Math 109 - Test 1A

February 13, 2020

Name __key__

Score _____

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

1. (4 points [3]) Which of these equations ARE linear equations? Circle all that apply.

$$\frac{6}{x+5} + 3 = \frac{1}{x}, \qquad \boxed{5(2 - x) = x,} \qquad x(x-6) = 0, \qquad \boxed{\frac{2x}{3} + \frac{1}{6} = x}$$

2. (3 points [3]) Solve for x: $3x - 9 = 8$

$$3x = 17$$

$$\boxed{x = \frac{17}{3}}$$

3. (4 points [3]) Solve for w: $\dfrac{12 - 6w}{5} = 6$

$$12 - 6w = 30$$

$$-6w = 18$$

$$\boxed{w = -3}$$

4. (4 points [3]) Yesterday, David rode his bike at the speed of 10 miles per hour. Today, he rode at 14 miles per hour. In the two days, he biked for a combined total time of 9 hours. Let x be the number of hours he biked yesterday. Write an algebraic expression in terms of the single variable x that gives the total number of miles he biked in the two days. (Remember that *distance equals rate times time.*)

x = HOURS YESTERDAY

$9-x$ = HOURS TODAY

$\Rightarrow$

$10x$ = MILES YESTERDAY

$14(9-x)$ = MILES TODAY

$$\boxed{\text{TOTAL MILES} = 10x + 14(9-x)}$$

$$\text{OR} \quad 126 - 4x$$

5. (4 points [3])   Solve for r: $3r - (5 - 2r) = 3(r - 2) + 2r + 2$

$$3r - 5 + 2r = 3r - 6 + 2r + 2$$
$$5r - 5 = 5r - 4$$
$$-5 = -4 \qquad \text{CONTRADICTION}$$

No solution.

6. (3 points [3])   Solve for x: $4 - 7x \le 32$

$$-7x \le 28$$
$$x \ge -4$$

7. (3 points [3])   On an interstate expressway, you cannot drive slower than 45 mph and you cannot drive faster than 70 mph. Use x to represent speed (in mph), and write an inequality that describes the speeds you can drive.

$$x \ge 45$$
AND
$$x \le 70$$

$$45 \le x \le 70$$

8. (5 points [3])   Solve for y. Write your solution set in interval notation, and graph it on a number line.
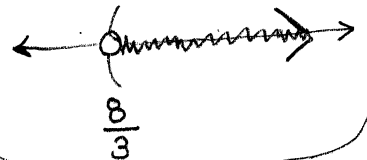
$$8y + 14 < 2(3 + 2y) + 7y$$

$$8y + 14 < 6 + 4y + 7y$$
$$8y + 14 < 6 + 11y$$
$$8 < 3y$$
$$\frac{8}{3} < y \quad \text{or} \quad y > \frac{8}{3}$$

$$\left(\tfrac{8}{3}, \infty \right)$$

2

9. (4 points [3])   Solve for x: $3x + 13 > \frac{3}{2}(4 + 2x)$

$$3x + 13 > 6 + 3x$$

$$13 > 6$$

ALWAYS TRUE $\Rightarrow$ ALL NUMBERS ARE SOLUTIONS.

10. (6 points [3])   Solve for y. Write your solution set in interval notation, and graph it on a number line.

$$3(y - 4) + 2y > 3 \qquad \text{or} \qquad 7 - 2y \geq 13$$

$$3y - 12 + 2y > 3 \qquad\qquad -2y \geq 6$$

$$5y > 15$$

$$y > 3 \qquad\text{OR}\qquad y \leq -3$$

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

11. (3 points [3])   Kate Jindo sells her famous, craft hot sauce for $8 per bottle. Let b represent the number of bottles that Kate will sell at the farmer's market. Kate would like to make at least $300. Write an inequality involving b that Kate could solve to determine the numbers of bottles she must sell.

$$8b \geq 300$$

12. (4 points [1,9]) Determine the values of x that are restricted from the following
expression: $\dfrac{x - 6}{x^2 + 2x - 15}$

$$(X+5)(X-3) = 0$$

$$\boxed{X = -5, \quad X = 3}$$

13. (4 points [1,3,9]) Solve for u: $\dfrac{5}{u} = \dfrac{8}{u - 7}$

$$5(u-7) = 8u$$

$$5u - 35 = 8u$$

$$-35 = 3u$$

$$\boxed{u = \dfrac{-35}{3}}$$

14. (4 points [1,3,9]) Solve for x: $5 - \dfrac{3}{x + 3} = \dfrac{x}{x + 3}$

MULT BY X+3...

$$5(X+3) - 3 = X$$

$$5X + 15 - 3 = X$$

$$5X + 12 = X$$

$$4X = -12$$

$$\cancel{X = -3}$$

BUT X=-3
IS A RESTRICTED
VALUE.

$$\boxed{\text{NO SOLUTION.}}$$

15. (4 points [7]) Solve for x: $8(3x - 7)(x - 9) = 0$

$$3X - 7 = 0 \quad \text{OR} \quad X - 9 = 0$$

$$\boxed{X = \dfrac{7}{3} \quad \text{OR} \quad X = 9}$$

4

16. (5 points [7]) Solve for t: $t^2 + 4t + 3 = 15$

$$t^2 + 4t - 12 = 0$$

$$(t + 6)(t - 2) = 0$$

$$\boxed{t = -6 \quad \text{or} \quad t = 2}$$

17. (5 points [9]) Solve for x. Round your final answer(s) to the nearest hundredth.

$$(2x + 5)^3 - 10 = 0$$

$$(2x + 5)^3 = 10$$

$$2x + 5 = \sqrt[3]{10}$$

$$2x = \sqrt[3]{10} - 5$$

$$\boxed{x = \frac{\sqrt[3]{10} - 5}{2} \approx -1.42}$$

18. (6 points [7]) Solve for x. Write your final answer(s) in decimal form, rounded to the nearest hundredth.

$$2x^2 - 3x - 1 = 0$$

QUAD FORMULA...

$$a = 2, \quad b = -3, \quad c = -1$$

$$x = \frac{3 \pm \sqrt{(-3)^2 - 4(2)(-1)}}{2(2)} = \frac{3 \pm \sqrt{9 + 8}}{4} = \frac{3 \pm \sqrt{17}}{4} \approx \boxed{1.78 \quad \text{or} \quad -0.28}$$

19. (4 points [9]) Solve for w: $8 + \sqrt{5w + 2} = 4$

$$\sqrt{5w + 2} = -4$$

NOT POSSIBLE. $\boxed{\text{No REAL SOLUTIONS}}$

20. (10 points [3,7,9]) Solve for x: $\dfrac{6}{(x-1)(x-3)} = 1 + \dfrac{3}{x-3}$

MULT BY $(x-1)(x-3)$ ...

$6 = (x-1)(x-3) + 3(x-1)$

$6 = x^2 - 4x + 3 + 3x - 3$

$6 = x^2 - x$

$x^2 - x - 6 = 0 \Rightarrow (x-3)(x+2) = 0$

$x = 3$ or $\boxed{x = -2}$

$x = 3$ IS A RESTRICTED VALUE.

21. (4 points [9]) Solve for x. Round your answer(s) to the nearest hundredth.

$(x-4)^3 + 17 = 3$

$(x-4)^3 = -14$

$x - 4 = \sqrt[3]{-14}$

$\boxed{x = \sqrt[3]{-14} + 4 \approx 1.59}$

22. (4 points [9]) Solve for x: $(3x-7)^{1/5} - 2 = 0$

$\sqrt[5]{3x-7} = 2 \quad \Big\} \quad 2^5 = 32$

$3x - 7 = 32$

$3x = 39 \Rightarrow \boxed{x = 13}$

23. (3 points [9]) The following equation is "quadratic in form." In order to solve it, what substitution would be most helpful?

$(\sqrt{x} - 4)^2 + 3(\sqrt{x} - 4) + 2 = 0$

$\boxed{u = \sqrt{x} - 4}$

THIS MAKES $u^2 + 3u + 2 = 0$

6