- Can you use a calculator to graph an equation of the form $ax + by = c$?
- Can you change an equation from $ax + by = c$ form to $y = mx + b$ form?
- How can rewriting the equation $600 = 5s + 10c$ (or $600 = 5x + 10y$) from Problem 3.1 in $y = mx + b$ form help you find solutions?

Problem 3.2 Connecting $y = mx + b$ and $ax + by = c$

A. Four students want to write $12x + 3y = 9$ in equivalent $y = mx + b$ form. Here are their explanations:

Jared

$$\begin{aligned} 12x + 3y &= 9 \\ 3y &= -12x + 9 \quad (1) \\ y &= -4x + 3 \quad (2) \end{aligned}$$

Molly

$$\begin{aligned} 12x + 3y &= 9 \\ 3y &= 9 - 12x \quad (1) \\ y &= 3 - 12x \quad (2) \end{aligned}$$

Ali

$$\begin{aligned} 12x + 3y &= 9 \\ 4x + y &= 3 \quad (1) \\ y &= -4x + 3 \quad (2) \end{aligned}$$

Mia

$$\begin{aligned} 12x + 3y &= 9 \\ 3y &= 9 - 12x \quad (1) \\ y &= 3 - 4x \quad (2) \\ y &= 4x - 3 \quad (3) \end{aligned}$$

DAY 4: GROUP ACTIVITY

1. Did each student get an equation equivalent to the original? If so, explain the reasoning for each step. If not, tell what errors the student made.
2. What does it mean for two equations to be equivalent?

B. Write each equation in $y = mx + b$ form.

1. $x - y = 4$
2. $2x + y = 9$
3. $8x + 4y = -12$
4. $12 = 3x - 6y$
5. $x + y = 2.5$
6. $600 = 5x + 10y$

C. Suppose you are given an equation in $ax + by = c$ form. How can you predict the slope, y-intercept, and x-intercept of its graph?

D. Write each equation in $ax + by = c$ form.

1. $y = 5 - 3x$
2. $y = \frac{2}{3}x + \frac{1}{4}$
3. $x = 2y - 3$
4. $2x = y + \frac{1}{2}$
5. $y - 2 = \frac{1}{4}x + 1$
6. $3y + 3 = 6x - 15$

ACE Homework starts on page 42.

DAY 4 HOMEWORK (USE P 11 : 12)

NAME______________________________ DATE ______________

6-2

Study Guide

Student Edition
Pages 332–338

Writing Linear Equations in Point-Slope and Standard Forms

If you know the slope of a line and the coordinates of one point on the line, you can write an equation of the line by using the **point-slope form.** For a given point (x_1, y_1) on a nonvertical line with slope m, the point-slope form of a linear equation is $y - y_1 = m(x - x_1)$.

Any linear equation can be expressed in the form $Ax + By = C$ where A, B, and C are integers and A and B are not both zero. This is called the **standard form.** An equation that is written in point-slope form can be changed to standard form.

Example 1: Write the point-slope form of an equation of the line that passes through (6, 1) and has a slope of $-\frac{5}{2}$.

$$y - y_1 = m(x - x_1)$$
$$y - 1 = -\frac{5}{2}(x - 6)$$

Example 2: Write $y + 5 = 3(x - 4)$ in standard form.

$$\begin{aligned} y + 5 &= 3(x - 4) \\ y + 5 &= 3x - 12 \\ -3x + y &= -17 \\ 3x - y &= 17 \end{aligned}$$

You can also find an equation of a line if you know the coordinates of two points on the line. First, find the slope of the line. Then write an equation of the line by using the point-slope form or the standard form.

Write the standard form of an equation of the line that passes through the given point and has the given slope.

1. (2, 1), 4

2. (−7, 2), 6

3. $\left(\frac{1}{2}, 3\right)$, 5

4. (4, 9), $\frac{3}{4}$

5. (−6, 7), 0

6. (8, 3), 1

Write the point-slope form of an equation of the line that passes through each pair of points.

7. (6, 3), (−8, 5)

8. (−1, 9), (10, 7)

9. (8, 5), (0, −4)

10. (−3, −4), (5, −6)

11. (2, 9), (9, 2)

12. (−1, −4), (−6, −10)

DAY 4: HOMEWORK (USE P 11 & 12)

NAME ______________________ DATE ________

6-2

Practice

Student Edition
Pages 332–338

Writing Linear Equations in Point-Slope and Standard Forms

Write the standard form of an equation of the line that passes through the given point and has the given slope.

1. $(1, 1), \frac{1}{4}$

2. $(6, 0), -\frac{1}{2}$

3. $(-2, 1), 1$

4. $(-6, -2), -\frac{1}{3}$

5. $(3, -4), 0$

6. $(-4, 1), \frac{3}{2}$

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

8. $(5, -3)$, none

Write the point-slope form of an equation of the line that passes through each pair of points.

9. $(-1, -7), (1, 3)$

10. $(5, 3), (-4, 3)$

11. $(-4, 6), (-2, 5)$

12. $(2, -6), (2, 5)$

13. $(-3, -2), (4, 5)$

14. $(-5, 1), (0, -2)$

16

DAY 5: NOTES (STUDY THESE!!)

Name ______________________

Notes - Slope, Midpoint

Date ______________________ Period ________

I. RECALL: What is slope (again)? How do I find the slope of a line?

Slope Formula

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

x_1 y_1 x_2 y_2

Example: Find the slope of the line that contains the following points $(6, -3)$ and $(-10, 5)$.

(no relation)

Example: Tell whether the lines through the given points are parallel, perpendicular, or neither.

(same) (opp/recip)

A. Line A: (3, -6) and (-4, 8)
Line B: (0, 2) and (-1, 4)

Line A:

Line B:

B. Line A: (-1, 0) and (6, 5)
Line B: (-7, -8) and (4, 0)

Line A:

Line B:

C. Line A: (5, 9) and (10, 11)
Line B: (1, 8) and (3, 3)

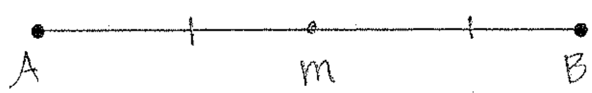
Line A:

Line B:

II. What is the midpoint of a segment? How do I find the midpoint of a segment?

The midpoint of a segment is ____

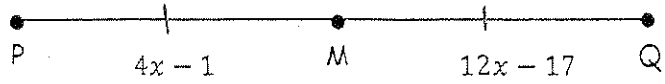
The midpoint of a segment is the ____________ __ ________ point.



17 ★SEE PPT ON MATHWITHMSFISCH.WEEBLY.COM FOR ANSWERS

DAY 5: NOTES (STUDY THESE!!)

Example: In the diagram, M is the midpoint of the segment. Find the value of x, MQ, and PQ.



x = ____________   MQ = ____________   PQ = ____________

Midpoint Formula

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Example: Find the coordinates of the midpoint of the segment with the given endpoints.

x_1 y_1 x_2 y_2

A. $\overline{CD}$, where C(-2,-1) and D(4,2)

M =

x_1 y_1 x_2 y_2

B. $\overline{EF}$, where E(-2,3) and F(5,-3)

M =

What if you are given an endpoint and the midpoint, and you are asked to find the other endpoint?

Example: Use the given endpoint R and the midpoint M of $\overline{RS}$ to find the coordinates of the other endpoint S.

endpt midpt

R(8,0) and M(4,-5)

Example: Use the given endpoint R and the midpoint M of $\overline{RS}$ to find the coordinates of the other endpoint S.

endpt

R(-8,3) and M(-2,7)

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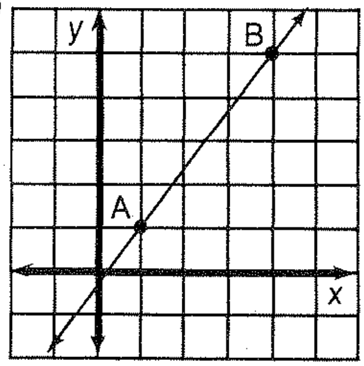
DAY 5: HOMEWORK ✱ EXTRA INSTRUCTION: FIND THE MIDPOINT OF EACH SEGMENT & GRAPH IT!!!

What Do You Call a Duck That Steals?

For the first six exercises, find the slope of the line $\overleftrightarrow{AB}$. For the remaining exercises, find the slope of the line that passes through the two given points. Cross out each box in the rectangle below that contains a correct answer. When you finish, print the letters from the remaining boxes in the spaces at the bottom of the page.

1


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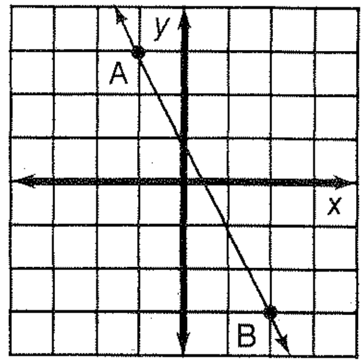

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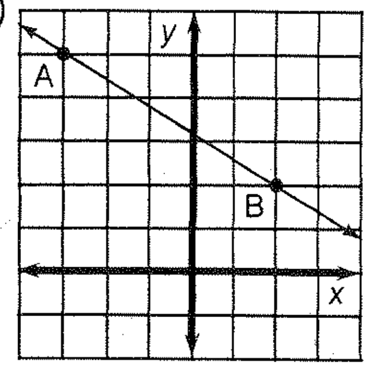

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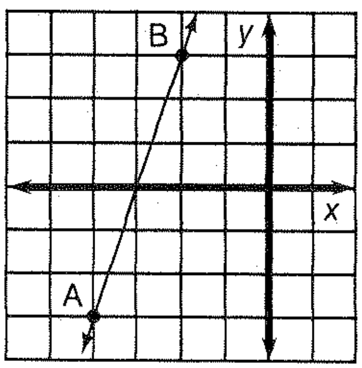

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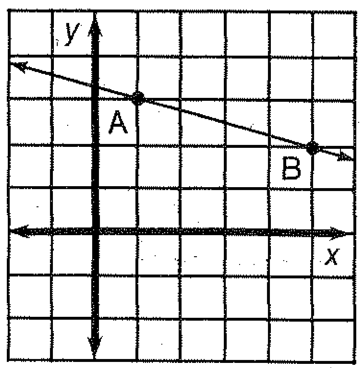

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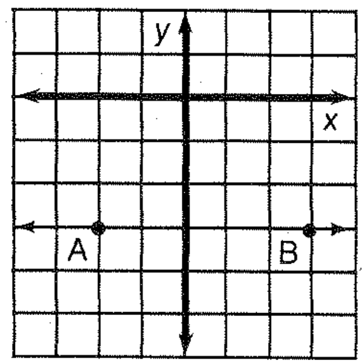


7. (2, 1); (5, 3)
8. (8, 3); (2, 5)
9. (1, −4); (6, −2)
10. (−3, 1); (−7, 4)
11. (9, 2); (3, −1)
12. (−5, 8); (−4, 2)
13. (0, −1); (4, −7)
14. (1, −1); (−2, −6)
15. (−4, −8); (−2, 0)
16. (−3, −3); (0, 0)
17. (2, 5); (9, 1)
18. (0, 0); (−2, 7)

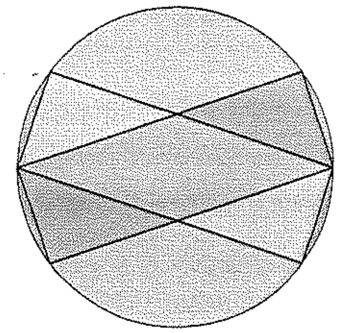
DU 0	AB -6	CK $-\frac{3}{5}$	ST $-\frac{4}{7}$	AR 9	IG $\frac{1}{2}$	AT $-\frac{7}{2}$	OB $-\frac{7}{6}$	IG $\frac{4}{3}$	ET $\frac{2}{3}$	BE $-\frac{5}{4}$	ST $\frac{5}{3}$
CA $\frac{2}{5}$	RD $\frac{1}{6}$	RI $-\frac{1}{4}$	CH -2	UC -8	RI $-\frac{3}{2}$	ME 1	AQ $-\frac{1}{3}$	UA $-\frac{3}{4}$	KY $\frac{8}{5}$	ET 4	CK 3

OBJECTIVE 5–h: To find the slope of a line given two points on the line (not using the graph).

DAY 6: INTRODUCTORY GROUP ACTIVITY

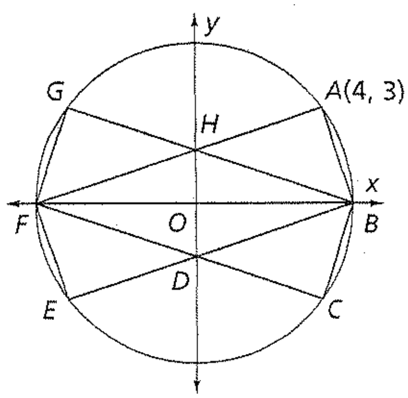
1.2 Parallels and Perpendiculars

The design at the right is made from a circle and two overlapping rectangles. One way to make a crop circle with this design is to place stakes at key points and connect the stakes with string outlining the regions. However, you first need to find the location of these points. You can use what you know about coordinate geometry to analyze the design's key points and features.



Problem 1.2 Parallels and Perpendiculars

This diagram shows some of the key points in the design. The design has reflection symmetry in both the x-axis and the y-axis. The radius is 5 units.



A. Find the coordinates of points B, C, E, F, and G.

B. List all pairs of parallel lines. How do the slopes of the lines in each pair compare? Explain why this makes sense.

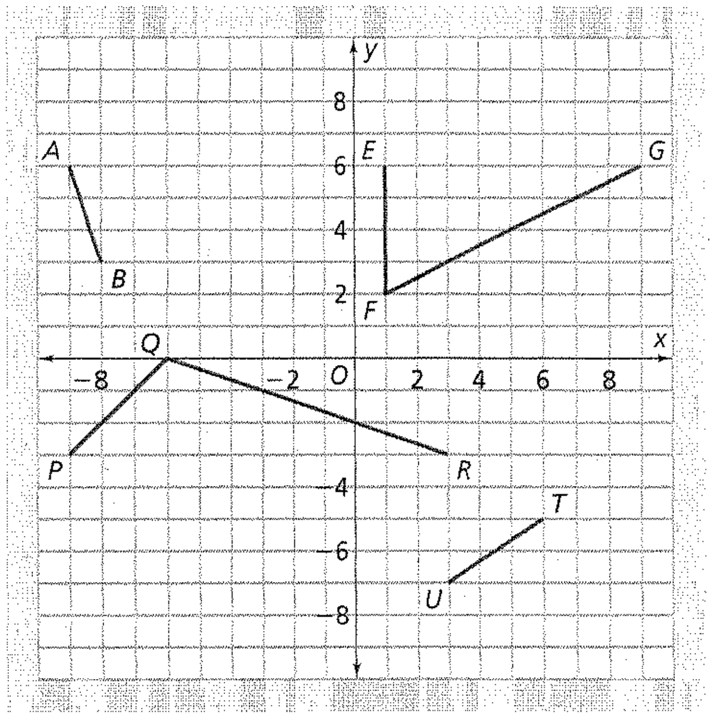
C. List all pairs of perpendicular lines. How do the slopes of the lines in each pair compare? Explain why this makes sense.

D. Locate a new point $K(2, y)$ on the circle. Draw a line segment from point K to the point $(5, 0)$. Can you draw a rectangle with this segment as one side and all its vertices on the circle? If so, give the coordinates of the vertices.

DAY 6: INTRODUCTORY GROUP ACTIVITY

E. 1. Kara was sketching on grid paper to try out some design ideas. She got interrupted! On a copy of Kara's diagram below, complete the polygons specified. (There may be more than one way to draw each one.) The polygons should all fit on the grid and should not overlap.

- Rectangle $ABCD$
- Parallelogram $EFGH$
- Parallelogram $PQRS$
- Rectangle $TUVW$



2. Give the coordinates of the vertex points for each figure.

3. Compare the slopes for all pairs of parallel sides. Describe the patterns you see. Are the patterns the same as you found in Question B?

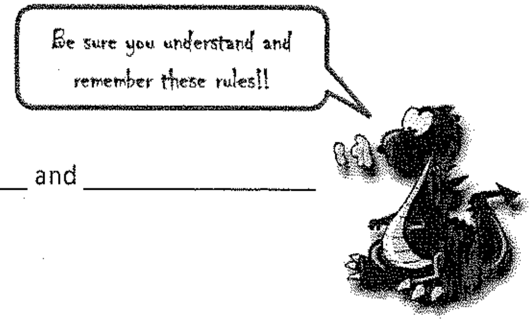
4. Compare the slopes for all pairs of perpendicular sides. Describe the patterns you see. Are the patterns the same as you found in Question C?

5. What is true about the equations for a pair of parallel lines? What is true about the equations for a pair of perpendicular lines?

ACE Homework starts on page 12.

DAY 6: NOTES (STUDY THESE!!) – Parallel and Perpendicular Lines

Summarize your findings from the opening activity:



For two lines to be parallel, they must have the same ____________ value.

For two lines to be perpendicular, their slope values must be ________________ and ________________ or their slopes must multiply together to be ______.

Lesson Objectives:

- Determine whether two lines are parallel or perpendicular or neither
- Find the equation of a parallel or perpendicular line to another line passing through a given point

Vocabulary: Parallel Lines, Perpendicular Lines, Opposite Reciprocals

Finding Parallel Equations:

Example: Find the equation of the line that is parallel to the line 3x – 2y = 8 and passes through the point (-3, 7).

Think: What is the slope you need? _______
What is the point you need? ________

Find the equation of this line in point-slope form, then simplify it to slope-intercept form:

Try it: Find the equation of the line that is parallel to the line $y = -\frac{2}{5}x - 6$ and passes through the point (3, -8).

Think: What is the slope you need? _______
What is the point you need? ________

Find the equation of this line in point-slope form, then simplify it to slope-intercept form:

Finding Perpendicular Equations:

Example: Find the equation of the line that is perpendicular to the line $y = -\frac{4}{7}(x + 2) - 5$ and passes through the point (-6,-1).

Think: What is the slope you need? _______
What is the point you need? ________

Find the equation of this line in point-slope form, then simplify it to slope-intercept form:

Try it: Find the equation of the line that is perpendicular to the line 7x – 2y = 5 and passes through the point (-4, 5).

Think: What is the slope you need? _______
What is the point you need? ________

Find the equation of this line in point-slope form, then simplify it to slope-intercept form:

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DAY 6: NOTES (STUDY THESE!!)

Thinking problems:

1) What is the slope of a line that is parallel to the x-axis?

2) ... perpendicular to the x-axis?

3) What is the slope of a line that is parallel to the y-axis?

4) ... perpendicular to the y-axis?

5) Find the equation of the line parallel to x = 6 passing through (-3, 9).

6) Find the equation of the line perpendicular to x = -2 passing through (2, 7).

Determine whether the graphs of the given equations are *parallel, perpendicular*, or *neither.* Explain.

1) $y = 4x + 5$
$-4x + y = -13$

2) $y = \frac{7}{9}x - 7$
$y = -\frac{7}{9}x + 3$

3) $y = \frac{7}{8}$
$x = -4$

4) $y = -6x - 8$
$-x + 6y = 12$

5) $3x + 6y = 12$
$y - 4 = -\frac{1}{2}(x + 2)$

6) $y = 4x + 12$
$x + 4y = 32$

Determine whether each statement is *always, sometimes*, or *never* true. Explain.

1) Two lines with different slopes are perpendicular.

2) The slopes of vertical lines and horizontal lines are negative reciprocals.

3) A vertical line is perpendicular to the *x*-axis.

<u>**Application:**</u> On a map, Sandusky St. passes through coordinates (2, -1) and (4, 8). Pennsylvania Ave. intersects Sandusky St. and passes through coordinates (1, 3) and (6, 2). Are these streets perpendicular? Explain.

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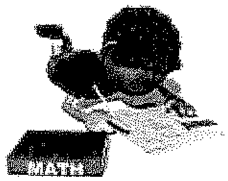
DAY 6: HOMEWORK (USE NOTES)



Parallel & Perpendicular
~
Student Practice Worksheet

Name____________________________________Date____________Grade_________

Find the slope-intercept form of the line described.

1. Passes through (4, 2), parallel to y = $-\frac{3}{4}x - 5$

2. Passes through (4, 2), perpendicular to y = $-\frac{3}{4}x - 5$

3. Passes through (-3, -3), parallel to y = $\frac{7}{3}x + 3$

4. Passes through (-3, -3), Perpendicular to y = $\frac{7}{3}x + 3$

5. Passes through (-4, 0), parallel to y = $\frac{3}{4}x - 2$

6. Passes through (-4, 0), perpendicular to y = $\frac{3}{4}x - 2$

7. Passes through (-1, 4), parallel to y = -5x + 2

DAY 6: HOMEWORK (USE NOTES)

8. Passes through (-1, 4), perpendicular to $y = -5x + 2$

9. Passes through (2, 0), perpendicular to $y = \frac{1}{3}x + 3$

10. Passes through (2, 0), parallel to $y = \frac{1}{3}x + 3$

11. Passes through (4, -4), parallel to $y = -x - 4$

12. Passes through (4, -4), perpendicular to $y = -x - 4$

13. Passes through (-2, 4), perpendicular to $y = -\frac{5}{2}x + 5$

14. Passes through (-2, 4), parallel to $y = -\frac{5}{2}x + 5$

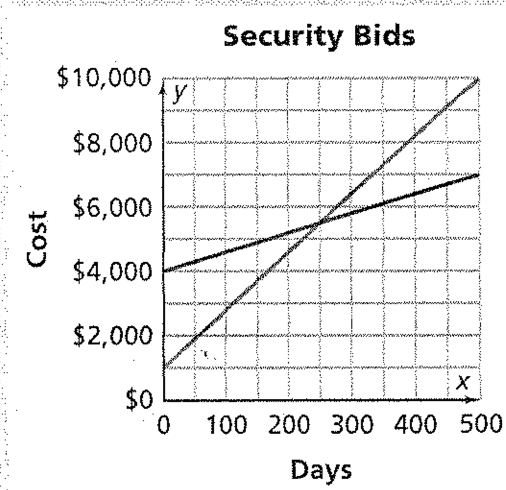
15. Passes through (-4, -1), parallel to $y = -\frac{1}{2}x - 1$

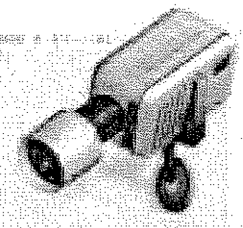
16. Passes through (-4, -1), perpendicular to $y = -\frac{1}{2}x - 1$

DAY 7: INTRODUCTORY GROUP ACTIVITY

2.1 Graphs of Linear Systems

The cost of the security services from Super Locks and Fail Safe depends on the number of days the company provides service. The graph below shows the bids for both companies.





Problem 2.1 Graphs of Linear Systems

A. Use the graphs to estimate the answers to these questions. Explain your reasoning in each case.

1. For what number of days will the costs for the two companies be the same? What is that cost?
2. For what numbers of days will Super Locks cost less than Fail Safe?
3. For what numbers of days will Super Locks cost less than $6,000?
4. What is the cost of one year of service from Fail Safe?
5. How can Fail Safe adjust its per-day charge to make its cost for 500 days of service cheaper than Super Locks' cost?

B. For each company, write an equation for the cost c for d days of security services.

C. For parts (1) and (4) of Question A, write an equation you can solve to answer the question. Then use symbolic methods to find the exact answers.

ACE Homework starts on page 30.

DAY 7: INTRODUCTORY GROUP ACTIVITY

2.2 Linear Inequalities

In Problem 2.1, you used graphic and symbolic methods to analyze a **system of linear equations.** The problem conditions could be expressed as two equations relating security costs and the number of days for the business contract. The coordinates of the intersection point of the graphs satisfied both equations in the system. This point is the *solution* of the system.

Getting Ready for Problem 2.2

The cost equations for the two security companies are a system of linear equations:

$$c = 3{,}975 + 6d \quad \text{(Super Locks)}$$
$$\text{and} \quad c = 995 + 17.95d \quad \text{(Fail Safe)}$$

In previous units, you learned some methods to solve this linear system to find the number of days for which the costs are the same for both companies. Here is one possible solution method:

$$3{,}975 + 6d = 995 + 17.95d \qquad (1)$$
$$2{,}980 = 11.95d \qquad (2)$$
$$249 \approx d \qquad (3)$$

- Give a reason for each step in the solution.
- What is the overall strategy that guides the solution process?
- What does the statement $d \approx 249$ tell you?
- How can the solution to this system help you answer this question: For what numbers of days will Super Locks cost less than Fail Safe?
- What does your answer to the previous question tell you about solutions to the inequality $3{,}975 + 6d < 995 + 17.95d$?

DAY 7: INTRODUCTORY GROUP ACTIVITY

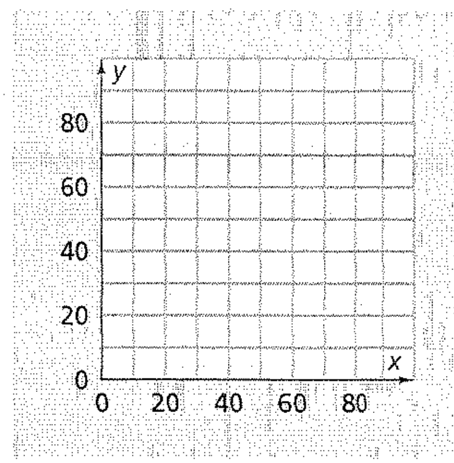
Problem 3.3 Intersections of Lines

A. Let x stand for the number of \$10 adult memberships and y for the number of \$5 student memberships.

1. What equation relates x and y to the \$400 income?
2. Give two solutions for your equation from part (1).
3. What equation relates x and y to the total of 50 new members? Are the solutions you found in part (2) also solutions of this equation?

B.

1. Graph the two equations from Question A on a single coordinate grid like the one at the right.
2. Estimate the coordinates of the point where the graphs intersect. Explain what the coordinates tell you about the numbers of adult and student memberships sold.
3. Consider the graph of the equation that relates x and y to the \$400 income. Could a point that is *not* on this graph be a solution to the equation?
4. Could there be a common solution for both of your equations that is *not* shown on your graph?



In Question A, you wrote a system of equations. One equation represents all (x, y) pairs that give a total income of \$400, and the other represents all (x, y) pairs that give a total of 50 memberships. The coordinates of the intersection point satisfy both equations, or conditions. These coordinates are the *solution to the system.*

Many real-life problems can be represented by systems of equations. In Question C, you'll practice solving such systems graphically.

C. Use graphic methods to solve each system. In each case, substitute the solution values into the equations to see if your solution is exact or an estimate.

1. $x + y = 4$ and $x - y = -2$
2. $2x + y = -1$ and $x - 2y = 7$
3. $2x + y = 3$ and $-x + 2y = 6$

ACE **Homework starts on page 42.**

DAY 4 NOTES: (STUDY THESE!!)

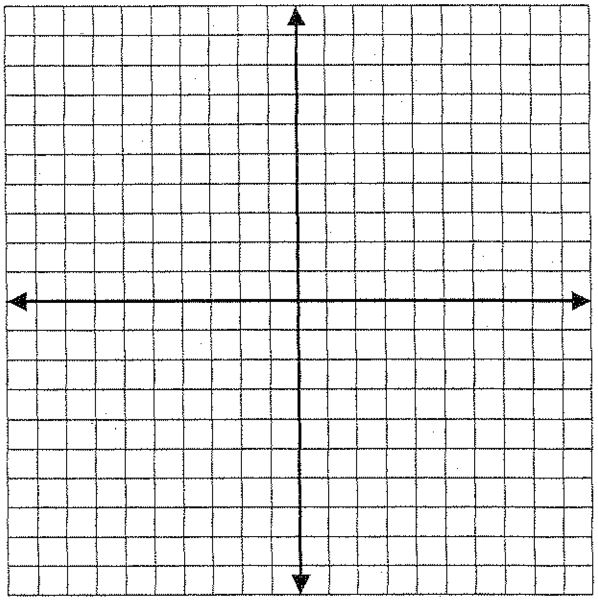
Systems of Equations Lab - Finding the Intersection

Name: Class:

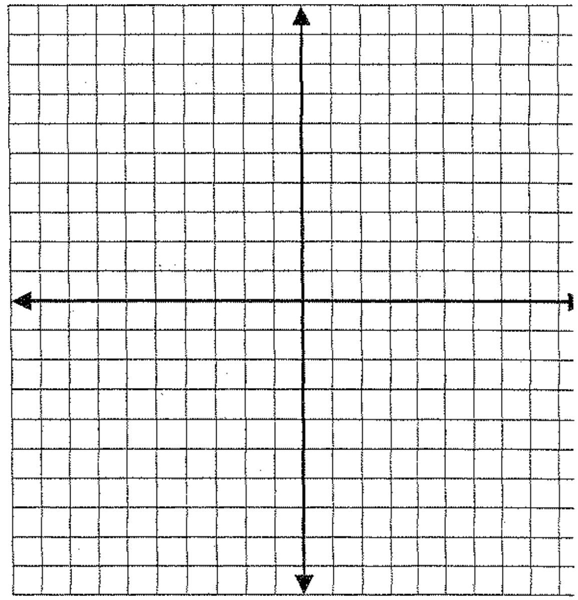
Directions: For the following equations, complete a-c.

a. Create a table (use at least 3 points - negative and positive) and then graph both equations.
b. Find the point of intersection for the graphs.
c. Test the point of intersection you found by substituting its coordinates into the equations.

1. $y = 5x + 24$
$y = -3x - 8$



2. $y = -\frac{1}{2}x + 2$
$y = x - 10$



YOU TRY:

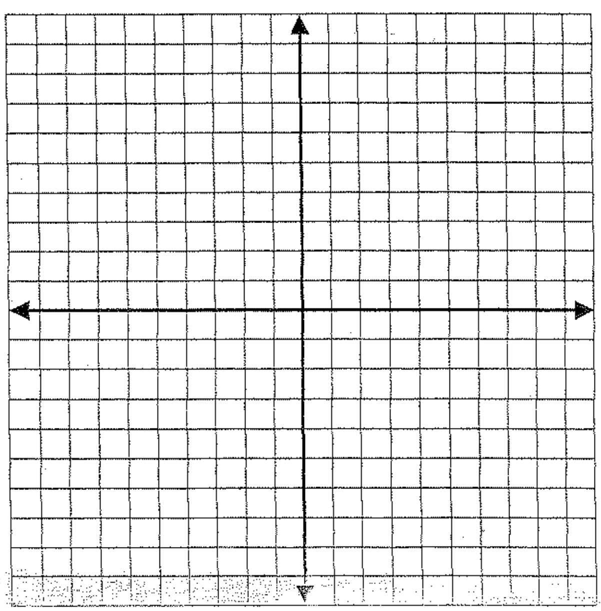
Systems of Equations Lab - Finding the Intersection

Name: Class:

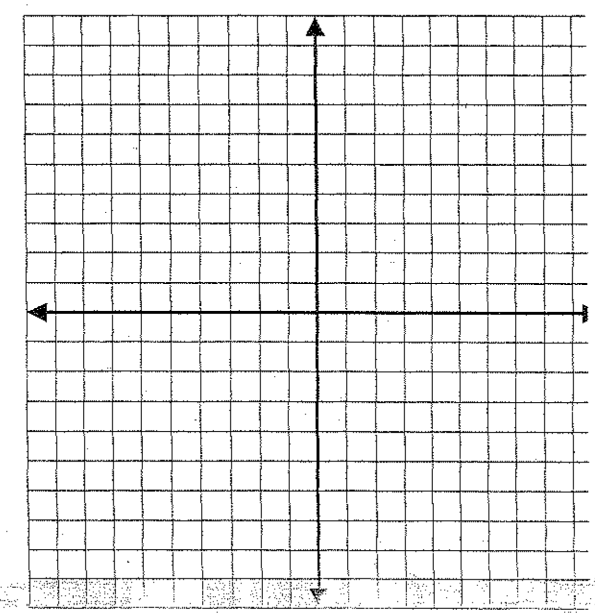
Directions: For the following equations, complete a-c.

a. Create a table (use at least 3 points - negative and positive) and then graph both equations.
b. Find the point of intersection for the graphs.
c. Test the point of intersection you found by substituting its coordinates into the equations.

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



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



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Applications Connections Extensions ACE

DAY 7: HOMEWORK

Applications (USE P

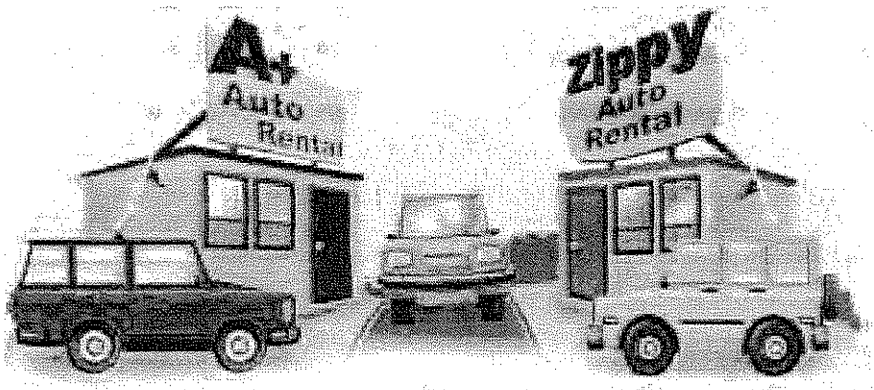
1. a. Sam needs to rent a car for a one-week trip in Oregon. He is considering two companies. A+ Auto Rental charges $175 plus $0.10 per mile. Zippy Auto Rental charges $220 plus $0.05 per mile. Write an equation relating the rental cost for each company to the miles driven.

   b. Graph the equations.

   c. Under what circumstances is the rental cost the same for both companies? What is that cost?

   d. Under what circumstances is renting from Zippy cheaper than renting from A+?

   e. Suppose Sam rents a car from A+ and drives it 225 miles. What is his rental cost?



CHECK THIS OUT!

Homework Help Online
PHSchool.com
For: Help with Exercise 2
Web Code: ape-7202

2. Maggie lives 1,250 meters from school. Ming lives 800 meters from school. Both girls leave for school at the same time. Maggie walks at an average speed of 70 meters per minute, while Ming walks at an average speed of 40 meters per minute. Maggie's route takes her past Ming's house.

   a. Write equations that show Maggie and Ming's distances from school t minutes after they leave their homes.

   Answer parts (b)–(d) by writing and solving equations or inequalities.

   b. When, if ever, will Maggie catch up with Ming?

   c. How long will Maggie remain behind Ming?

   d. At what times is the distance between the two girls less than 20 meters?