Math 129 - Test 1
September 24, 2020

Name key

Score _____

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

1. (2 points [3]) Give an example of a linear equation that involves the variable x.

$3x + 5 = 8$

2. (2 points [3]) Give an example of an equation that is NOT linear.

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

3. (3 points [3]) Solve for r: $2.6(r + 1.5) = 1.1r$

$2.6r + 3.9 = 1.1r$

$1.5r + 3.9 = 0$

$1.5r = -3.9$

$r = \frac{-3.9}{1.5} = -2.6$

$r = -2.6$

4. (3 points [3]) Solve for w: $2w + 4 - 3(-2w - 2) = 4(w - 1)$

$2w + 4 + 6w + 6 = 4w - 4$

$8w + 10 = 4w - 4$

$4w = -14$

$w = -\frac{14}{4}$

$w = -\frac{7}{2}$

5. (3 points [3]) Solve for x: $5\left(-x + \frac{1}{7}\right) = x + \frac{5}{7} - 6x$

$-5x + \frac{5}{7} = \frac{5}{7} - 5x$

IDENTITY! ALL #'S ARE SOLUTIONS.

6. (3 points [3]) Let x be the smallest of three consecutive whole numbers. Write an algebraic expression for the sum of the three numbers. (Your final answer should contain only one variable, x.)

THE NUMBERS MUST BE x, $x+1$, AND $x+2$.

THE SUM IS $x + (x+1) + (x+2) = 3x+3$

7. (4 points [3]) Solve for t. Write your solution set in interval notation, and graph it on a number line.

$$5t + 13(t-1) \leq -3(2-4t)$$

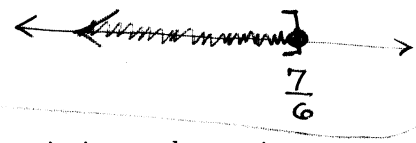
$5t + 13t - 13 \leq -6 + 12t$

$18t - 13 \leq -6 + 12t$

$6t \leq 7$

$t \leq \frac{7}{6}$

$(-\infty, \frac{7}{6}]$



8. (6 points [3]) Solve for x. Write your solution set in interval notation, and graph it on a number line.

$$-25 \geq -5(x+2) \quad \text{and} \quad x < \frac{1}{2}(x+6)$$

$-25 \geq -5x - 10$

$-15 \geq -5x$

$3 \leq x$

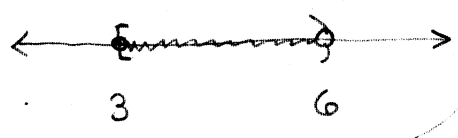
$x < \frac{1}{2}x + 3$

$\frac{1}{2}x < 3$

$x < 6$

$x \geq 3$ AND $x < 6$

$3 \leq x < 6$ $\quad [3, 6)$



9. (2 points [3]) Write an inequality to represent the following situation.

On the interstate, you cannot drive slower than 45 mph and you cannot drive faster than 70 mph. Use x to represent the speed (in mph) that you can drive.

$45 \leq x \leq 70$

10. (3 points [3]) Solve for u: $8u + 2(9 - 6u) > -6(u + 3) + 2(u + 1)$

$8u + 18 - 12u > -6u - 18 + 2u + 2$

$-4u + 18 > -4u - 16$

$18 > -16$

Always true! All #'s are solutions.

11. (4 points [11]) Solve for x: $-6|2x - 7| = -12$

$|2x - 7| = 2$

$2x - 7 = 2$ or $2x - 7 = -2$

$2x = 9$ $\qquad 2x = 5$

$x = \frac{9}{2}$ or $x = \frac{5}{2}$

12. (3 points [11]) Solve for y: $13 - |25y + 32| = 75$

$-|25y + 32| = 62$

$|25y + 32| = -62$

Impossible! No solution.

13. (6 points [11]) Solve for x. Write your solution set in interval notation, and graph it on a number line.

$$|-5-2x|+4>13$$

$|-5-2x|>9$

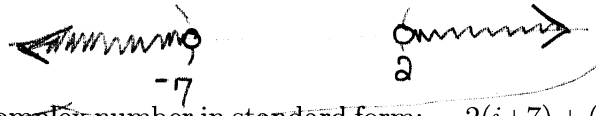
$-5-2x<-9$ or $-5-2x>9$

$-2x<-4$ $\quad -2x>14$

$x>2$ $\quad x<-7$

$x>2$ or $x<-7$

$(2,\infty) \cup (-\infty,-7)$



14. (4 points [7,12]) Write as a ~~complex number in~~ standard form: $2(i+7)+(3+2i)(5-i)$

$2i+14+15+10i-3i-2i^2$

$29+9i-2i^2$

$= \boxed{31+9i}$

15. (3 points [7,12]) Simplify i^{115}. Show your work.

$4\overline{)115}$ R 3, 28

8

35

32

3

$i^{115}=(i^4)^{28}i^3=i^3=\boxed{-i}$

16. (3 points [7]) Solve for x: $2(3x-5)(x+9)=0$

$3x-5=0$ $\quad x+9=0$

$x=\frac{5}{3}$ or $x=-9$

17. (4 points [7]) Solve for x: $x^2 - 4x = 21$

$x^2 - 4x - 21 = 0$

$(x+3)(x-7) = 0$

$x = -3$ or $x = 7$

18. (4 points [7]) Find all values of j for which the equation $8x^2 + 9x + j = 0$ has no real solutions. Write your answer as an equality or inequality in terms of j.

DISCRIMINANT $< 0 \Rightarrow 81 - 4(8)j < 0$

$81 - 32j < 0$

$81 < 32j$

$\frac{81}{32} < j$

$j > \frac{81}{32}$

19. (4 points [7]) Solve for x: $(3x-2)^2 = 49$

SQUARE ROOTS... $3x - 2 = \pm\sqrt{49}$

$3x - 2 = \pm 7$

$3x = 2 \pm 7$

$x = \frac{2 \pm 7}{3}$

$x = 3$ or $x = -\frac{5}{3}$

20. (8 points [7]) Solve for x. Write your solution(s) in exact form, simplified as much as possible.

$$4x^2 - 8x + 7 = 0$$

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(4)(7)}}{2(4)} = \frac{8 \pm \sqrt{64 - 112}}{8} = \frac{8 \pm i\sqrt{48}}{8}$$

$\sqrt{48} = \sqrt{16}\sqrt{3} = 4\sqrt{3}$

$$= \frac{8 \pm 4i\sqrt{3}}{8}$$

$$= \frac{2 \pm i\sqrt{3}}{2}$$

$x = \frac{2 + i\sqrt{3}}{2}$, $x = \frac{2 - i\sqrt{3}}{2}$

21. (5 points [7]) A ball is thrown from a height of 82 meters with an initial downward velocity of 4.5 meters per second. The height of the ball (in meters) after t seconds is given by $h = 82 - 4.5t - 4.9t^2$. When does the ball hit the ground? Round your answer to the nearest hundredth.

$$0 = 82 - 4.5t - 4.9t^2$$

$$t = \frac{4.5 \pm \sqrt{(-4.5)^2 - 4(-4.9)(82)}}{2(-4.9)} = \frac{4.5 \pm \sqrt{1627.45}}{-9.8}$$

$$t = \frac{4.5 + \sqrt{1627.45}}{-9.8} \approx -4.58 \text{ sec}$$

$$\text{or} \quad t = \frac{4.5 - \sqrt{1627.45}}{-9.8} \approx 3.66 \text{ sec}$$

22. (3 points [7]) Compute the discriminant and say what it tells you about the solutions.

$$4x^2 - 17x + 10 = 0$$

$$b^2 - 4ac = (-17)^2 - 4(4)(10)$$

$$= 289 - 160 = 129$$

Two distinct real solutions.

23. (3 points [1,11]) Determine the values of w that are restricted from the following expression: $\dfrac{w-1}{w^2-2w-3}$.

$$w^2 - 2w - 3 = (w-3)(w+1) = 0$$

$$w = 3 \quad w = -1$$

Restricted values are $w = 3$ & $w = -1$

24. (4 points [3,7,11]) Solve for x: $\dfrac{30}{x+3} = \dfrac{21}{x}$

$30x = 21(x+3)$

$30x = 21x + 63$

$9x = 63$ → $\boxed{x = 7}$

25. (7 points [3,7,11]) Solve for u: $\dfrac{2}{(u-1)(u-2)} = 3 + \dfrac{2}{u-2}$; $u \neq 1, u \neq 2$

Mult by $(u-1)(u-2)$ ...

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

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

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

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

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

$\boxed{u = \frac{1}{3}}$ or ~~$u = 2$~~ ← RESTRICTED

26. (4 points [11]) Solve for x. Round your answer(s) to the nearest hundredth.

$(2x-5)^3 - 28 = 1$

$(2x-5)^3 = 29$

$2x - 5 = \sqrt[3]{29}$

$2x = 5 + \sqrt[3]{29}$

$x = \dfrac{5 + \sqrt[3]{29}}{2}$

$\boxed{x \approx 4.04}$