Math 1020, Exam #3, Fall 2013   Name ___KEY___

Instructions: Show all work. Use exact answers unless specifically asked to round. Answer all parts of each question.

1. Solve the following inequalities. For each problem, write the answer in i) set notation, ii) on a number line, iii) in interval notation, where such expressions exist. (8 points each)

a. $3x - 1 \geq 3 + x$

$$\frac{-x \qquad\qquad -x}{2x - 1 \geq 3}$$

$$\frac{+1 \qquad +1}{}$$

$$\frac{2x \geq 4}{2 \qquad 2}$$

$$x \geq 2$$

i) $\{x \mid x \geq 2\}$

ii)
       2

iii) $[2, \infty)$

b. $2y - 5 + y > 3(y - 2)$

$3y - 5 > 3y - 6$

$\dfrac{-3y \qquad -3y}{-5 > -6}$

-6 -5   0   true

i) $\{x \mid x \text{ is all real numbers}\}$

ii)

iii) $(-\infty, \infty)$

c. $\frac{3c-1}{4} + 1 \leq \frac{6c+5}{2} + 2$ LCD $= 4$

$$\cancel{4}\left(\frac{3c-1}{\cancel{4}}\right) + 4(1) \leq \overset{2}{\cancel{4}}\left(\frac{6c+5}{\cancel{2}}\right) + 4(2)$$

$3c - 1 + 4 \leq 2(6c+5) + 8$

$3c - 1 + 4 \leq 12c + 10 + 8$

$3c + 3 \leq 12c + 18$

$\dfrac{-3c \qquad\qquad -3c}{3 \leq 9c + 18}$

$\dfrac{-18 \qquad\qquad -18}{\dfrac{-15 \leq 9c}{9 \qquad 9}}$

$-\frac{5}{3} \leq c$ or $c \geq -\frac{5}{3}$

i) $\{c \mid c \geq -\frac{5}{3}\}$

ii)
          $-\frac{5}{3}$

iii) $[-\frac{5}{3}, \infty)$

d. $5(n + 2) - 2n < 3(n + 4)$

$$5n + 10 - 2n < 3n + 12$$
$$3n + 10 < 3n + 12$$
$$ -10 \qquad -10$$
$$\overline{}$$
$$3n < 3n + 2$$
$$-3n \qquad -3n$$
$$\overline{}$$
$$0 < 2 \quad \text{true}$$

i) $\{x \mid \text{is all real numbers}\}$

ii) ⟵——————⟶

iii) $(-\infty, \infty)$

2. Explain how you recognize when the solution set of an inequality is all real numbers and when it has no solution (is the empty set). (5 points)

1) the variables disappear in both cases

2) analyze the inequality w/ real numbers left behind. is it true? Then it is all real numbers. is it false? Then it is no solution.

$0 < 2$ true : all reals; $0 > 2$ false : no solution

3. Compare and contrast solving an inequality with solving an equation. How are the two procedures similar? How are they different? (6 points)

The two procedures are very similar for linear equations. Differences come up w/ multiplying or dividing by a negative number (must flip inequality but no change in equation) and in analyzing the special cases.
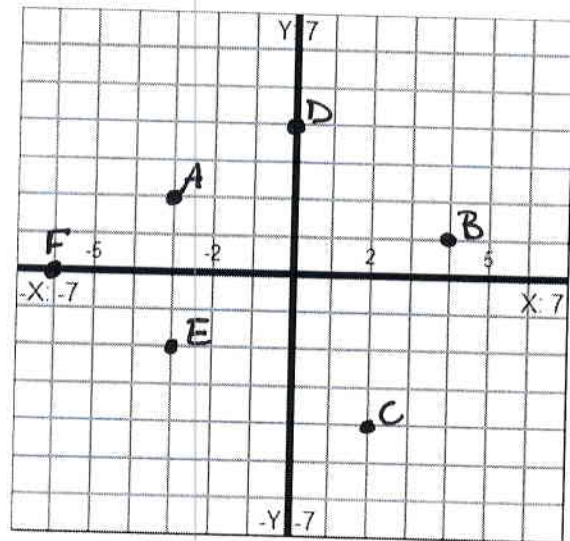
4. For the graph shown below, state the coordinates of each point (You may assume the coordinate are all integers.) (7 points)

A. $(0,3)$

B. $(-1,-3)$

C. $(0,0)$

D. $(-5,4)$

E. $(3,-1)$

F. $(-3,0)$

G. $(2,6)$
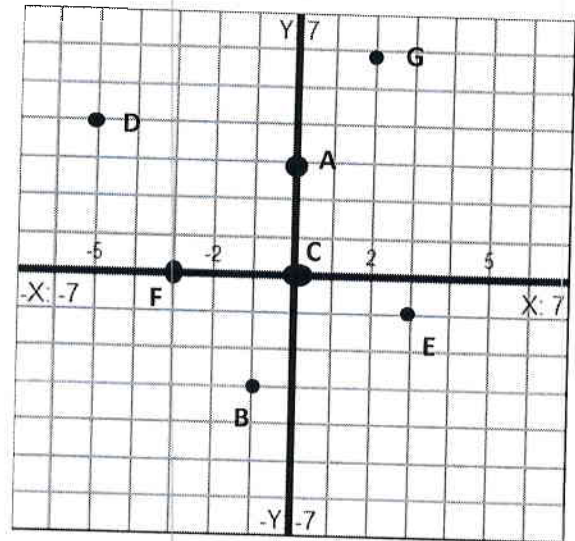
5. For the points shown below, graph each point and label it on the graph. State which quadrant each point is in. If it is not in a quadrant, state which axis it lies on. (2 points each)

A. $(-3,2)$ II

B. $(4,1)$ I

C. $(2,-4)$ IV

D. $(0,4)$ y-axis

E. $(-3,-2)$ III

F. $(-6,0)$ x-axis

6. Determine if the given points satisfy the equation $y = 2x - 3$. (6 points)

a. $(-1,-5)$ $2(-1)-3 = -2-3 = -5$ ✓ yes

b. $(-3,-2)$ $2(-3)-3 = -6-3 = -9 \neq -2$ No

c. $(-2,-7)$ $2(-2)-3 = -4-3 = -7$ yes ✓

7. Fill in the table with points that satisfy the equation $x - 2y + 6 = 0$. (9 points)

x	y	(x,y)
1	$\frac{7}{2}$	$(1, \frac{7}{2})$
-4	1	$(-4, 1)$
-2	2	$(-2, 2)$

$1 - 2y + 6 = 0$
$7 - 2y = 0$
$\frac{2y}{2} = \frac{7}{2} \Rightarrow y = \frac{7}{2}$

$x - 2(1) + 6 = 0$
$x - 2 + 6 = 0$
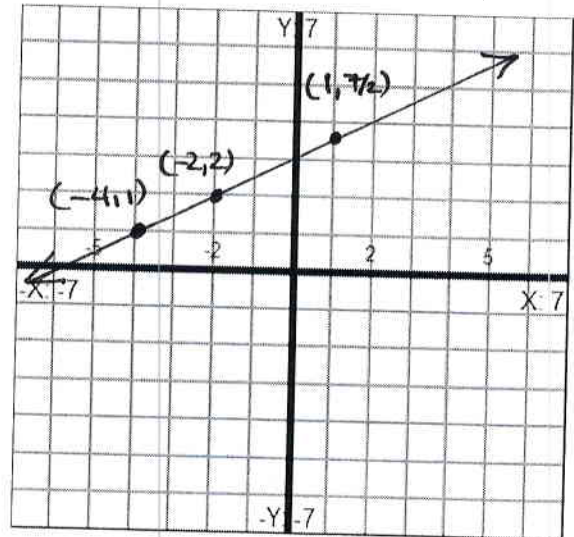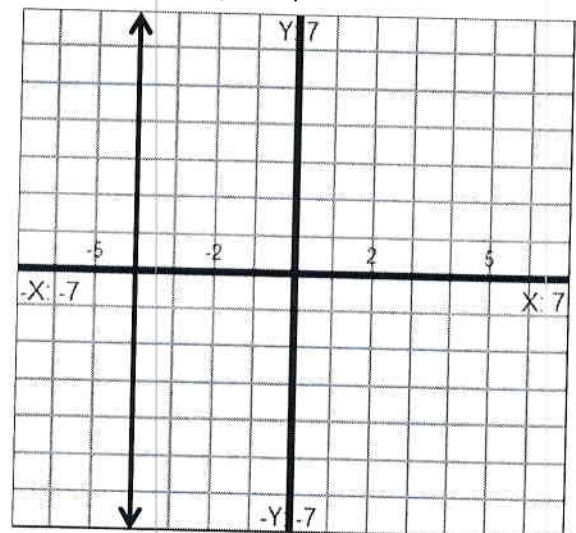$x + 4 = 0 \Rightarrow x = -4$

$-2 - 2y + 6 = 0$
$4 - 2y = 0$
$\frac{4}{2} = \frac{2y}{2} \Rightarrow y = 2$

8. Use the points you obtained in #7, and graph the equation on the graph below. Label the points. (6 points)

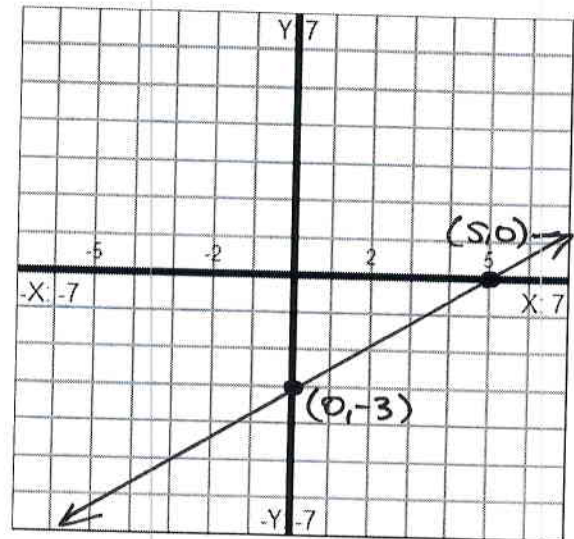9. Find the equation of the line plotted below. State any intercepts. (4 points)

$x = -4$

x-intercept at $(-4, 0)$

no y-intercepts

10. Find the x- and y-intercepts of the equation $3x - 5y = 15$. Plot and label those points on the graph and use them to draw the graph of the line. (6 points)

$x = 0 \Rightarrow y\text{-int}$
$3(0) - 5y = 15$
$\dfrac{-5y}{-5} = \dfrac{15}{-5} \Rightarrow y = -3$
$(0, -3)$

$y = 0 \Rightarrow x\text{-int}$
$3x - 5(0) = 15$
$\dfrac{3x}{3} = \dfrac{15}{3} \Rightarrow x = 5 \quad (5, 0)$

11. Determine if the following equations are linear or nonlinear. (2 points each)

    a. $y = 2$ linear

    b. $y = \dfrac{4}{x}$ nonlinear

    c. $y = x^2 + 1$ nonlinear

    d. $y = \dfrac{x}{2}$ linear

    e. $2x - 5y = 10$ linear

12. Find the slope of the line connecting the points $(3, -2)$ and $(4,5)$. (3 points)

$m = \dfrac{5 - (-2)}{4 - 3} = \dfrac{7}{1} = 7$

13. Interpret the slope $m = \frac{4}{5}$. (4 points)
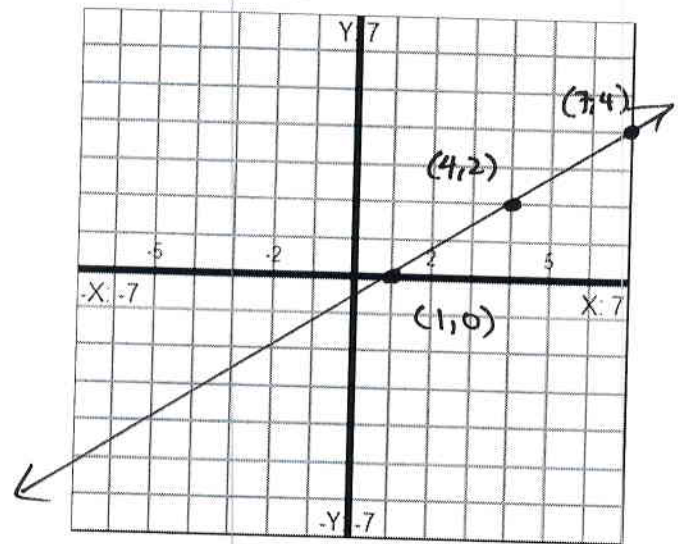
for each 5 steps to the right in x, go up 4 steps in y

OR

for each one step to the right in x, go up 4/5 of a step in y

14. Graph the line that passes through the point (4,2), with a slope of $m = \frac{2}{3}$ on the graph below. Be sure to label at least two additional points on the graph. (6 points)

$(4+3, 2+2) = (7, 4)$

or

$(4-3, 2-2) = (1, 0)$

15. What is the equation of a vertical line that passes through the point (3,4). What is its slope? (5 points)

vertical line: X=3

The slope of a vertical line is undefined

16. What is the equation of a horizontal line passing through the point $(-4,5)$. What is the slope? (5 points)

$$y = 5$$

the slope of a horizontal line is 0.

17. The Standard Form of a linear equation is the form $Ax + By = C$. And equation in such a form is $3x - 4y = 12$. In 3.4, we will learn about the y-intercept form of a linear equation: $y = mx + b$. You can obtain this form from the standard form by solving it for y. Do this for the given equation. (5 points)
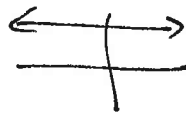
$$\frac{3x - 4y = 12}{-3x \qquad\quad -3x}$$

$$\frac{-4y}{-4} = \frac{-3x + 12}{-4} \implies y = \frac{3}{4}x - 3$$

$$\frac{-3x}{-4} + \frac{12}{-4}$$

18. Sketch examples of graphs with the following characteristics. (You do not need to provide an equation, just a sketch.) (3 points each)
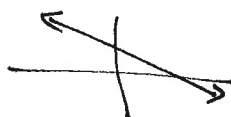   a. A line with a positive slope
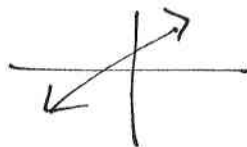
    b. A line with a zero slope

    c. A line with a negative slope

    d. A line with an undefined slope.