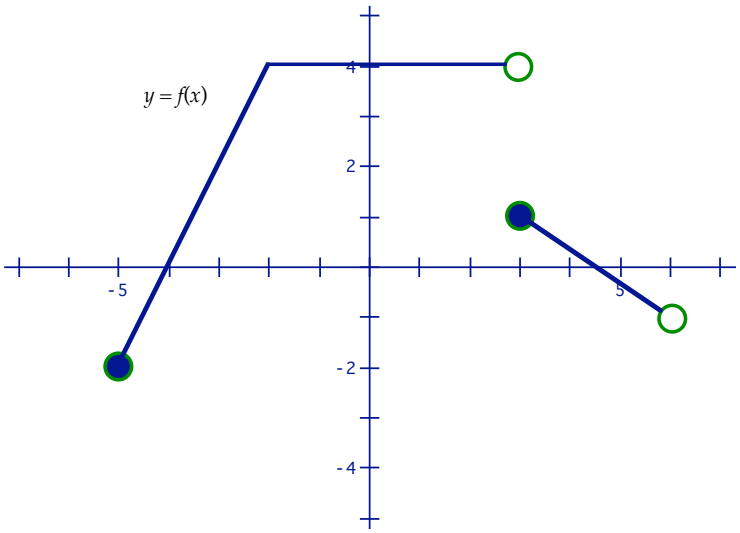
Functions: Exam 1 Name _____

You must complete and turn in this page before you may use your calculator.

Use this figure to answer problems 1 - 6



1. Estimate the following:

   a. $f(-3) =$ **2** **(2 pts)**

   b. z such that $f(z) = 0$

   $z = -4$ or 4.5 **(4 pts)**

2. Explain if f is a function or not and why.

   Yes, each x-value has only one y-value. **(4 pts)**

3. Write the linear equations for the three segments that make up $f(x)$.

   $y + 2 = 2(x + 5)$ or **$y = 8 + 2x$** or **$y = 2(x + 4)$**

   $y = 4$

   $y - 1 = {}^{-2}/_{3}(x - 3)$ or **$y = 3 - {}^{2}/_{3}x$** or **$y = {}^{-2}/_{3}(x - 4.5)$** **(6 pts)**

4. What is the domain and range of $f(x)$.

   Domain: $-5 \le x < 6$ **Range: $-2 \le y \le 4$** **(4 pts)**

5. Complete the story to match the graph (give rates, times and positions as much as you can).

   At 5minuts before 8:00 I noticed a spider hanging from a thread of web about 2 feet below my eye-level. It climbed at 2ft/min for three minutes then hung at 4 ft above eye-level for 5 min. At 8:03 it dropped to 1 foot above eye-level then descended slowly at 2/3 foot per minute for 3 minutes. At 8:06 the spider vanished from my sight. **(3 pts)**

6. Write a piecewise function for $f(x)$.

$$f(x) = \begin{cases} -5 \le x < -2 \\ -2 \le x < 3 \\ 3 \le x < 6 \end{cases}$$ **(5 pts)**

7. Solve each equation for x.

a. $18 = 5 - 2(x - 6)$

$18 = 5 - 2x + 12$

$18 = 17 - 2x$

$x = -½$ **(2 pts)**

b. $wx + wy = 3xy$

$wy = 3xy - wx$

$wy = (3y - w)x$

$x = \dfrac{wy}{3y - w}$ **(2 pts)**

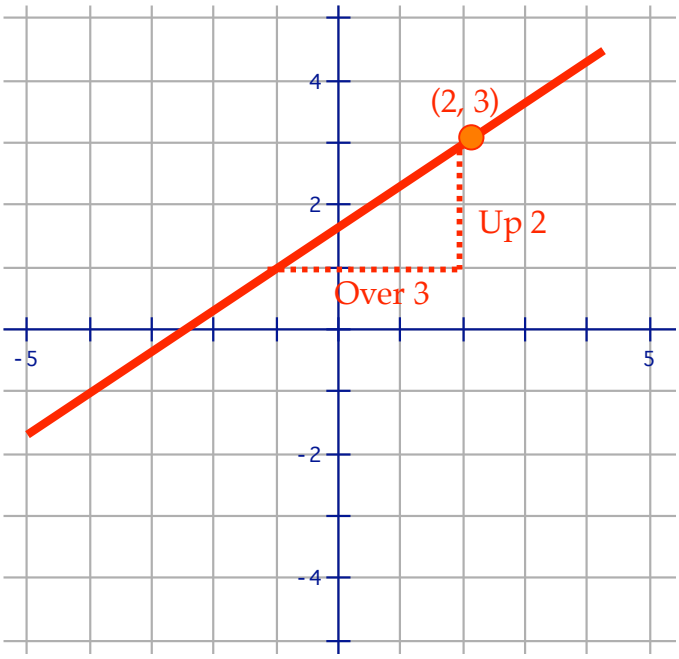
c. $x^2 + 7x = 8$

$(x + 8)(x - 1) = 0$

$x = -8, 1$ **(2 pts)**

Use the line $y - 3 = \frac{2}{3}(x - 2)$ to answer problems 8 - 11

8. Graph the line. **(5 pts)**



9. Write an equation of a line parallel through (-3, -1).

$y + 1 = \dfrac{2}{3}(x + 3)$ **(5 pts)**

10. Write an equation of a line perpendicular through (-3, -1).

$y + 1 = \dfrac{-3}{2}(x + 3)$ **(5 pts)**

11. Find the inverse function and solve for y.

$y = 2 + \dfrac{3}{2}(x - 3)$ **(5 pts)**

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You may use your calculator for this page.

A new plastic is made with 5 different concentrations of a polymer added then the material was tested and broken. Use this table of data to answer questions 12 –

Polymer added (ppm)	20	25	30	35	40
Breaking strength (psi)	161	175	182	185	186

12. Is there a linear relation between amount of polymer and the breaking strength? Explain.

No, rates (2.8, 1.4, 0.6, 0.2) are not equal. **(5 pts)**

13. What is the rate of change between 25 and 30ppm polymer?

$\frac{182-175}{30-25} = 1.4 \text{psi/ppm}$ (or 7/5) **(5 pts)**

14. Interpret the value you found in problem 13.

The breaking strength increases 1.4psi for each ppm of polymer that is added. **(4 pts)**

15. Use a linear approximation to estimate the breaking strength of plastic made with 23 ppm of polymer.

$161 + 2.8(23 - 20) = 169.4 \text{psi}$ **(6 pts)**

16. What is the direction and concavity of this relationship? Explain how you know this.

It is increasing and concave down. The y-values increase at a decreasing rate. (or the rates are positive and decreasing.) **(4 pts)**

A manufacturer can produce at most 2,000 units in a month. The cost of production (in dollars) will depend on the number of units produced and can be approximated by the equation $C(p) = 32050 + 160p$ where p is the number of units produced.

17. Complete the table showing production costs and unit costs. (Unit cost is defined as Total cost divided by units produced.) **(4 pts)**

Production	200	400	600	800
Cost	64050	96050	128050	160050
Unit Cost	320.25	240.12	213.42	200.06

18. Write a function for the number of Unit cost in terms of only p.

$$U(p) = \frac{32050 + 160p}{p} = \frac{32050}{p} + 160$$ **(5 pts)**

19. Give a realistic domain and range for your function.

Domain: $1 \le p \le 2000$ (Integer only)
Range: $176.025 \le u \le 32{,}210$ **(5 pts)**

20. If your goal is unit cost under \$200 what should you do? (show how you found your answer.)

$$200 = \frac{32050 + 160p}{p}$$
$$200p = 32050 + 160p$$
$$40p = 32050$$
$$p = 801.25$$

Make 802 or more. **(4 pts)**

21. Interpret the slope of the total cost model, $C(p)$.

Each additional unit made cost the producer \$160. **(4 pts)**