DIY: *Lines – Graphing and Equations*

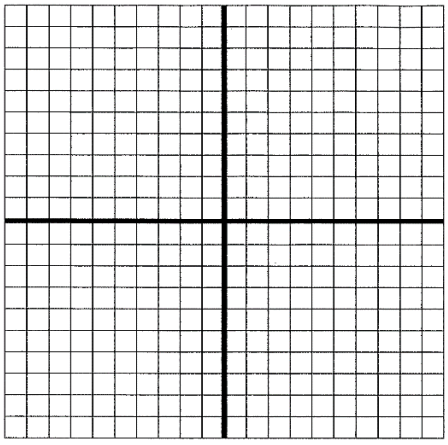
To review lines, watch the following set of YouTube videos explaining **graphing lines, finding slopes and equations of lines.** They are followed by several practice problems for you to try, covering all the basic concepts covered in the videos, with answers and detailed solutions. Some additional resources are included for more practice at the end.

1. **Graphing Points and Lines on a Coordinate Plane**
   a. Introduction to Coordinate Plane
   b. Graphing Linear Equations by Plotting Ordered Pairs
   c. Graphing Linear Equations by Solve for Y and then Plotting Ordered Pairs
2. **Slope of a Line**
   a. Part 1: Slope of a line
   b. Part 2: Graphing lines with equations of form y=mx
   c. Part 3: Graphing lines with equations of form y=mx+b
   d. Identifying parallel and perpendicular lines
3. **Finding Equations of Lines**
   a. Finding equations of lines given two points on line
   b. Finding the equation of a line using the point-slope form
   c. Three main forms of linear equations in two variables
   d. Horizontal and Vertical lines
   e. Equations of Parallel and Perpendicular lines

Practice problems: The following problems use the techniques demonstrated in the above videos. The answers are given after the problems. Then detailed solutions, if you need them, are provided after the answer section. For further assistance and help please contact ***Math Assistance Area***.

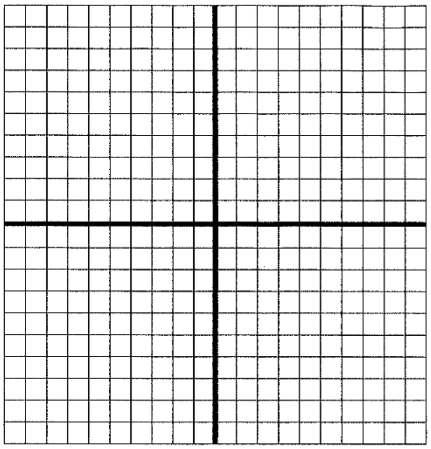
1. Plot the following points in the graph coordinate plane provided.

a. (2,3) b. (0,5) c. (-5,0) d. (-1,7) e. (-4,-8) f. (3,-1)

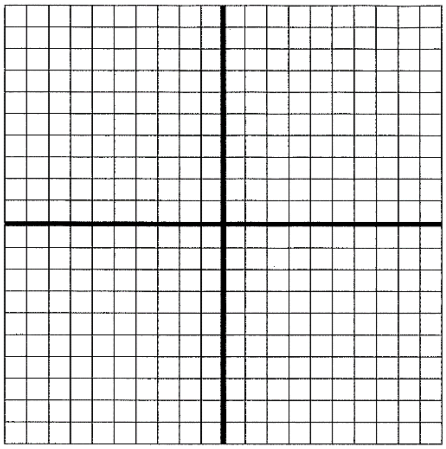


2. Graph the following lines by plotting ordered pairs of points.

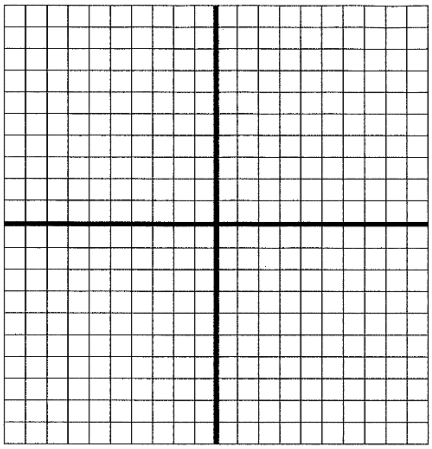
a. y=2x+5



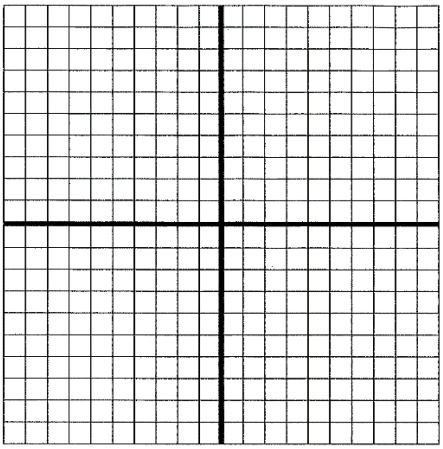
b. y= -3x-2



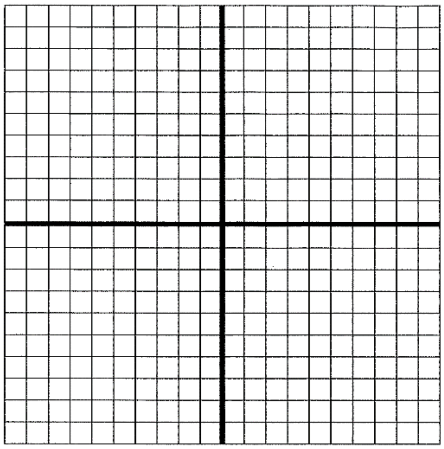
c. 2y+2x=2



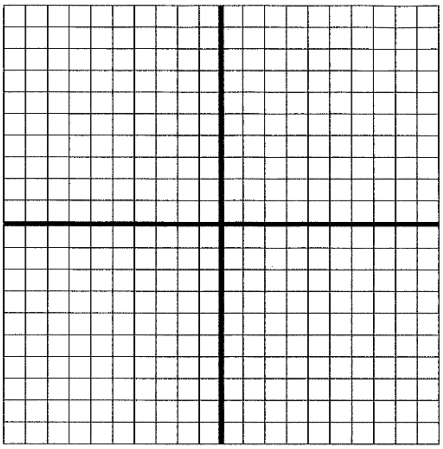
d. 8x+10y=10



e. X=6

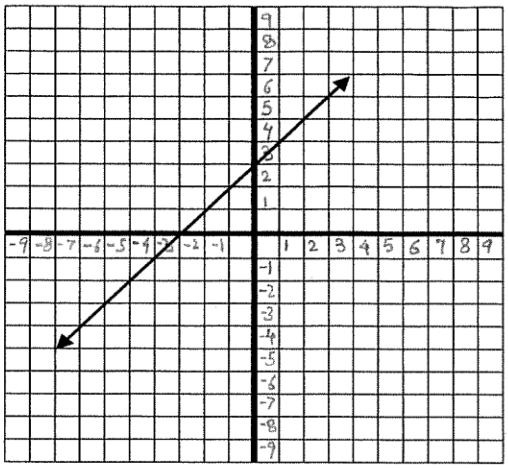


f. Y= -5

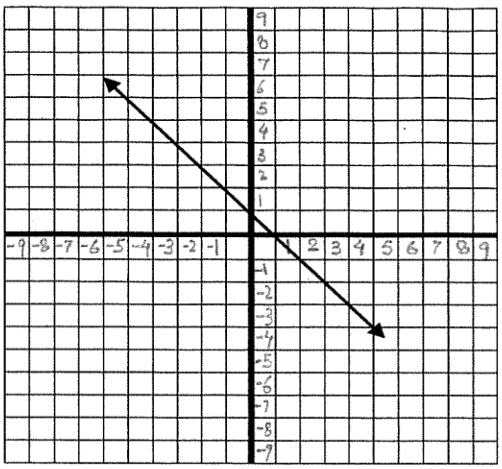


3. Find the slope and y intercept of the following lines:

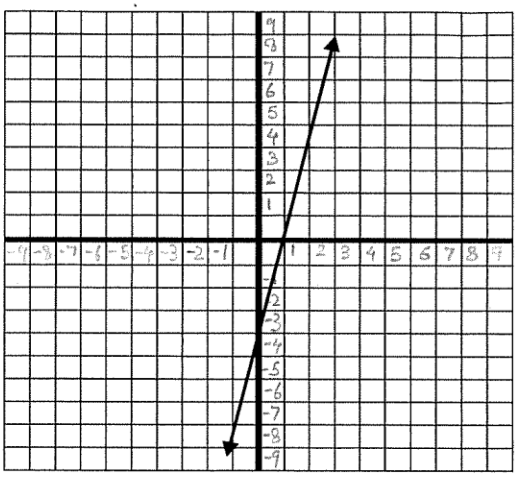
a.



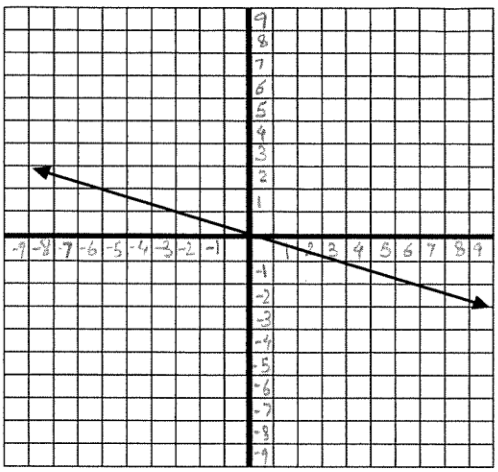
b.



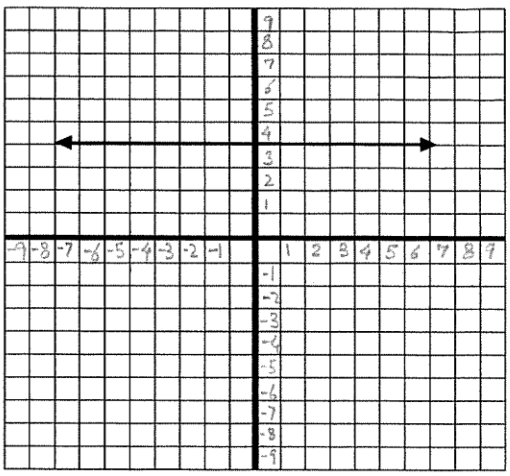
c.



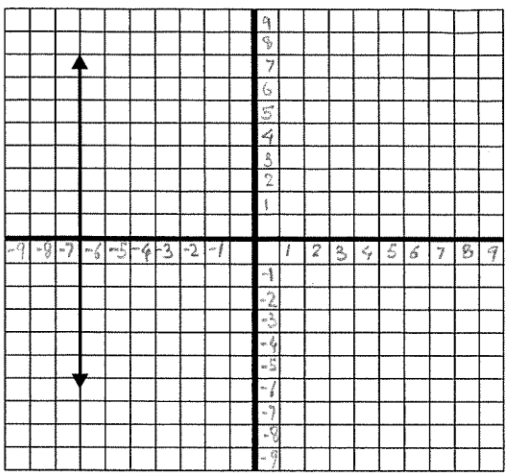
d.



e.



f.



4. Find the slope of the line passing through:

a. (1,7) and (4,10)
b. (10,5) and (-20,2)
c. (-15,0) and (2,0)
d. (13,22) and (-19,-28)
e. (-100,-6) and (69,7)
f. (-12,-13) and (-9,-50)

5. Find the equations of the following lines using the information given. Where possible, find the equation using the point-slope formula, then express the final equation in slope-intercept form.

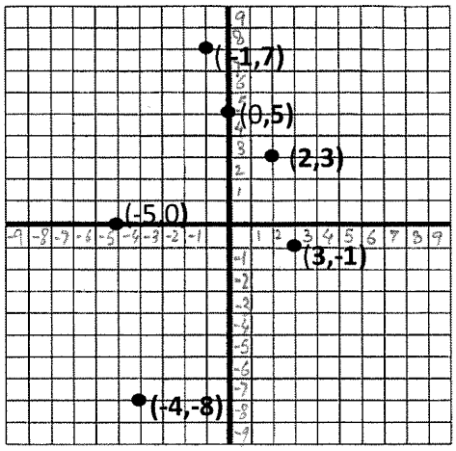
a. Slope of $\frac{2}{3}$ and y-intercept at (0,-2)
b. Passing through point (2,4) and with slope 1/3
c. Passing through points (0,0) and (3,-5)
d. (Slope of $-\frac{3}{2}$ and x-intercept at (-3, 0)
e. Parallel to y-axis and passing through (-4,0)
f. Parallel to x-axis and passing through (0,6)

6. Write the equations of the following lines:
   a. Parallel to y = 12x + 9 and passing through the point (2, 12)
   b. Perpendicular to 3x - 5y = 25 and passing through the point (6, -2)

7. When purchased, the value of a machine was $56,000. The machine's value depreciates linearly, with a scrap value of $2,000 after 9 years.
   a. Write an equation for the value of the machine, y, in dollars, in terms of the number of years since its purchase, x.
   b. Use the equation found in part a to find the value of the machine 3 years after purchase.
   c. In the context of this application, what are the meanings of the y-intercept and slope?

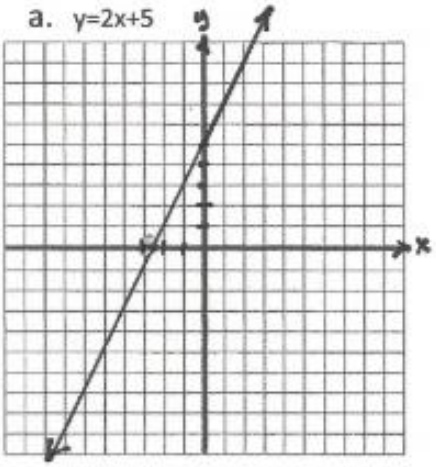
Answers:

1.

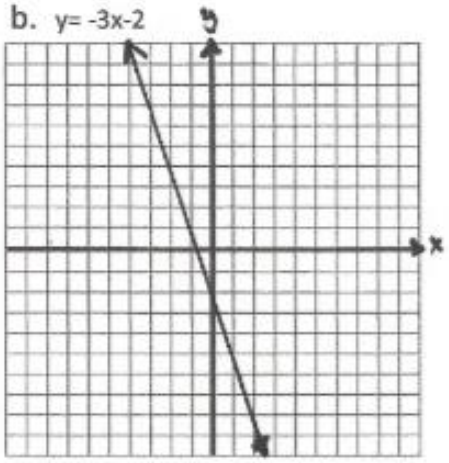


2. Graph the following lines by plotting ordered pairs of points.

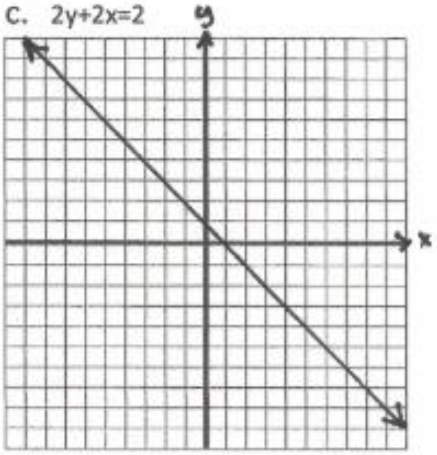
a. y=2x+5



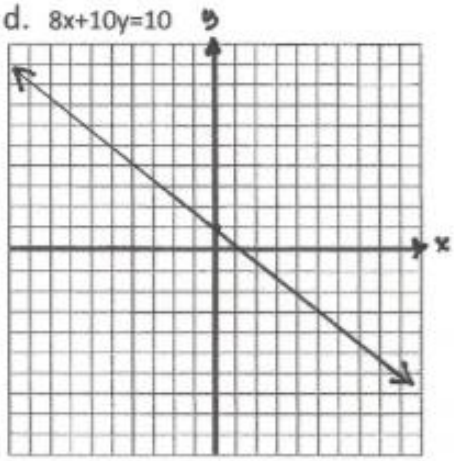
b. y= -3x-2



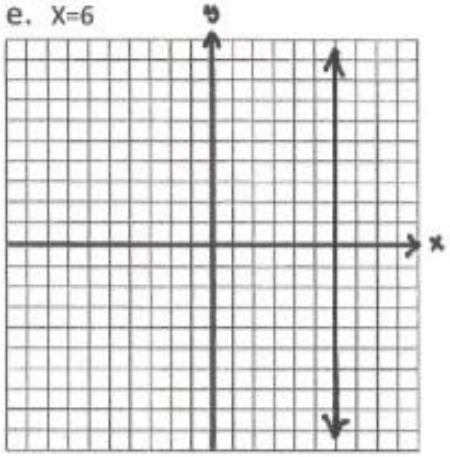
c. 2y+2x=2



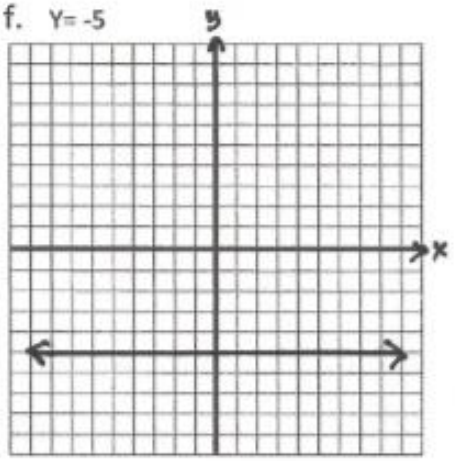
d. 8x+10y=10



e. X=6



f. Y= -5



3.

a) Y-int: (0,3)
Slope m = 1

b) Y-int: (0,1)
Slope m = -1

c) Y-int: (0,-4)
Slope m = 4

d) Y-int: (0,0)
Slope m = $\frac{-1}{3}$

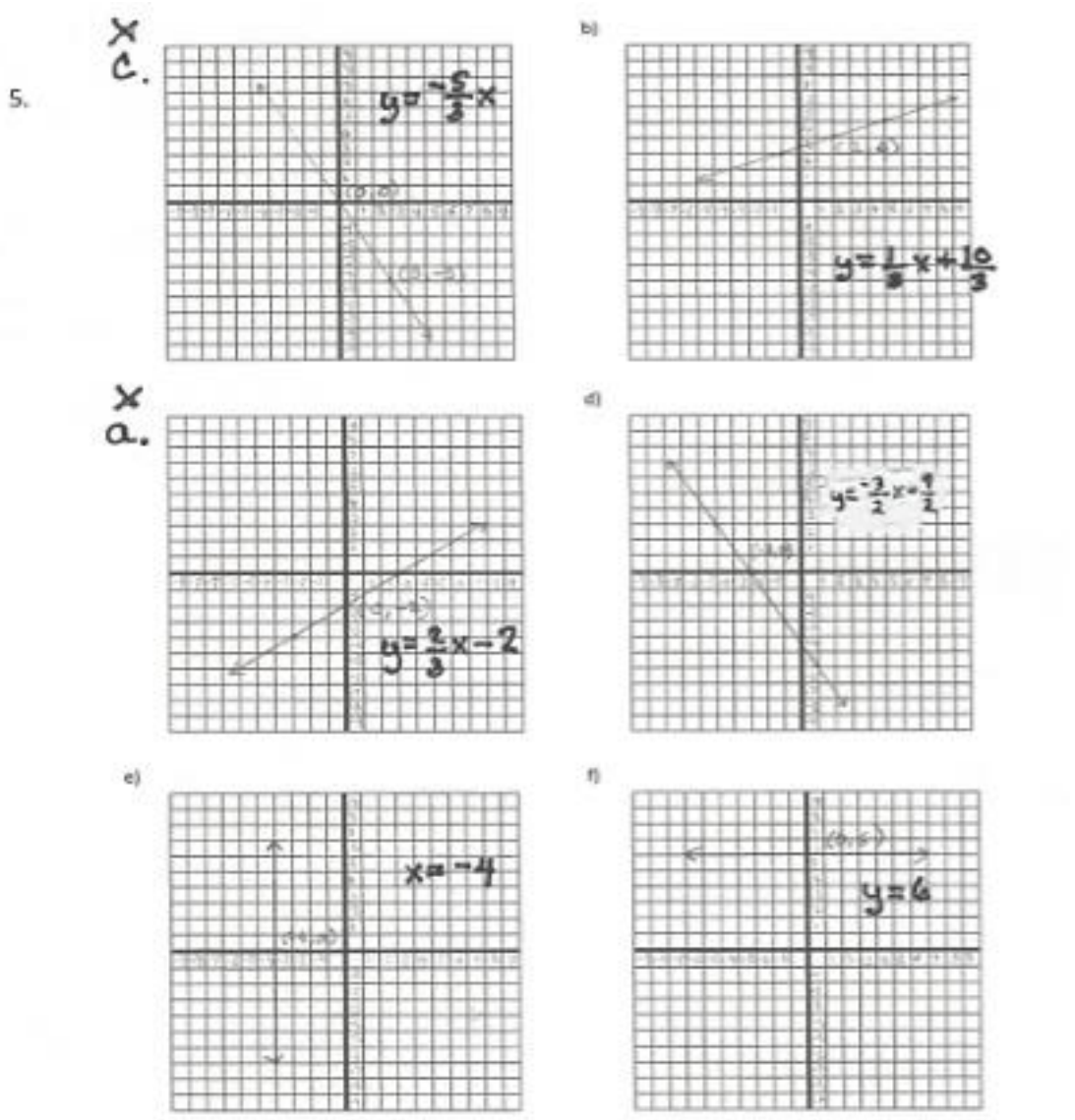
e) Y-int: (0,4)
Slope m= 0

f) Y-int: None
Slope m is undefined

4.

a) 1 b) $\frac{1}{10}$ c) 0 d) $\frac{25}{16}$ e) $\frac{1}{13}$ f) $\frac{-37}{3}$

5.



6. a. $y = 12x - 12$ b. $y = -\frac{5}{3}x + 8$

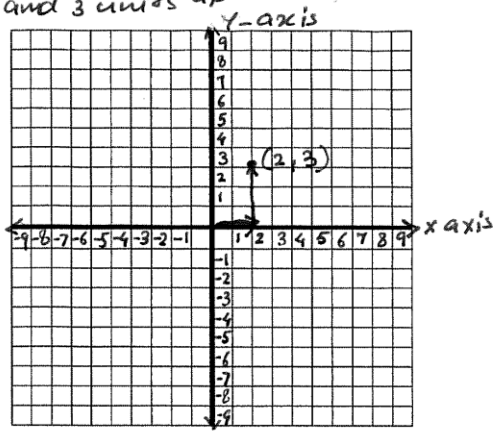
7. a. $y = -6000x + 56{,}000$

b. \$38,000

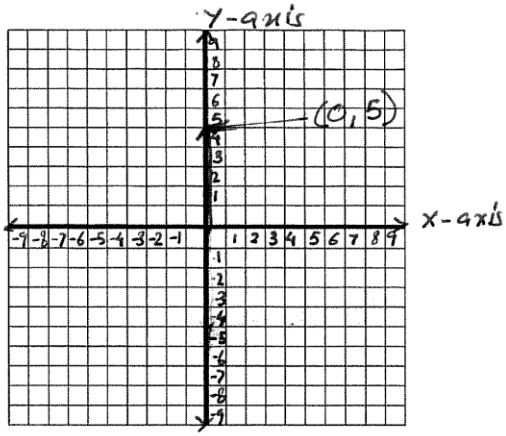
c. y-intercept is the value at purchase (when time x = 0). The slope is the decrease in value of the machine per year.

Detailed Solutions for Graphing and Equations of Lines

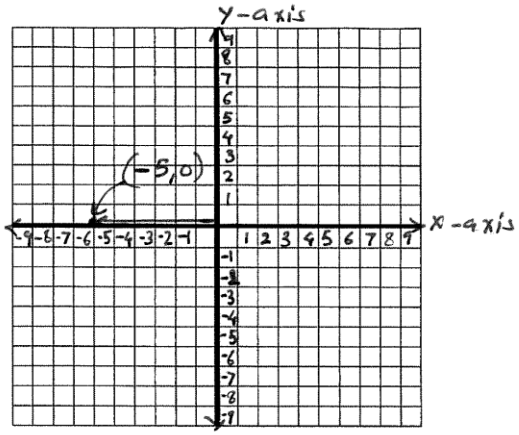
1 a) $(2,3)$ move 2 units to the right and 3 units up



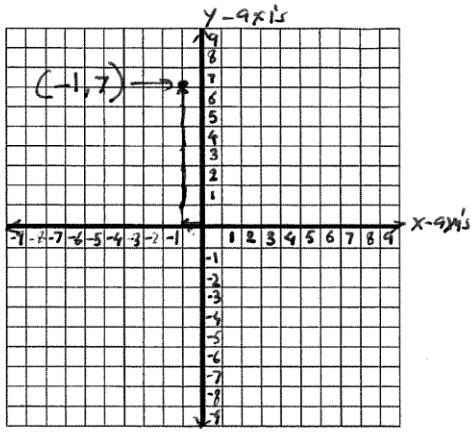
1 b) $(0,5)$ move 5 units up.



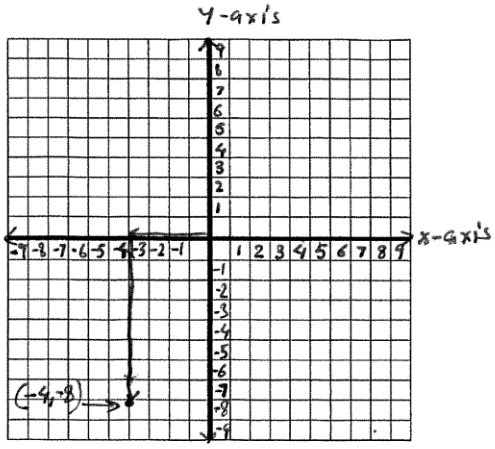
1 c) $(-5,0)$ move 5 units to the left



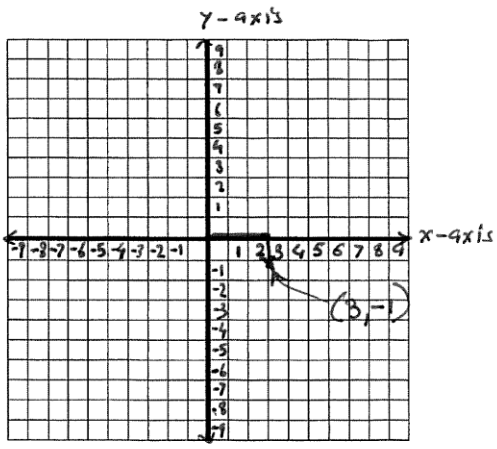
1 d) $(-1,7)$ move 1 unit to the left and 7 units up.



1 e) $(-4,-8)$ move 4 units left and 8 units down

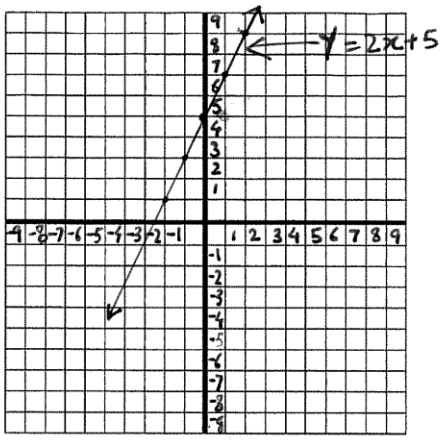


1 f) $(3,-1)$ move 3 units right and 1 unit down



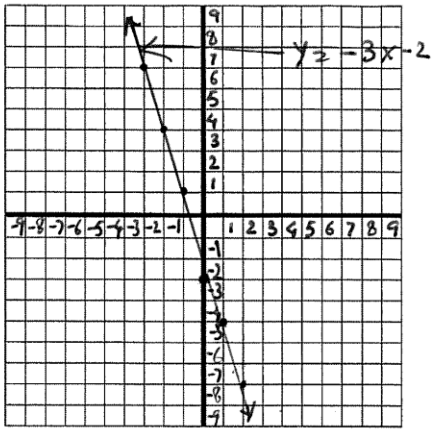
2 a) $Y = 2x + 5$

X	$Y = 2x + 5$	Y
−2	$Y = 2(-2) + 5$	1
−1	$Y = 2(-1) + 5$	3
0	$Y = 2(0) + 5$	5
1	$Y = 2(1) + 5$	7
2	$Y = 2(2) + 5$	9



2 b) $Y = -3x - 2$

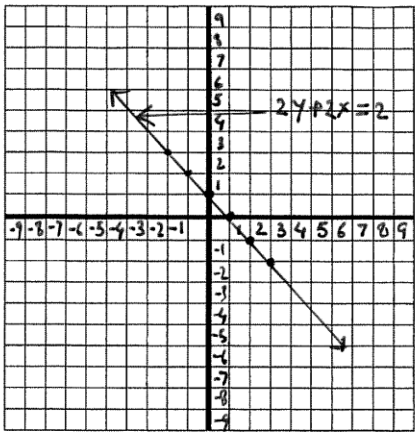
X	$Y = -3x - 2$	Y
−3	$Y = -3(-3) - 2$	7
−2	$Y = -3(-2) - 2$	4
−1	$Y = -3(-1) - 2$	1
0	$Y = -3(0) - 2$	−2
1	$Y = -3(1) - 2$	−5
2	$Y = -3(2) - 2$	−8
3	$Y = -3(3) - 2$	−11



2 c) $2Y + 2X = 2$ or $\frac{2Y}{2} = \frac{-2X}{2} + \frac{2}{2}$

or $Y = -X + 1$

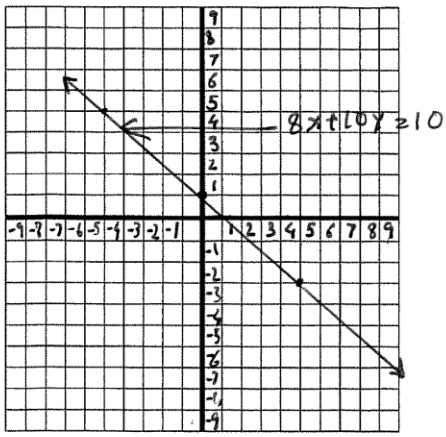
X	$Y = -X + 1$	Y
−2	$Y = -(-2) + 1$	3
−1	$Y = -(-1) + 1$	2
0	$Y = -(0) + 1$	1
1	$Y = -(1) + 1$	0
2	$Y = -(2) + 1$	−1
3	$Y = -(3) + 1$	−2



2 d) $8X + 10Y = 10$ or $\frac{10Y}{10} = \frac{-8X}{10} + \frac{10}{10}$

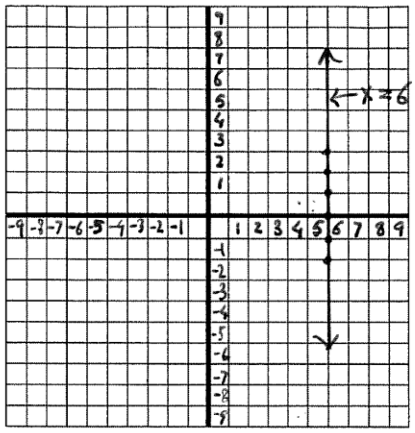
or $Y = -\frac{4}{5}X + 1$

X	$Y = -\frac{4}{5}X + 1$	
−5	$Y = -\frac{4}{5}(-5) + 1$ $= 4 + 1$	5
0	$Y = -\frac{4}{5}(0) + 1$	1
5	$Y = -\frac{4}{5}(5) + 1$ $= -4 + 1$	−3



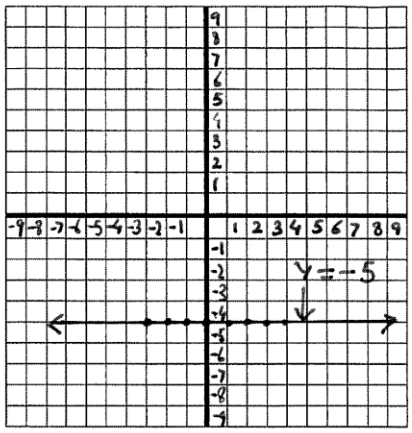
2e) $x = 6$

x	y
6	-1
6	-1
6	0
6	1
6	2
6	3



2f) $y = -5$

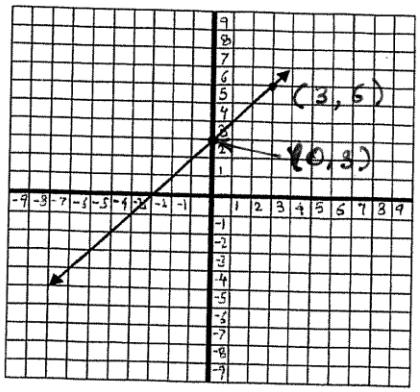
x	y
-2	-5
-1	-5
0	-5
1	-5
2	-5



3a) y-intercept $(0,3)$ $m = 1$

another point $(3,6)$

a.



slope $m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$

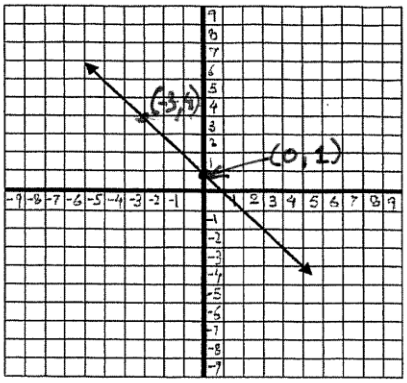
Two points for the slope are $(\overset{x_1}{0}, \overset{y_1}{3})$ and $(\overset{x_2}{3}, \overset{y_2}{6})$

$m = \frac{6-3}{3-0} = \frac{3}{3} = 1$

3b) y-intercept $(0,1)$ $m = -1$

another point $(-3, 4)$

b.



slope $m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$

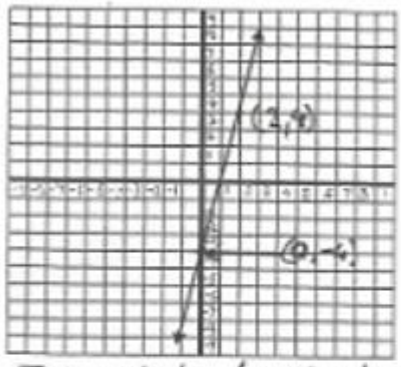
Two points on the line are $(\overset{x_1}{0}, \overset{y_1}{1})$ and $(\overset{x_2}{-3}, \overset{y_2}{4})$

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

3c) Y-intercept (0, -4) another point (2, 4) m = 4

3d) Y-intercept (0, 0) another point (-6, 2) m = $-\frac{1}{3}$

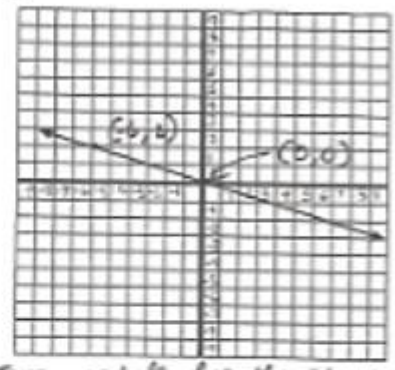
c.



Two points for the slope are $(0, -4)$ & $(2, 4)$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-(-4)}{2-0} = \frac{4+4}{2} = \frac{8}{2} = 4$

d.



Two points for the slope are $(0, 2)$ and $(0, 0)$

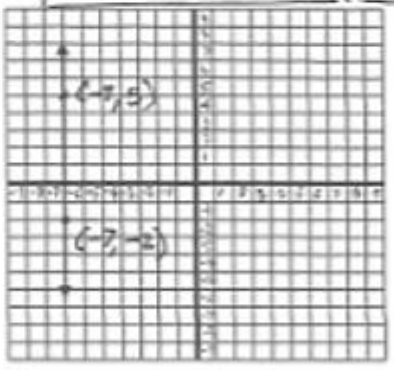
$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-2}{0-(-6)} = \frac{-2}{6} = -\frac{1}{3}$

3 e. Y intercept = (0, 4) m = 0

Two points for the slope are $(-5, 4)$ and $(0, 4)$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-4}{0-(-5)} = \frac{0}{5} = 0$

3 f. Y intercept — None m = undefined



Two points for the slope are $(-7, 5)$ and $(-7, -2)$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2-5}{-7-(-7)} = \frac{-7}{0}$

= undefined

4. a. Points (1,7) and (4,10)

Slope = $m = \frac{\text{rise}}{\text{run}}$ or $\frac{\text{change in } y}{\text{change in } x} = \frac{\Delta y}{\Delta x} = \frac{3}{3} = \boxed{1}$

using the formula, $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10-7}{4-1} = \frac{3}{3} = 1$

b. (10,5), (−20,2) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2-5}{-20-10} = \frac{-3}{-30} = \boxed{\frac{1}{10}}$

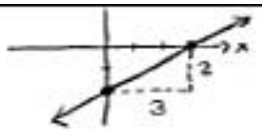
c. (−15,0), (2,0) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-0}{2-(-15)} = \frac{0}{17} = \boxed{0}$ (horizontal line)

d. (13,22), (−19,−28) $m = \frac{-28-22}{-19-13} = \frac{-50}{-32} = \boxed{\frac{25}{16}}$

e. (−100,−6), (69,7) $m = \frac{7-(-6)}{69-(-100)} = \frac{7+6}{69+100} = \frac{13}{169} = \boxed{\frac{1}{13}}$

f. (−12,−13), (−9,−50) $m = \frac{-50-(-13)}{-9-(-12)} = \frac{-50+13}{-9+12} = \boxed{\frac{-37}{3}}$

5. a. slope $m = \frac{2}{3}$ y-intercept $(0,-2)$



using the slope-intercept form:

$y = mx + b \quad m = \frac{2}{3}, \; b = -2$

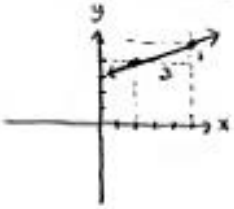
$\boxed{y = \frac{2}{3}x - 2}$ ← same equation!

using the point-slope form: $y - y_1 = m(x - x_1)$

$y - (-2) = \frac{2}{3}(x - 0)$

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

b. through $(2,4)$ with slope $\frac{1}{3}$. $y - y_1 = m(x - x_1)$



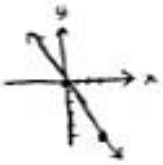
$y - 4 = \frac{1}{3}(x - 2)$

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

$+4 \qquad +4 = \frac{12}{3}$

$y = \frac{1}{3}x - \frac{2}{3} + \frac{12}{3} \Rightarrow \boxed{y = \frac{1}{3}x + \frac{10}{3}}$

c. passing through $(0,0)$ and $(3,-5)$



slope $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5-0}{3-0} = \frac{-5}{3}$

$y - y_1 = m(x - x_1) \Rightarrow y - 0 = -\frac{5}{3}(x - 0) \Rightarrow \boxed{y = -\frac{5}{3}x}$

(note: 1. process could be short-cutted by recognizing that the y-intercept = 0.

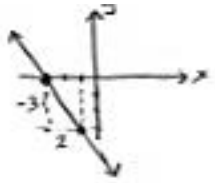
2. the same equation would be reached using $(3,-5)$.

$y - (-5) = -\frac{5}{3}(x - 3) \Rightarrow y + 5 = -\frac{5}{3}x + 5$

$-5 \qquad -5$

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

5. d. slope $= -\frac{3}{2}$ with x-intercept $(-3,0)$

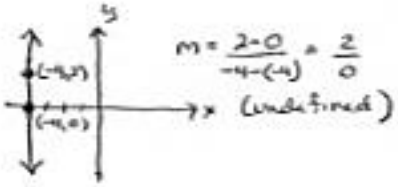


$y - y_1 = m(x - x_1)$

$y - 0 = -\frac{3}{2}(x - (-3))$

$y = -\frac{3}{2}(x + 3) \Longrightarrow \boxed{y = -\frac{3}{2}x - \frac{9}{2}}$

e. parallel to y-axis, through $(-4,0)$

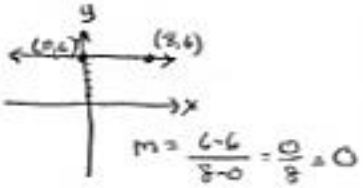


vertical line! undefined slope, so slope-intercept or point-slope forms cannot be used.

equation is of form $x =$ constant.

in this case, $\boxed{x = -4}$

f. parallel to x-axis, through $(0,6)$



horizontal line — $m = 0$ (no "rise")

$y - y_1 = m(x - x_1)$ gives $(y - 6) = 0(x - 0)$

$y - 6 = 0$

or $\boxed{y = 6}$

6. a. $y = 12x + 9$

the slope of this line is 12, so the slope of a line parallel to this line is also $\boxed{12}$

b. $3x - 5y = 25$ Find equation of line perpendicular, but through $(6,-2)$.

solve for y to find the slope of this line.

$$3x - 5y = 25$$
$$+5y \quad +5y$$
$$3x = 5y + 25$$
$$-25 \quad -25$$
$$3x - 25 = 5y \quad \text{or} \quad 5y = 3x - 25$$
$$y = \frac{3}{5}x - 5$$

slope $= \frac{3}{5}$

The slope of this line is $\frac{3}{5}$, so the slope of a line perpendicular to this line is $\boxed{\frac{-5}{3}}$.

Using the point-slope formula: $y - y_1 = m(x - x_1)$

where $m = -\frac{5}{3}$ and $(x_1, y_1) = (6,-2)$

$$y - (-2) = -\frac{5}{3}(x - 6)$$
$$y + 2 = -\frac{5}{3}x + \frac{30}{3}$$
$$y + 2 = -\frac{5}{3}x + 10 \quad \text{(subtract 2 from both sides)}$$
$$\boxed{y = -\frac{5}{3}x + 8}$$

7. a. when $x=0$, $y=56{,}000$ $(0, 56{,}000)$
when $x=9$, $y=2{,}000$ $(9, 2{,}000)$

$$m = \frac{y_2-y_1}{x_2-x_1} = \frac{56{,}000-2000}{0-9} = \frac{54{,}000}{-9} = -6{,}000.$$

b = y-intercept = y-value when $x=0$ = 56,000

$y = mx+b$

$$\boxed{y = -6000x + 56{,}000}$$

b. when $x=3$ $y = -6000(3)+56{,}000$

$= -18{,}000 + 56{,}000$

$= \boxed{\#38{,}000}$

c. the y-intercept is the value of the machine at purchase ($x=0$).

the slope is the decrease in value each year.

(value <u>decreases</u> by #6000 per year).

Additional Resources

Go To http://www.kutasoftware.com/free.html

Under "Linear Equations and Inequalities":

- Finding slope from a graph
- Finding slope from two points
- Graphing lines using slope-intercept form
- Graphing lines using standard form
- Writing linear equations

You can print out the worksheets and work on them. The solutions are provided at the end of the worksheets

For help please contact the ***Math Assistance Area***.