Math 109 - Test 1

September 19, 2019

Name __key__

Score _____

Show all work to receive full credit. Supply explanations where necessary.

1. (2 points [3]) Which one of these equations IS A LINEAR EQUATION?

$$3x - 2 = 3\sqrt{x} - 7, \qquad 8(x+2) = 7(x-5) + x^2, \qquad \boxed{\dfrac{x}{5} + \dfrac{3}{7} = x,} \qquad 5x + \dfrac{5}{x} = 5$$

RADICAL   QUADRATIC   LINEAR   RATIONAL

2. (3 points [3]) Solve for t: $6\left(\dfrac{-2t+18}{6}\right) = (1)\,6$

$$-2t + 18 = 6$$
$$-2t = -12$$
$$\boxed{t = 6}$$

3. (4 points [3]) Solve for y: $-3(y+5) + 5y = 3y + 10 - (y+25)$

$$-3y - 15 + 5y = 3y + 10 - y - 25$$
$$2y - 15 = 2y - 15$$

IDENTITY ⟹ All #'s ARE SOLUTIONS.

4. (4 points [3]) When walking, Oscar burns 96 calories per mile and Emma burns 64 calories per mile. One day the two of them walk a total of 8 miles. Let x represent the number of miles walked by Oscar. Write an algebraic expression for the total number of calories burned by the two of them. (Your final answer should contain only the variable x.)

OSCAR WALKS X MILES ⟹ EMMA WALKS $8-X$

OSCAR CALS + EMMA CALS = TOTAL CALS

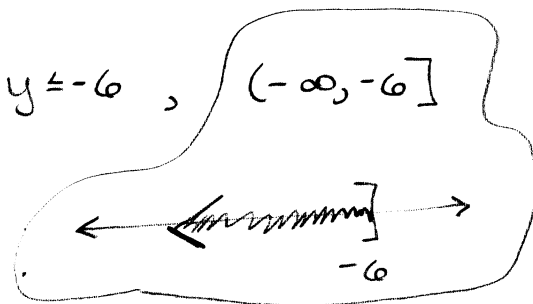$$\boxed{96x + 64(8-x) = \text{TOTAL CALS}}$$

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5. (5 points [3]) Solve for y. Write your solution set in interval notation, and graph it on a number line.

$$9y - 22 \geq -2(2 - 6y)$$

$9y - 22 \geq -4 + 12y$

$-18 \geq 3y \quad \rightarrow \quad y \leq -6 \quad, \quad (-\infty, -6]$

$-6 \geq y$

-6

6. (3 points [3]) Solve for y: $\quad 2(5 - y) + 2y > 7$

$10 - 2y + 2y > 7$

$10 > 7 \quad$ Always true.

All #'s are solutions.

7. (6 points [3]) Solve for x. Write your solution set in interval notation, and graph it on a number line.

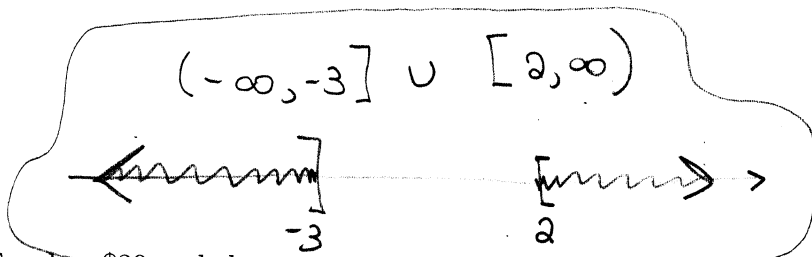$$30 \leq -5(x - 3) \quad \text{or} \quad \frac{3}{2}x \geq x + 1$$

$30 \leq -5x + 15 \qquad\qquad \frac{1}{2}x \geq 1$

$15 \leq -5x \qquad\qquad\qquad x \geq 2$

$-3 \geq x \qquad\qquad \text{or}$

$(-\infty, -3] \cup [2, \infty)$

$-3 \qquad\qquad 2$

8. (4 points [3]) Tess has $30 and she wants to go to the fair. It costs $10 for admission and $1.50 per ride. Let r represent the number of rides that Tess will purchase. Write an inequality involving r that Tess could solve to determine the numbers of rides she can afford.

Admission + Cost of rides $\leq$ $30

$10 + 1.5r \leq 30$

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9. (3 points [1,9]) Ashanti solved the equation $\dfrac{r}{r-4} = \dfrac{4}{r-4} - \dfrac{4}{5}$ and found that $r = 4$. She then immediately concluded that there is no solution. Why did she make that conclusion?

$r = 4$ WOULD MAKE A DENOMINATOR ZERO.

$r = 4$ IS A RESTRICTED VALUE --- IT MUST

• BE EXCLUDED FROM ANY SOLUTION SET.

10. (4 points [1,9]) Solve for x: $\dfrac{10}{x} = \dfrac{18}{x-4}$

CROSS MULTIPLY...

$10(x-4) = 18x$

$10x - 40 = 18x$

$-40 = 8x$

$\boxed{x = -5}$

11. (8 points [3,7,9]) Solve for u: $\dfrac{2}{(u-1)(u-2)} = 3 + \dfrac{2}{u-2}$

MULT BY $(u-2)(u-1)$...

$2 = 3(u-2)(u-1) + 2(u-1)$

$2 = 3u^2 - 9u + 6 + 2u - 2$

$3u^2 - 7u + 2 = 0$

$(3u-1)(u-2) = 0$

$\boxed{u = \frac{1}{3}}$ OR $\cancel{u = 2}$

RESTRICTED!
$u = 2$ MUST
BE
EXCLUDED!

12. (3 points [7]) Solve for x: $5(x-7)(5x+3) = 0$

$x - 7 = 0$ OR $5x + 3 = 0$

$\boxed{x = 7 \quad \text{OR} \quad x = -\frac{3}{5}}$

13. (4 points [7]) Solve for x: $x^2 - 30 = x$

$x^2 - x - 30 = 0$

$(x-6)(x+5) = 0$

$\boxed{x = 6 \text{ OR } x = -5}$

14. (3 points [7]) Use the discriminant to determine a value for b so that the equation has exactly one real solution.

$$x^2 + bx + 16 = 0$$

DISC $= 0$ FOR 1 SOL'N.

$$b^2 - 4ac = b^2 - 4(1)(16) = b^2 - 64 = 0$$

$$\boxed{b = \pm 8}$$

15. (5 points [7]) Solve for x. Write your answer(s) in decimal form, rounded to the nearest hundredth.

$$5x^2 - x - 3 = 0$$

$$X = \frac{1 \pm \sqrt{1 - 4(5)(-3)}}{2(5)} = \frac{1 \pm \sqrt{1 + 60}}{10}$$

$$X = \frac{1 \pm \sqrt{61}}{10}$$

$$X = \frac{1 + \sqrt{61}}{10} \approx 0.88 \quad \text{OR} \quad X = \frac{1 - \sqrt{61}}{10} \approx -0.68$$

16. (5 points [9]) Solve for x. Round your answer(s) to the nearest hundredth.

$$(3x + 2)^3 - 18 = 0$$

$$(3x + 2)^3 = 18$$

$$3x + 2 = \sqrt[3]{18}$$

$$3x = \sqrt[3]{18} - 2$$

$$X = \frac{\sqrt[3]{18} - 2}{3} \approx \boxed{0.21}$$

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17. (4 points [9]) Solve for w: $3 + \sqrt{4w+1} = 8$

$$\sqrt{4w+1} = 5$$
$$4w+1 = 25$$
$$4w = 24 \quad \longrightarrow \quad \boxed{w = 6}$$

18. (4 points [9]) Solve for x. Round your answer(s) to the nearest hundredth.

$$(x-3)^{3/2} - 4 = 0$$

$$x-3 = 4^{2/3}$$

$$\boxed{x = 4^{2/3} + 3 \approx 5.52}$$

19. (10 points [2,3]) Think about the linear equation $3x + 5y = 30$ and its graph.

(a) Determine the x- and y-intercepts.

$$y = 0 \Rightarrow 3x = 30$$
$$x = 10$$
$$\boxed{(10,0)}$$
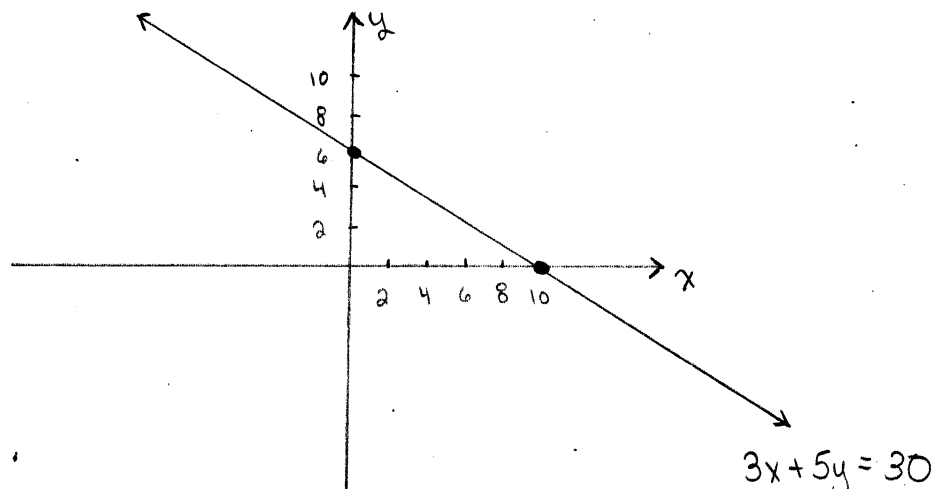
$$x = 0 \Rightarrow 5y = 30$$
$$y = 6$$
$$\boxed{(0,6)}$$

(b) Find the slope.

$$m = \frac{\Delta y}{\Delta x} = \frac{6-0}{0-10} = \frac{-6}{10} = \boxed{-\frac{3}{5}}$$

(c) Carefully sketch the graph and label your axes.

$$3x + 5y = 30$$

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20. (2 points [9]) In order to solve the following equation, what substitution would be most helpful?
$$(x^2 - 4)^2 + 3(x^2 - 4) + 2 = 0$$

$$u = x^2 - 4$$

21. (4 points [2]) Find equations for the horizontal and vertical lines passing through $(-7, 13)$.

Hor. Line
$$y = 13$$

Vert. Line
$$x = -7$$

22. (10 points [8]) Think about the graph of the equation $y = 2x^2 - 4$.

(a) What is the name of this type of graph? PARABOLA

(b) Make a table showing five (5) points on the graph. Include the vertex as one of your points (and say which one is the vertex).

x	y
0	-4
1	-2
-1	-2
2	4
-2	4

$(0, -4)$ IS THE VERTEX.

(c) Carefully sketch the graph and label your axes.

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