

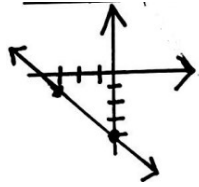
Guided Worksheet: Slope, Graphing & Writing Equations of Lines, Solving Systems of Linear Equations

DIRECTIONS Show work for each problem. Refer to the examples to guide you as you do the review work. Ask questions as necessary as well. ☺

Slope

1. Make a tiny sketch of the line passing through the given points. Then find the slope of the line.

Example $(-3, -1) & (0, -4)$



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

$$m = \frac{-4 - (-1)}{0 - (-3)} = \frac{-3}{3} = -1$$

or $m = -\frac{\text{rise}}{\text{run}}$

$$m = -\frac{3}{3}$$

$$m = -1$$

- a) $(-1, 2) & (3, 5)$ b) $(1, -3) & (1, 4)$ c) $(0, 4) & (-3, -2)$ d) $(-2, 2) & (-5, 2)$

2. Name the slope of the given line.

Example $y = -4x - 7$

$$m = -4$$

Example $3x + 5y = -11$

$$5y = -3x - 11$$

$$y = -\frac{3}{5}x - \frac{11}{5}$$

$$m = -\frac{3}{5}$$

or $m = -\frac{a}{b}$

$$m = -\frac{3}{5}$$

a) $y = -\frac{3}{4}x + 1$

b) $6x - 2y = 5$

3. Name the slope...

- a) of any horizontal line b) of any vertical line

4. Name the slope of the line being described.

Example \perp to $y = \frac{2}{3}x - 8$ Example \parallel to $x = -2$

given line: $m = \frac{2}{3}$

given line is vertical \Rightarrow m is und.

\perp line: $m = -\frac{3}{2}$

\parallel line: m is also undefined

- a) \parallel to $y = 6x - 5$ b) \perp to $x = 4$ c) \perp to $3x + 2y = 7$ d) \parallel to $y = -1$

5. Are the two lines being described parallel \parallel , perpendicular \perp , or simply intersecting? Name the slope of each in order to justify your answer.

Example l_1 : passes through $(0, 4)$ & $(-2, 7)$, l_2 : $15x + 10y = -1$

$$m = \frac{7-4}{-2-0} = \frac{3}{-2}$$

$$m = -\frac{a}{b}$$

$$m = \frac{-15}{10} = -\frac{3}{2}$$

$l_1 \parallel l_2$

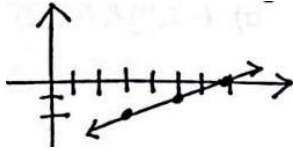
- a) l_3 : $y = \frac{1}{3}x + 4$, l_4 : $y = 3x - 1$

- b) l_5 : $-10x + 8y = 3$, l_6 : $y = \frac{5}{4}x + 2$

- c) l_7 : passes through $(0, 4)$ & $(1, -6)$, l_8 : $3x - 30y = -6$

6. Name two additional points which must lie on the line. There are many correct answers. Sketching is helpful!

Example line through $(3, -2)$, $m = \frac{1}{2}$



start at $(3, -2)$
count up 1, right 2
or count down 1, left 2

$(5, -1)$ & $(7, 0)$

a) line through $(4, 3)$, $m = \frac{-2}{5}$

b) line through $(-1, -3)$, $m = 0$

7. Find the missing coordinate.

Example The line passes through $(2, a)$ & $(4, -1)$ and has a slope $= \frac{1}{3}$.

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

$$\frac{1}{3} = \frac{a + 1}{2 - 4}$$

$$\begin{aligned} 3(a + 1) &= -2 \\ 3a + 3 &= -2 \\ 3a &= -5 \\ a &= -\frac{5}{3} \end{aligned}$$

a) The line passes through $(b, 4)$ & $(3, -2)$ and has a slope $= \frac{6}{5}$.

b) The line passes through $(-2, c)$ & $(5, 0)$ and has a slope $= -2$.

Graphing Lines

8. Graph the lines.

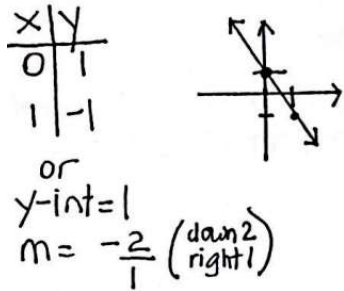
a) through $(2, 3)$ with a slope $= \frac{5}{2}$

b) through $(2, 1)$ with zero slope

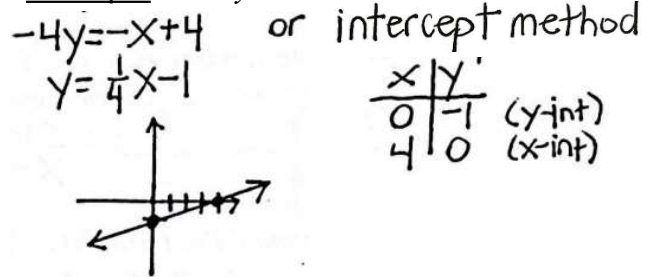
c) through $(-2,3)$ with undefined slope

9. Graph the diagonal lines using the method of your choice.

Example $y = -2x + 1$



Example $x - 4y = 4$



a) $y = x$

c) $y = -\frac{1}{4}x + 2$

e) $4x + 3y = 24$

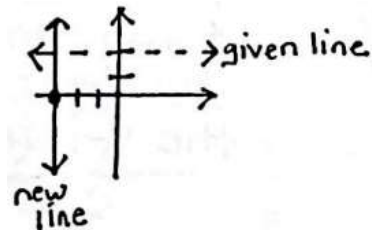
b) $y = 3x - 4$

d) $-2x + 3y = -6$

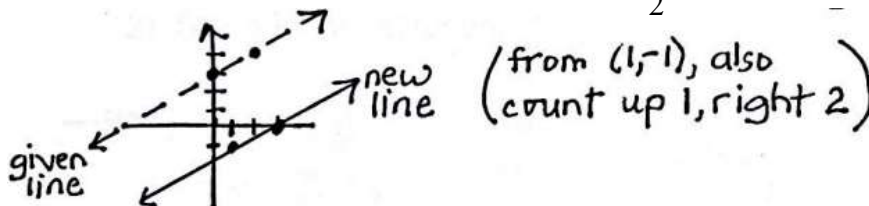
f) $5x - 3y = 10$

10. Graph the lines being described. It is helpful to graph both the given line (dotted) and the new line (solid) on the same coordinate plane in order to see the parallel or perpendicular description.

Example the line through $(-3,0)$ that is \perp to $y = 2$



Example the line through $(1,-1)$ that is \parallel to $y = \frac{1}{2}x + 3$



a) the line through (1,3) that is // to $x = -2$

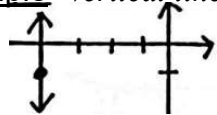
b) the line through (3,1) that is \perp to $y = 5x + 4$

c) the perpendicular bisector of the segment with endpoints (0,6) & (8,-4)

Writing Equations of Lines

11. Write the equation of each horizontal or vertical line.

Example vertical line through (-4,-1)



Since the vertical line cuts through the X-axis, the equation is $x = -4$.

a) horizontal line through (2,-2) b) line through (-2,-4) with undefined slope

c) line through (-4,-1) & (3,-1) d) the line through (1,3) that is // to $x = -2$
(refer to your graph in 10a)

12. Write the equation of each diagonal line.

Example line through (4,0) & (0,-3)

$$m = \frac{-3-0}{0-4} = \frac{-3}{-4} = \frac{3}{4}$$

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

(Go straight to $y = mx + b$ form since (0,-3) is the y-intercept.)

Example line through (5,-2) with slope = $\frac{2}{7}$

$$y - (-2) = \frac{2}{7}(x - 5)$$

$$y + 2 = \frac{2}{7}(x - 5)$$

$$7(y + 2) = 2(x - 5)$$

$$7y + 14 = 2x - 10$$

$$7y = 2x - 24$$

$$y = \frac{2}{7}x - \frac{24}{7}$$

(start with point-slope form since you don't have the y-intercept.)

a) line through (0,2) with slope = $-\frac{1}{9}$

b) line through (-3,4) with slope = $\frac{3}{2}$

c) *line through* $(-6,0)$ & $(0,9)$

d) *line through* $(5,-1)$ & $(1,-3)$

e) *line through* $(-2,8)$ & $(1,-1)$

f) *the line through* $(0,-1)$ *that is // to* $y = \frac{5}{2}x - 3$

g) *the line through* $(3,1)$ *that is \perp to* $y = 5x + 4$ (refer to your graph in 10b)

h) the perpendicular bisector of the segment with endpoints $(0,6)$ & $(8,-4)$
(refer to your graph in 10c)

Challenge problems

13. Determine k so that the given line will have the given slope.

a) $12x - ky = 5$, $m = 3$

c) $(-4,k)$ & $(-1,3k)$, $m = 4$

b) $kx + 2y = 6$, $m = k + 1$

d) $(k+1,k)$ & $(-3,2)$, $m = 2$

14. If $f(x)$ and $g(x)$ are linear functions, write the equation for each given:

a) $f(3) = -2$, $f(2) = 0$

b) $g(4) = 4$, $g(6) = -9$

Systems of Linear Equations

Information To solve a system of linear equations means to determine the point at which the two lines intersect. There are three types of linear systems:

1. A system of intersecting lines has *one solution*.
2. A system of parallel lines has *no solution*.
3. A system of overlapping lines has *infinitely many solutions*.

There are 3 basic ways to solve systems:

1. Graphing
2. Substitution
3. Elimination

Examples

1) Solve by graphing:
$$\begin{cases} 5x + 3y = 30 \\ x + 3y = 18 \end{cases}$$

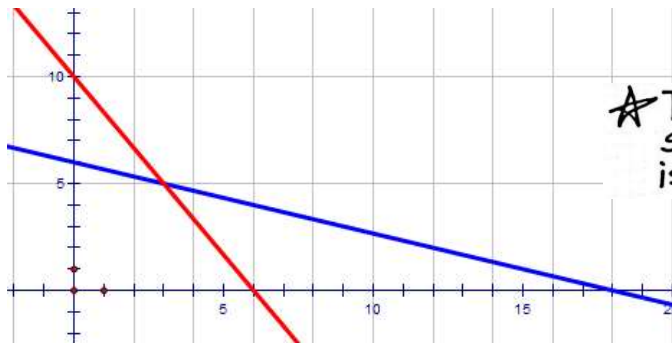
intercept method

$$5x + 3y = 30$$

x	y
0	10
6	0

$$x + 3y = 18$$

x	y
0	6
18	0



★ The solution is (3, 5).

2) Solve by substitution:
$$\begin{cases} 3x - 5y = -71 \\ -8x + 4y = 68 \end{cases}$$

$$-8x + 4y = 68$$

$$4y = 8x + 68$$

$$y = 2x + 17$$

Isolate y in 2nd equation.

$$3x - 5(2x + 17) = -71$$

$$3x - 10x - 85 = -71$$

$$-7x = 14$$

$$x = -2$$

Sub y into the 1st equation.

Solve for x.

$$y = 2(-2) + 17$$

$$y = -4 + 17$$

$$y = 13$$

$$(-2, 13)$$

Sub x back in for y.

Give answer as ordered pair.

3) Solve by elimination:
$$\begin{cases} \frac{4}{5}x - \frac{2}{3}y = 18 \\ 3y = 4x - 87 \end{cases}$$

$$15 \left[\frac{4}{5}x - \frac{2}{3}y = 18 \right]$$

$$-4x + 3y = -87$$

Clear fractions. Rearrange.

$$12x - 10y = 270$$

$$3[-4x + 3y = -87]$$

Set up to eliminate.

$$12x - 10y = 270$$

$$-12x + 9y = -261$$

combine equations.

$$-y = 9$$

$$y = -9$$

Solve for y.

$$-4x + 3(-9) = -87$$

$$-4x = -87 + 27$$

$$-4x = -60$$

$$x = 15$$

Sub in to get x.

$$(15, -9)$$

Ordered pair.

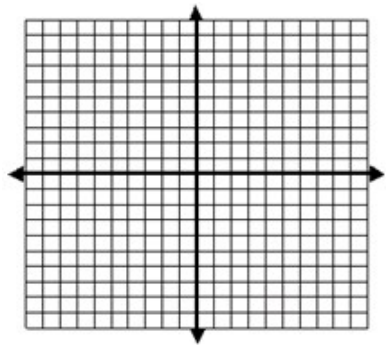
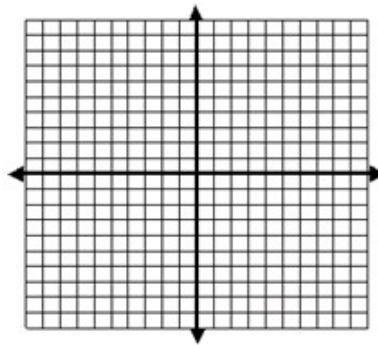
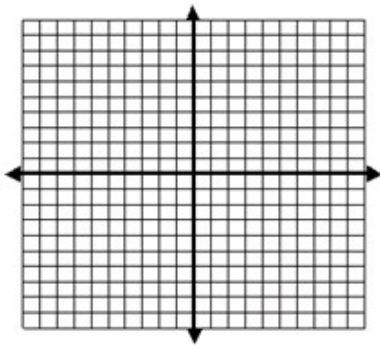
Practice Problems

Solve by graphing. If the lines intersect, name the point of intersection. If the lines are parallel, clearly state "no solution". If the lines overlap, clearly state "many solutions".

15.
$$\begin{cases} 5x - 2y = 8 \\ y = \frac{5}{2}x + 1 \end{cases}$$

16.
$$\begin{cases} 2x - y = 1 \\ 3x + 4y = -15 \end{cases}$$

17.
$$\begin{cases} x + 2y = 6 \\ -\frac{3}{4}y = \frac{3}{8}x - \frac{9}{4} \end{cases}$$



Solve by substitution. If the lines intersect, state the solution as an ordered pair.

18.
$$\begin{cases} y = 3x - 37 \\ 4x + 2y = 26 \end{cases}$$

19.
$$\begin{cases} 6x - 4y = 18 \\ x + 7y = -66 \end{cases}$$

20.
$$\begin{cases} 3x - 8y = -47 \\ 4x + 2y = -12 \end{cases}$$

21.
$$\begin{cases} 6x - 9y = -36 \\ \frac{5}{4}y = \frac{5}{6}x + 5 \end{cases}$$

Solve by elimination. If the lines intersect, state the solution as an ordered pair.

$$22. \begin{cases} 5x + 3y = 6 \\ 4x - 9y = -75 \end{cases}$$

$$23. \begin{cases} 10x - 15y = 20 \\ 2x - 3y = -10 \end{cases}$$

$$24. \begin{cases} 5x + 35y = -5 \\ -11x + 6y = -72 \end{cases}$$

$$25. \begin{cases} y = -2x - 11 \\ 2x - \frac{22}{7}y = \frac{-222}{7} \end{cases}$$

Applications! Read each scenario and set up two equations with two variables for each one. Solve each system by the method of your choice. Be sure to answer the “word problems” with clearly stated “word answers”, not as ordered pairs. (For example, don’t write (3,4). Instead write “3 elephants and 4 rhinos live at the zoo.”)

26. A body building team is made up of 15 competitors. On average, the female competitors can bench press 120 lbs, while the male competitors can bench press 225 lbs. At one competition, the team benches a total of 2745 lbs. How many female and male competitors are on the team?

27. The male competitors on the body building team can generally squat about 50 lbs less than twice the females' squatting weight. In a co-ed partner squat event, the male/female squat partners squatted a total of 475 lbs. What, then, is the average squatting weight for male and female competitors?

28. The cheerleading team sells sun products as a fundraiser to defray camp expenses. Kara sells 31 bottles of sunscreen and 16 tubes of lip balm and raises \$69.45. Macy sells 24 bottles of sunscreen and 20 tubes of lip balm and raises \$61. How much profit is raised from the sale of a single sunscreen and a single lip balm?

29. Before cell phones came along and unlimited long-distance calling packages were widely available, long-distance carriers offered competitive calling plans. AT&T introduced their "dime line". Customers paid a monthly fee of \$5 plus only 10 cents per minute of long-distance calling time. Sprint offered a plan in which customers simply paid 30 cents per minute with no monthly fee. How many minutes of long-distance time make the customer charges equal? Which plan would be more beneficial to a small business that dealt with clients across the country? Explain your answer.

30. Two friends rent an apartment for \$975/month. Each person's rent contribution is based on bedroom size. One bedroom is 60 square feet larger than the other. Each person pays \$3.25/square foot. Let x be the area of the small bedroom and y be the area of the large bedroom. Find the size of each bedroom and the rent contribution each person makes per month.