Math 129 - Test 2

October 16, 2019

Name key

Score _____

Show all work to receive full credit. Supply explanations where necessary. Label your axes when graphing.

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1. (6 points [1,8,9,10]) Consider the following equation in the two variables ♠ and ♣:

$$♠^2 + ♣ = 7$$

(a) Show that $(♣, ♠) = (3, 2)$ is a solution.

$2^2 + 3 = 4 + 3 = 7$ ✓

(b) If you were to sketch the graph of the equation $♠^2 + ♣ = 7$ which variable would you associate with the vertical axis? Explain why.

VERTICAL AXIS IS ASSOCIATED WITH THE 2ND COORD. IN THIS CASE, THAT IS THE SPADE, ♠.

(c) Find a solution for the equation and write it as an ordered pair. (Do not use the solution from part (a).)

$(♣, ♠) = (7, 0)$

2. (5 points [11]) Solve for x: $\sqrt{x+6} = x$

$x + 6 = x^2$

$x^2 - x - 6 = 0$

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

$x = 3$, ~~$x = -2$~~

3. (5 points [2,4]) Find an equation of the line that passes through the point $(-5, 2)$ and is perpendicular to the line described by $2x - y = 8$. Write your final answer in standard form.

$y = 2x - 8$

$m = 2$

$m_\perp = -\frac{1}{2}$

$m = -\frac{1}{2}$

Point $(-5, 2)$

$y - 2 = -\frac{1}{2}(x+5)$

$y - 2 = -\frac{1}{2}x - \frac{5}{2}$

$y = -\frac{1}{2}x - \frac{1}{2}$ → $x + 2y = -1$

4. (6 points [9,10]) The points $(2, 1)$ and $(8, 9)$ are the endpoints of a diameter of a circle.

(a) Find the center of the circle.

$$\text{Center} = \left(\frac{2+8}{2}, \frac{1+9}{2}\right) = \boxed{(5, 5)}$$

(b) Compute the length of the diameter.

$$d = \sqrt{(8-2)^2 + (9-1)^2} = \sqrt{36+64} = \sqrt{100}$$
$$= \boxed{10}$$

(c) Write the standard form equation for the circle.

$$(x-h)^2 + (y-k)^2 = r^2 \Rightarrow \boxed{(x-5)^2 + (y-5)^2 = 25}$$

$(h, k) = (5, 5)$, $r = 5$

5. (5 points [2,3,4]) An engineer working with a voltage-controlled amplifier finds that an input of 1.32 volts is amplified to 14.00 volts, while an input of 3.79 volts has an output of 8.00 volts. Assume that the input and output voltages satisfy a linear equation. Find that linear equation. Write your final answer in slope-intercept form.

$(1.32, 14.00)$
$(3.79, 8.00)$

$$m = \frac{\Delta y}{\Delta x} = \frac{-6.00}{2.47}$$

$$y - 8 = \frac{-6}{2.47}(x - 3.79)$$

$$y = \frac{-6}{2.47}x + \left(\frac{6}{2.47}\right)(3.79) + 8$$

Rounding to 2 decimal places...

$$\boxed{y = -2.43x + 17.21}$$

x = input voltage

y = output voltage

6. (4 points [11]) Solve for x. Round your answer(s) to the nearest hundredth.

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

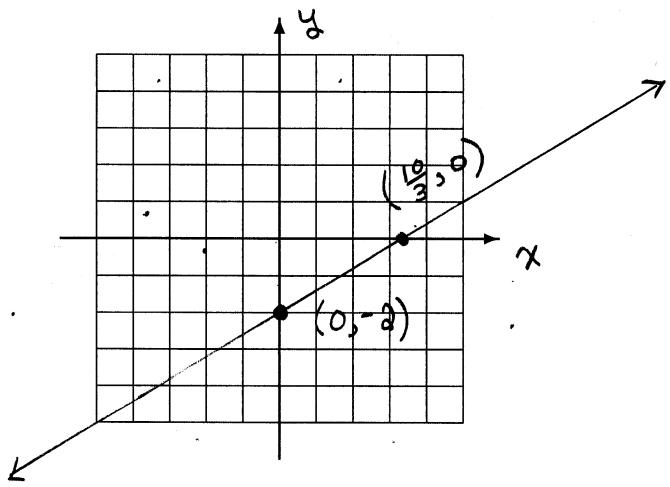
$$(x-3)^{3/2} = 4$$

$$x - 3 = 4^{2/3} = \sqrt[3]{16}$$

$$x = \sqrt[3]{16} + 3 \approx \boxed{5.52}$$

7. (5 points [3]) Find the x- and y-intercepts of the line described by $3x - 5y = 10$. Then sketch the graph of the line. Label the axes and the intercepts.

	x	y
Y-INT:	0	-2
X-INT:	$\frac{10}{3}$	0

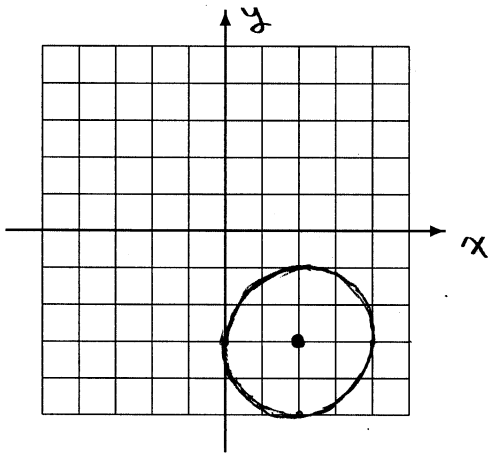


8. (4 points [2,3,4]) Determine equations of the horizontal and vertical lines that pass through $(-2, 7)$. Label which is which.

HORIZONTAL: $y = 7$

VERTICAL: $x = -2$

9. (4 points [9,10]) Sketch the graph of the equation $(x-2)^2 + (y+3)^2 = 4$.



$(h, k) = (2, -3)$

$r = 2$

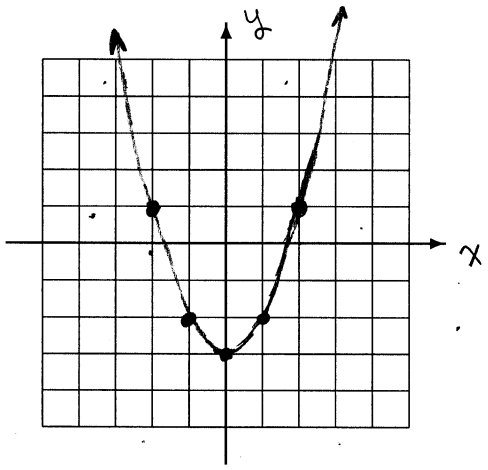
10. (2 points [7,11]) The equation $2x^{2/5} - 7x^{1/5} + 3 = 0$ is "quadratic in form." What substitution will reduce the equation to quadratic? Do not solve.

$u = x^{1/5}$ WILL MAKE

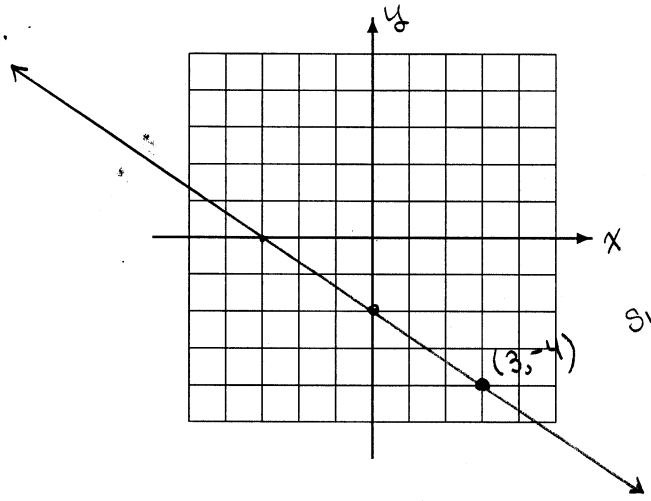
$2u^2 - 7u + 3 = 0$

11. (5 points [1,9,10]) Make a table that shows five points on the graph of $f(x) = x^2 - 3$. Then plot your points and sketch the graph of $y = f(x)$.

x	$y = f(x)$
0	-3
1	-2
-1	-2
2	1
-2	1



12. (5 points [2,4]) A line with slope $-2/3$ passes through the point $(3, -4)$. Sketch the graph of the line, and find an equation of the line.



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

$-4 = -\frac{2}{3}(3) + b$

$b = -2$

Slope $= \frac{2}{-3}$

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

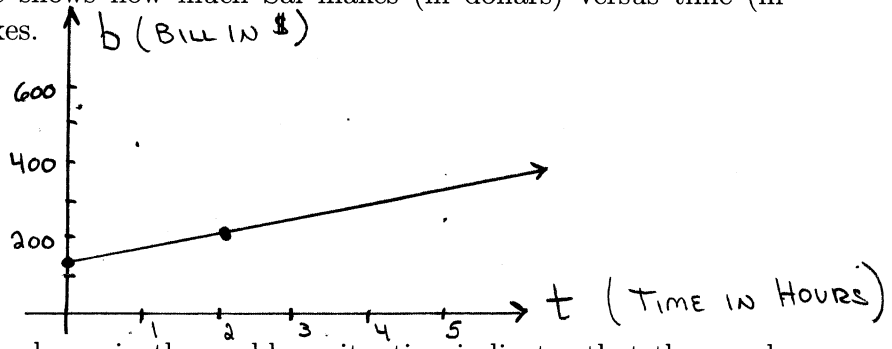
13. (4 points [2,3,4]) The line L passes through the points $(2, 3)$ and $(-5, 3)$. Find an equation of the line parallel to L and passing through $(6, -4)$.

HORIZONTAL LINE $y = 3$

HORIZONTAL LINE THROUGH $(6,-4)$ IS $y = -4$

14. (6 points [2,3,4]) Sal fixes vintage arcade games. He charges a flat fee of \$140 to make a house call, but then he charges a constant hourly rate on top of that. He recently made a house call to fix a Centipede game and ended up billing the client \$230 after 2 hours of work.

(a) Sketch the graph the shows how much Sal makes (in dollars) versus time (in hours). Label your axes.



(b) Which single word or phrase in the problem situation indicates that the graph should be a line?

CONSTANT HOURLY RATE

(c) Compute the slope of the graph. What does the slope of the graph represent?

(0, 140)
(2, 230)

$\frac{230-140}{2} = \frac{90}{2} = \boxed{45}$

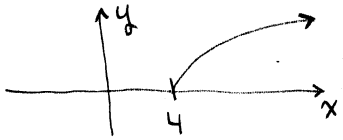
SAL CHARGES \$45 PER HOUR

15. (6 points [1]) Let $f(x) = \sqrt{x-4}$.

(a) What is the domain of f?

$x - 4 \geq 0 \Rightarrow x \geq 4$ $\quad$ $[4, \infty)$

(b) What is the range of f?



$y \geq 0$ $\quad$ $[0, \infty)$

(c) Evaluate $f(85)$.

$\sqrt{85-4} = \sqrt{81} = \boxed{9}$

(d) Evaluate $f(0)$.

$\sqrt{0-4} = \sqrt{-4}$

NOT A REAL #.
0 IS NOT IN THE DOMAIN.

16. (3 points [10]) Three relations are shown below. Circle all that are NOT functions. Then write a sentence explaining why you made your choice(s).

(a) $\{(x, y) : y \text{ is a whole number and } x = 1\}$

(b) $\{(3,4),(3,4),(3,4),(3,4),(3,4),(3,4)\}$

(c) $\{(0,0),(1,0),(0,1),(1,1)\}$

IN EACH OF THESE, THERE IS AT LEAST ONE X-VALUE WITH MORE THAN ONE (DIFFERENT) y-VALUE.

17. (3 points [1]) Determine the domain of $G(x) = \dfrac{2x+7}{2x^2-7x+3}$.

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

$x=\frac{1}{2}$ OR $x=3$

DOMAIN = ALL REAL #'S EXCEPT $x=\frac{1}{2}$ OR $x=3$

18. (5 points [5]) Let $g(x) = x^2+5x-1$. Expand and simplify the expression $g(x+3)-g(x)$.

$g(x+3) - g(x) = [(x+3)^2 + 5(x+3) - 1] - [x^2 + 5x - 1]$

$= x^2 + 6x + 9 + 5x + 15 - 1 - x^2 - 5x + 1$

$= 6x + 24$

19. (4 points [2,4]) Find two solutions of the equation $8x - 3y = 4$. Plot your solutions as ordered pairs, and then sketch the graph of the equation.

$x=2,\ y=4$

$8(2) - 3(4) = 16 - 12 = 4$ ✓

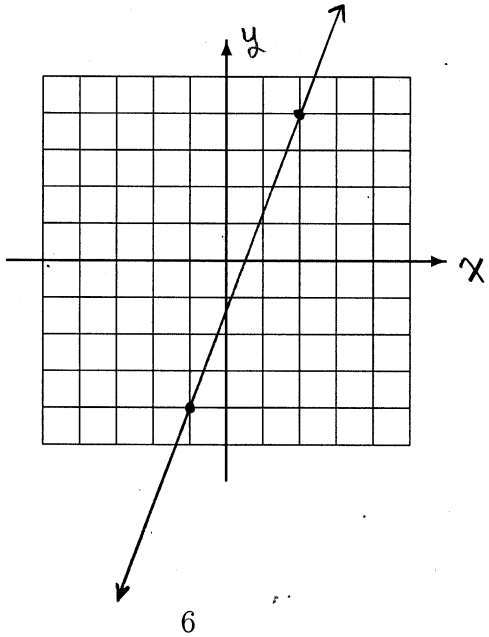
(2,4)

$x=-1,\ y=-4$

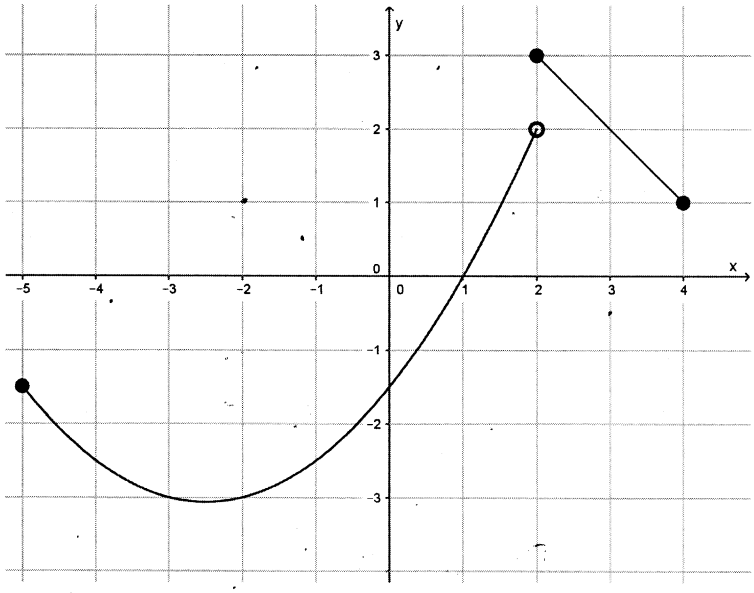
$8(-1) - 3(-4)$

$= -8 + 12 = 4$ ✓

(-1,-4)



20. (13 points [1,10]) The graph of $y = f(x)$ is shown below. Use the graph to solve each part of this problem.



(a) Is this the graph of a function? How do you know?

YES, THE GRAPH PASSES THE VERTICAL LINE TEST.

(b) What is the domain of f?

$[-5, 4]$

(c) What is the range of f?

ABOUT $[-3, 3]$

(d) Determine $f(-2)$.

$f(-2) \approx -3$

(e) Determine $f(5)$.

NOT DEFINED.

(f) Determine $f(2)$.

$f(2) = 3$

(g) Determine an x-value for which $f(x) = 1$.

$f(x) = 1$ AT $x \approx 1.5$ AND $x = 4$.