Student: _Solutions_

Date: _____

Instructor: Mary Robertson

Course: MAC 1105 Fall 2016 MaryAnn Robertson _Fall 2019_   **Assignment:** Final Exam Review

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1. Solve.

$$8\left(\frac{y-2}{4}-\frac{y+3}{8}=\frac{4y-3}{8}\right) \to$$

$$2(y-2)-(y+3)=4y-3$$
$$2y-4-y-3=4y-3$$
$$y-7=4y-3$$
$$-4=3y$$
$$\frac{-4}{3}=y$$

The solution set is { $-\frac{4}{3}$ }.

(Simplify your answer. Type an integer or a simplified fraction.)

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2. Solve.

$$\left(\frac{w}{w-2}-\frac{5w}{5w-3}=\frac{w-5}{5w^2-13w+6}\right)(w-2)(5w-3)\to$$

$$(5w-3)(w)-(w-2)(5w)=w-5$$
$$(5w^2-3w)-(5w^2-10w)=w-5$$
$$5w^2-3w-5w^2+10w=w-5$$
$$7w=w-5$$
$$6w=-5$$
$$w=-\frac{5}{6}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** $w=\dfrac{-5}{6}$

(Type an integer or a simplified fraction. Use a comma to separate answers as needed.)

○ **B.** The solution is all real numbers.

○ **C.** There is no solution.

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3. A freight train leaves the train station 1 hour before a passenger train. The two trains are traveling in the same direction on parallel tracks. If the rate of the passenger train is 5 mph faster than the freight train, how fast is each train traveling if the passenger train passes the freight train in 8 hours?

How fast is the freight train traveling?

___40___ mph

(Type an integer or a decimal.)

How fast is the passenger train traveling?

___45___ mph

(Type an integer or a decimal.)

$$r \cdot t = d$$

	r	t	d
freight	r	9	9r
passenger	r+5	8	8r+40

$$9r=8r+40$$
$$r=\boxed{\begin{array}{l}40 \text{ freight}\\45 \text{ passenger}\end{array}}$$

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4. Write the quotient in the form $a+bi$.

$$\left(\frac{5i}{4+4i}\right)\left(\frac{4-4i}{4-4i}\right)=\frac{20i-20i^2}{16-16i^2}=\frac{20+20i}{32}=\frac{20}{32}+\frac{20i}{32}=\boxed{\frac{5}{8}+\frac{5i}{8}}$$

$$\frac{5i}{4+4i}=\underline{\frac{5}{8}+\frac{5}{8}i}$$

(Simplify your answer. Type your answer in the form $a+bi$. Use integers or fractions for any numbers in the expression.)

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5. Solve the following quadratic equation using the quadratic formula.

$$2x^2-2x+9=0$$

$$x=\frac{1}{2}\pm\frac{i\sqrt{17}}{2}$$

$$x=\frac{2\pm\sqrt{(-2)^2-4(2)(9)}}{2(2)}=\frac{2\pm\sqrt{4-72}}{4}$$

$$x=\frac{2\pm\sqrt{-68}}{4}=\frac{2\pm2i\sqrt{17}}{4}=\boxed{\frac{1}{2}\pm\frac{i\sqrt{17}}{2}}$$

(Use a comma to separate answers as needed. Type an exact answer, using radicals as needed. Express complex numbers in terms of i.)

6. The length of a rectangle is 27 centimeters less than five times its width. Its area is 56 square centimeters. Find the dimensions of the rectangle.
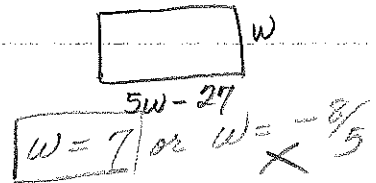
The width is ___7___ cm.

The length is ___8___ cm.

Handwritten work:
$w \cdot L = A$
$w(5w - 27) = 56$
$5w^2 - 27w = 56$
$5w^2 - 27w - 56 = 0$
$(5w + 8)(w - 7) = 0$
$w = 7$ or $w = -\frac{8}{5}$

7. Solve the equation.

$$\sqrt{6x + 6} = 6$$

The solution set is { ___5___ }.
(Simplify your answer. Use a comma to separate answers as needed.)

Handwritten work:
$(\sqrt{6x+6})^2 = (6)^2$
$6x + 6 = 36$
$6x = 30$
$x = 5$

8. Solve the three-part linear inequality. Graph the solution set on a number line and express the solution using interval notation.
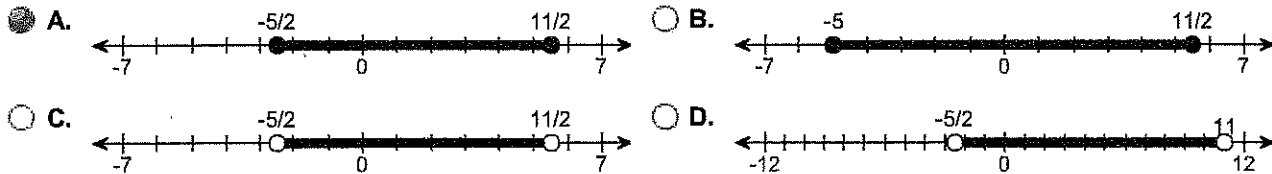
$$-10 \le 2x - 5 \le 6$$

Handwritten work:
$-10 \le 2x - 5 \le 6$
$-5 \le 2x \le 11$
$-\frac{5}{2} \le x \le \frac{11}{2}$ or $\left[-\frac{5}{2}, \frac{11}{2}\right]$

Choose the graph below.

● A.   -5/2 ... 11/2 (filled dots at -5/2 and 11/2, on scale -7 to 7)
○ B.   -5 ... 11/2 (filled dots, scale -7 to 7)
○ C.   -5/2 ... 11/2 (open dots, scale -7 to 7)
○ D.   -5/2 ... 11 (open dots, scale -12 to 12)

The solution is $\left[-\frac{5}{2}, \frac{11}{2}\right]$
(Type your answer in interval notation. Use integers or fractions for any numbers in the expression.)

9. Solve the inequality. Express the solution using interval notation.

$$|6 - 4x| \le 1$$

Handwritten work:
$6 - 4x \le 1$ and $6 - 4x \ge -1$
$-4x \le -5$ $-4x \ge -7$
$x \ge \frac{5}{4}$ and $x \le \frac{7}{4}$

Select the correct choice below and fill in any answer boxes in your choice.

● A. The solution is $\left[\frac{5}{4}, \frac{7}{4}\right]$.
(Simplify your answer. Use integers or fractions for any numbers in the expression. Type your answer in interval notation.)

○ B. The solution set is ∅.

10. Find the midpoint of the line segment joining points A and B.

A(5, − 4); B(4,7)

The midpoint is $\left(\frac{9}{2}, \frac{3}{2}\right)$. (Type an ordered pair. Simplify your answer.)

Handwritten work:
$\left(\frac{5+4}{2}, \frac{-4+7}{2}\right)$
$\left(\frac{9}{2}, \frac{3}{2}\right)$

11. Find the distance d(A,B) between points A and B.

A(1,1); B(− 1, − 8)

d(A,B) = $\sqrt{85}$

Handwritten work:
$d = \sqrt{(-1-1)^2 + (-8-1)^2}$
$= \sqrt{(-2)^2 + (-9)^2}$
$= \sqrt{4 + 81} = \sqrt{85}$

(Simplify your answer. Type an exact answer, using radicals as needed.)

12. Find the center, radius, and intercepts of the circle below and then sketch the graph of the circle.

$$(x + 3)^2 + (y + 6)^2 = 81$$

The center of the circle is ___(−3, −6)___ .
(Type an ordered pair.)

The radius is ___9___ .
(Simplify your answer. Type an exact answer, using radicals as needed.)

Select the correct choice below and, if necessary, fill in the answer box within your choice.

● **A.** The x-intercept(s) is/are ___−3 ± 3√5___ .
(Use a comma to separate answers as needed. Type

○ **B.** There is no x-intercept.

Select the correct choice below and, if necessary, fill in the answer box within your choice.

● **A.** The y-intercept(s) is/are ___−6 ± 6√2___ .
(Use a comma to separate answers as needed. Type

○ **B.** There is no y-intercept.

Use the graphing tool to graph the circle.

Handwritten work:
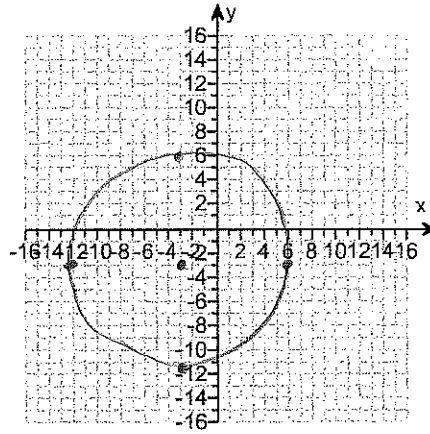
x-int
(y=0)
$(x+3)^2 + (0+6)^2 = 81$
$x^2 + 6x + 9 + 36 = 81$
$x^2 + 6x - 36 = 0$
$x = \dfrac{-6 \pm \sqrt{6^2 - 4(1)(-36)}}{2}$
$x = \dfrac{-6 \pm \sqrt{180}}{2}$
$x = \dfrac{-6 \pm 6\sqrt{5}}{2} = -3 \pm 3\sqrt{5}$

y-int (x=0)
$(0+3)^2 + (y+6)^2 = 81$
$9 + y^2 + 12y + 36 = 81$
$y^2 + 12y + 45 = 81$
$y^2 + 12y - 36 = 0$
$y = \dfrac{-12 \pm \sqrt{12^2 - 4(1)(-36)}}{2}$
$y = \dfrac{-12 \pm \sqrt{288}}{2}$
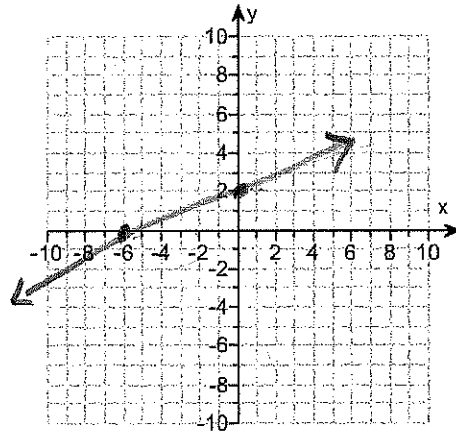$y = \dfrac{-12 \pm 12\sqrt{2}}{2}$
$y = -6 \pm 6\sqrt{2}$

13. Use the intercepts to graph the equation.

$$x - 3y = -6$$

Use the graphing tool to graph the line.

Handwritten work:

x-int
$x - 3(0) = -6$
$x = -6$

y-int
$0 - 3y = -6$
$-3y = -6$
$y = 2$

14. Use the given conditions to write an equation for the line in slope-intercept form.

Passing through (3, −6) and parallel to the line whose equation is 6x − 4y = 7

Write an equation for the line in slope-intercept form.

$y = \dfrac{3}{2}x - \dfrac{21}{2}$

(Type your answer in slope-intercept form. Use integers or simplified fractions for any numbers in the equation.)

Handwritten work:

$6x - 4y = 7$
$-4y = -6x + 7$
$y = \dfrac{-6x}{-4} + \dfrac{7}{-4}$
$y = \dfrac{3}{2}x - \dfrac{7}{4}$
$m = \dfrac{3}{2}$

$y + 6 = \dfrac{3}{2}(x - 3)$
$y + 6 = \dfrac{3}{2}x - \dfrac{9}{2}$
$y = \dfrac{3}{2}x - \dfrac{9}{2} - \dfrac{12}{2}$
$\boxed{y = \dfrac{3}{2}x - \dfrac{21}{2}}$

15. Use the given conditions to write an equation for the line in slope-intercept form.

Passing through $(-3,1)$ and perpendicular to the line whose equation is $y = \dfrac{5}{6}x + \dfrac{1}{2}$

$y - 1 = -\dfrac{6}{5}(x+3)$

$y - 1 = -\dfrac{6}{5}x - \dfrac{18}{5}$

Write an equation for the line in slope-intercept form.

$\perp m = -\dfrac{6}{5}$

$y = -\dfrac{6}{5}x - \dfrac{18}{5} + \dfrac{5}{5}$

$y = -\dfrac{6}{5}x - \dfrac{13}{5}$

$y = -\dfrac{6}{5}x - \dfrac{13}{5}$

(Type your answer in slope-intercept form. Use integers or simplified fractions for any numbers in the equation.)

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16. a) Determine if the relation is also a function.
    b) Give the domain and range of the relation or function.

   $\{(4, -2), (8,0), (2,7), (6,5), (9, 7), (3, 6)\}$

a) Is the relation a function?

○ No
● Yes

b) List the elements of the domain. Choose the correct answer below.

○ **A.** $D = \{-2, 0, 6, 8, 3\}$
○ **B.** $D = \{2, 9, 4, -2, 0\}$
● **C.** $D = \{2, 9, 4, 6, 8, 3\}$
○ **D.** $D = \{-2, 0, 7, 5, 6\}$

List the elements of the range. Choose the correct answer below.

○ **A.** $R = \{2, 9, 4, 6, 8, 3\}$
○ **B.** $R = \{-2, 0, 6, 8, 3\}$
● **C.** $R = \{-2, 0, 7, 5, 6\}$
○ **D.** $R = \{2, 9, 4, -2, 0\}$

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17. Evaluate the following function at the values 1, -1, and $x - 1$.

$$f(x) = x^2 - 3$$

$f(1) = \underline{\quad -2 \quad}$ (Type an integer or a simplified fraction.)

$f(-1) = \underline{\quad -2 \quad}$ (Type an integer or a simplified fraction.)

$f(x-1) = x^2 - 2x - 2$

(Simplify your answer. Type an expression using x as the variable. Use integers or fractions for any numbers in the expression.)

$f(1) = 1^2 - 3$
$= -2$

$f(-1) = (-1)^2 - 3$
$= -2$

$f(x-1) = (x-1)^2 - 3$
$= x^2 - 2x + 1 - 3$
$= x^2 - 2x - 2$

18.

Determine the difference quotient $\dfrac{f(x+h)-f(x)}{h}$.

$f(x) = 12 - 7x$

$f(x+h) = 12 - 7(x+h)$
$= 12 - 7x - 7h$

First, determine $f(x+h)$.

$f(x+h) = \underline{12 - 7x - 7h}$
(Simplify your answer.)

Next, determine $f(x)$.

$f(x) = \underline{12 - 7x}$
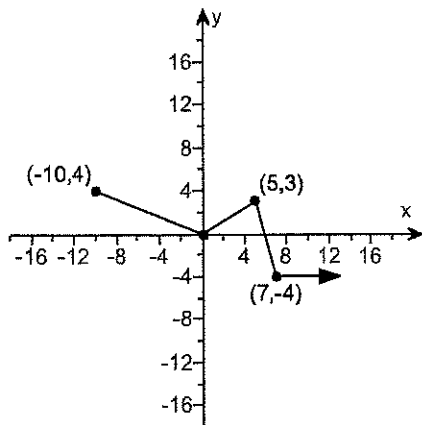(Simplify your answer.)

Now, simplify the expression $f(x+h) - f(x)$.

$(12 - 7x - 7h) - (12 - 7x)$
$12 - 7x - 7h - 12 + 7x$

$f(x+h) - f(x) = \underline{-7h}$
(Simplify your answer.)

Finally, determine the difference quotient $\dfrac{f(x+h)-f(x)}{h}$.

$\dfrac{-7h}{h} = -7$

$\dfrac{f(x+h)-f(x)}{h} = \underline{-7}$
(Simplify your answer.)

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1. Determine the interval(s) on which the function is (a) increasing, (b) decreasing, and (c) constant.

(-10,4)   (5,3)   (7,-4)

(a) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** The function is increasing on the interval(s) $(0,5)$
(Type your answer in interval notation. Use a comma

○ **B.** There is no solution.

(b) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

$(-10,0) , (5,7)$

● **A.** The function is decreasing on the interval(s) _____
(Type your answer in interval notation. Use a comma

○ **B.** There is no solution.

(c) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** The function is constant on the interval(s) $(7,\infty)$
(Type your answer in interval notation. Use a comma

○ **B.** There is no solution.

20. **(a)** For what value(s) of x does the function obtain a relative minimum?
(b) Find the relative minimum value.
(c) For what value(s) of x does the function obtain a relative maximum?
(d) Find the relative maximum value.

(a) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** The function obtains a relative minimum at ___ -2 ___
(Type an integer or a decimal.)

○ **B.** There is no solution.

(b) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** The relative minimum value is ___ -4 ___ .
(Type an integer or a decimal.)

○ **B.** There is no solution.

(c) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** The function obtains a relative maximum at ___ -8 ___
(Type an integer or a decimal.)

○ **B.** There is no solution.

(d) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** The relative maximum value is ___ 5 ___ .
(Type an integer or a decimal.)

○ **B.** There is no solution.
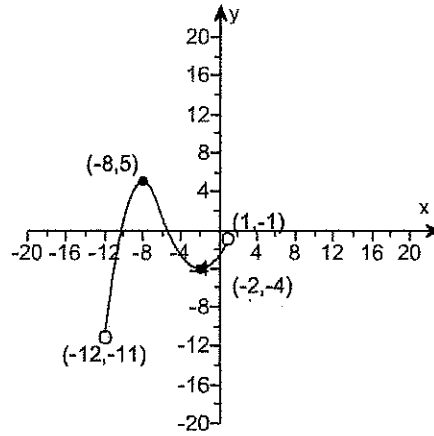
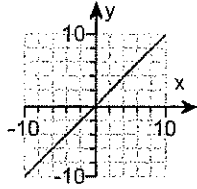21. Sketch the graph of the function and identify the properties that apply.

$f(x) = x^3$

Choose the correct graph of the function.

x	y
2	8
1	1
0	0
-1	-1
-2	-8
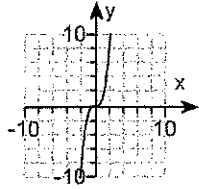
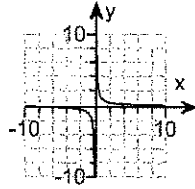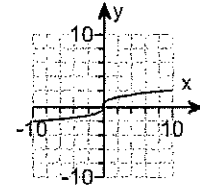● A.   ○ B.   ○ C.   ○ D.

Is the function f an odd function?

● yes
○ no

Is the function f a linear function?

● no
○ yes

Is the range of f $(-\infty, \infty)$?

● yes
○ no

22. Give the rule that describes the piecewise-defined function in the graph below.

$f(x) = 5$

$f(x) = x + 2$

(1,5)
(1,3)
(-8,-6)

What is the rule?
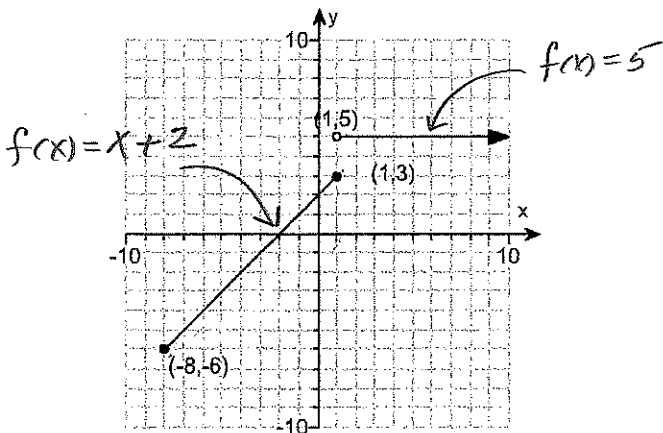
○ A. $f(x) = \begin{cases} x + 2 & \text{if } x \le 1 \\ 5 & \text{if } x > 1 \end{cases}$

● B. $f(x) = \begin{cases} x + 2 & \text{if } -8 \le x \le 1 \\ 5 & \text{if } x > 1 \end{cases}$

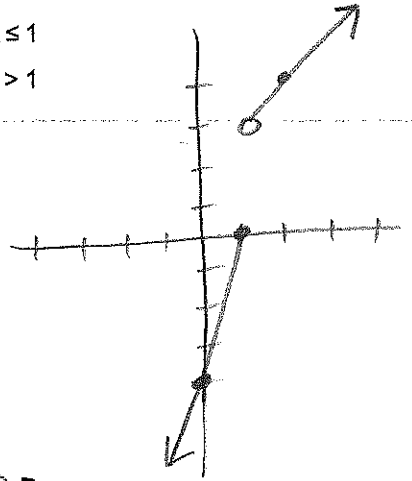○ C. $f(x) = \begin{cases} x + 3 & \text{if } -8 \le x < 1 \\ 5 & \text{if } x \ge 1 \end{cases}$

○ D. $f(x) = \begin{cases} x + 3 & \text{if } x \le 1 \\ 5 & \text{if } x > 1 \end{cases}$

23.

a. For the function f(x), find f(1), f(−1), and f(2).
b. Sketch the graph of f(x).

(handwritten table)

x	y
0	−4
1	0
1	3
2	4

$$f(x) = \begin{cases} 4x - 4 & \text{if } x \le 1 \\ x + 2 & \text{if } x > 1 \end{cases}$$
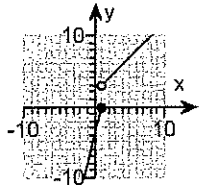
a. Find f(1), f(−1), and f(2).

f(1) = _0_ (Simplify your answer. Type an integer or a fraction.)

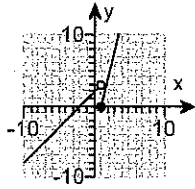f(−1) = _−8_ (Simplify your answer. Type an integer or a fraction.)

f(2) = _4_ (Simplify your answer. Type an integer or a fraction.)

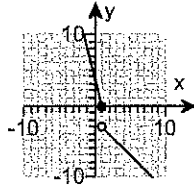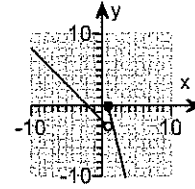**b.** Sketch the graph of f(x). Choose the correct graph below.

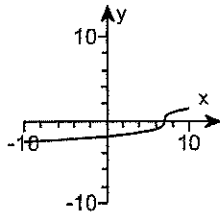● **A.**   ○ **B.**   ○ **C.**   ○ **D.**

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24. Use the graph of a known basic function and a horizontal shift to sketch the function.
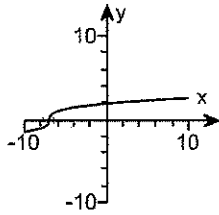
$$g(x) = \sqrt[3]{x + 7}$$

parent function: $g(x) = \sqrt[3]{x}$ *move 7 units left*
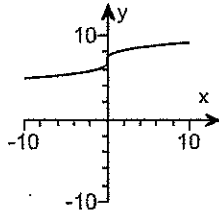
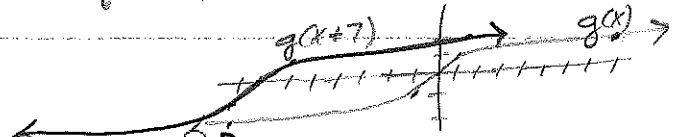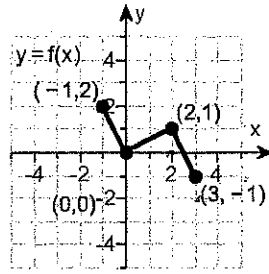Choose the graph that best sketches g(x).

○ **A.**   ● **B.**   ○ **C.**   ○ **D.**

25. Let $y = f(x)$ be the function sketched on the right. Use this graph to sketch the graph of $y = f(x-3) - 2$. Determine the four points on the new graph.

3 right   2 down

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

x	y	
-1	2	→ (2, 0)
0	0	→ (3, -2)
2	1	→ (5, -1)
3	-1	→ (6, -3)

(+3) (-2)

The point $(-1,2)$ shifts to which point on the new graph?

$(2, 0)$ (Type an ordered pair.)

The point $(0,0)$ shifts to which point on the new graph?

$(3, -2)$ (Type an ordered pair.)

The point $(2,1)$ shifts to which point on the new graph?
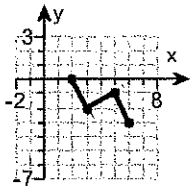
$(5, -1)$ (Type an ordered pair.)

The point $(3, -1)$ shifts to which point on the new graph?
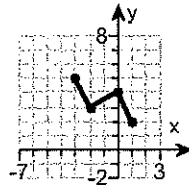
$(6, -3)$ (Type an ordered pair.)

Choose the correct graph below.

● A.   ○ B.   ○ C.   ○ D.
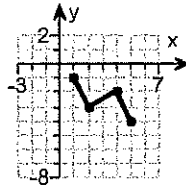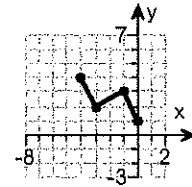
26. Evaluate $(gf)(3)$ given that $f(x) = \sqrt{x+6}$ and $g(x) = x^2 - 5$.

$(gf)(3) = g(3) \cdot f(3)$ $g(3) = \sqrt{9}$
$= 3$

Select the correct choice below and fill in any answer boxes in your choice.

$(gf)(3) = 3 \cdot 4$ $f(3) = 9 - 5$
$= 12$ $= 4$

● A. $(gf)(3) = $ _12_
   (Simplify your answer. Type an exact answer, using radicals as needed.)

○ B. The answer is undefined.

27.

For the pair of functions defined, find f + g, f − g, fg, and $\dfrac{f}{g}$. Give the domain of each.

$f(x) = 4x + 5, \; g(x) = x^2 - 4$

$(f + g)(x) = \underline{x^2 + 4x + 1}$ (Simplify your answer.) $4x + 5 + x^2 - 4$

The domain of $(f + g)(x)$ is $\underline{(-\infty, \infty)}$. (Type your answer in interval notation.)

$(f - g)(x) = \underline{-x^2 + 4x + 9}$ (Simplify your answer.) $(4x + 5) - (x^2 - 4) = 4x + 5 - x^2 + 4$

The domain of $(f - g)(x)$ is $\underline{(-\infty, \infty)}$. (Type your answer in interval notation.)

$(fg)(x) = \underline{}$ (Simplify your answer.) $(4x + 5)(x^2 - 4)$

$4x^3 + 5x^2 - 16x - 20$

The domain of $(fg)(x)$ is $\underline{(-\infty, \infty)}$. (Type your answer in interval notation.)

$\left(\dfrac{f}{g}\right)(x) = \underline{\dfrac{4x+5}{x^2 - 4}}$ (Simplify your answer.) $\dfrac{4x+5}{x^2-4}$ $\begin{aligned} x^2 - 4 &= 0 \\ x^2 &= 4 \\ x &= \pm 2 \end{aligned}$

The domain of $\left(\dfrac{f}{g}\right)(x)$ is $\underline{}$. (Type your answer in interval notation.)

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

28.

Let $f(x) = -2x - 1, \; h(x) = \dfrac{6}{x + 2}$. $(h \circ f)(x) = \dfrac{6}{-2x - 1 + 2} = \dfrac{6}{-2x + 1} = \dfrac{6}{-2(6) + 1} = -\dfrac{6}{11}$

Find $(h \circ f)(6)$.

(or)

$(h \circ f)(6) = \underline{\dfrac{-6}{11}}$ $f(6) = -2(6) - 1$ $h(-13) = \dfrac{6}{-13 + 2} = -\dfrac{6}{11}$

(Type an integer or a simplified fraction.) $= -13$

---

29. Determine whether the function is a one-to-one function.

$f(x) = -8|x|$

Not 1-to-1 b/c

Is the given function a one-to-one function? $f(1) = -8|1| = -8$

$f(-1) = -8|-1| = -8$

⦿ No

○ Yes

30. Determine whether f and g are inverse functions by evaluating (f ∘ g)(x) and (g ∘ f)(x).

$$f(x) = \frac{6}{5}x - 7 \text{ and } g(x) = \frac{5x - 35}{6}$$

What is (f ∘ g)(x)?

(f ∘ g)(x) = __x − 14__   (Use integers or fractions for any numbers in the expression.)

What is (g ∘ f)(x)?

(g ∘ f)(x) = __x − 35/3__   (Use integers or fractions for any numbers in the expression.)

Are f(x) and g(x) inverse functions?

● No
○ Yes

Handwritten work:

$(f \circ g)(x) = \frac{6}{5}\left(\frac{5x-35}{6}\right) - 7$

$= \frac{5x-35}{5} - 7$

$= x - 7 - 7$

$= x - 14$

$(g \circ f)(x) = \frac{5\left(\frac{6}{5}x-7\right) - 35}{6}$

$= \frac{6x - 35 - 35}{6}$

$= \frac{6x - 70}{6}$

$= x - \frac{35}{3}$

---

31. Write an equation for the inverse function, and then state the domain and range of f and f⁻¹.

$$f(x) = \sqrt[3]{4x - 5}$$

The inverse function is f⁻¹(x) = __$\frac{x^3 + 5}{4}$__ .
(Use integers or fractions for any numbers in the expression. Simplify your answer.)

The domain of f is __(−∞, ∞)__ .
(Type your answer in interval notation. Use integers or fractions for any numbers in the expression.)

The range of f is __(−∞, ∞)__ .
(Type your answer in interval notation. Use integers or fractions for any numbers in the expression.)

The domain of f⁻¹ is __(−∞, ∞)__ .
(Type your answer in interval notation. Use integers or fractions for any numbers in the expression.)

The range of f⁻¹ is __(−∞, ∞)__ .
(Type your answer in interval notation. Use integers or fractions for any numbers in the expression.)

Handwritten work:

$y = \sqrt[3]{4x - 5}$

$x = \sqrt[3]{4y - 5}$

$x^3 = 4y - 5$

$x^3 + 5 = 4y$

$\frac{x^3 + 5}{4} = y$ $\frac{x^3 + 5}{4} = f^{-1}(x)$

32. First rewrite the given quadratic function in standard form by completing the square, then address the following.

$f(x) = 3x^2 + 12x + 7$

Rewrite the quadratic function in standard form.

$f(x) =$ _$3(x+2)^2 - 5$_

a. What are the coordinates of the vertex?

The vertex is _$(-2, -5)$_.
(Type an ordered pair.)

b. Does the graph "open up" or "open down"?

● opens up
○ opens down

c. What is the equation of the axis of symmetry?

The axis of symmetry is _$x = -2$_.
(Type an equation.)

d. Find any x-intercepts. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** $x =$ _$-2 \pm \dfrac{\sqrt{15}}{3}$_
   (Type an exact answer, using radicals as needed. Us
○ **B.** There is no x-intercept.

e. Find the y-intercept. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.
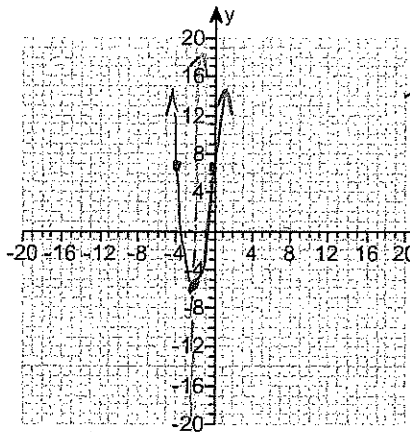
● **A.** $y =$ _7_
   (Type an integer or a fraction.)
○ **B.** There is no y-intercept.

f. Sketch the graph. Use the graphing tool to graph the function.

g. State the domain and range in interval notation.

The domain of f is the interval _$(-\infty, \infty)$_.
(Type your answer in interval notation.)

The range of f is the interval _$[-5, \infty)$_.
(Type your answer in interval notation.)

see bigger graph below.

$f(x) = 3(x^2 + 4x + 4) + 7 - 12$
$= 3(x + 2)^2 - 5$

(x-int)

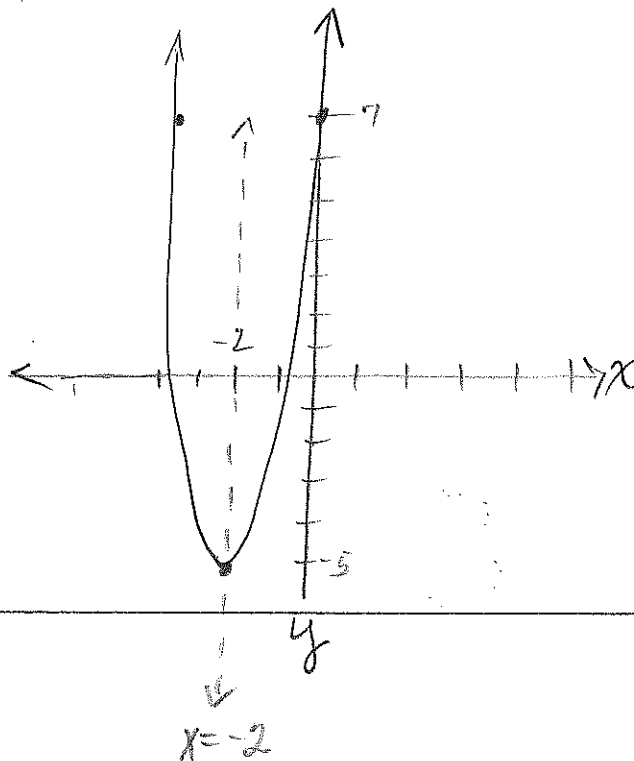$3(x+2)^2 - 5 = 0$
$3(x+2)^2 = 5$
$(x+2)^2 = \dfrac{5}{3}$
$x + 2 = \pm\sqrt{\dfrac{5}{3} \cdot \dfrac{3}{3}}$
$x = -2 \pm \dfrac{\sqrt{15}}{3}$

(y-int)

$f(0) = 3(0+2)^2 - 5$
$= 3(4) - 5$
$= 12 - 5$
$= 7.$

x = -2

33. Given the quadratic function in standard form, address the following.

    a. Sketch the graph.
    b. State the domain and range.

    $f(x) = -(x+1)^2 - 1$ $(-1, -1)$
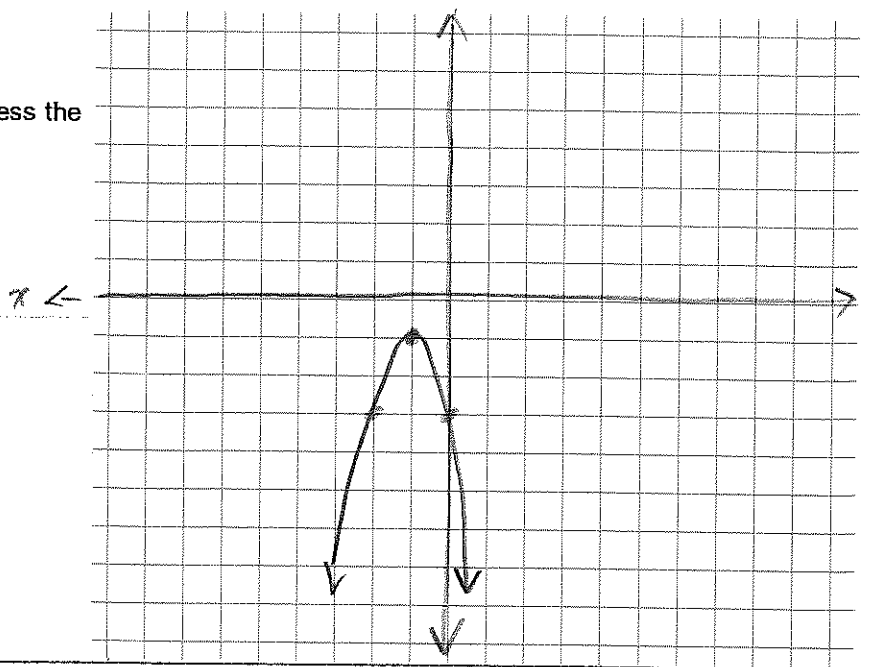
    a. Use the graphing tool to graph the function.

    vertex $(-1, -1)$ y-int: $(0, -2)$

    b. State the domain and range.

    The domain of f is the interval $(-\infty, \infty)$.
    (Type your answer in interval notation.)

    The range of f is the interval $(-\infty, -1]$.
    (Type your answer in interval notation.)

34. A toy rocket is shot vertically into the air from a 8-foot-tall launching pad with an initial velocity of 136 feet per second. Suppose the height of the rocket in feet t seconds after being launched can be modeled by the function

    $h(t) = -16t^2 + v_0 t + h_0$, where v_0 is the initial velocity of the rocket and h_0 is the initial height of the rocket. How long will it take for the rocket to reach its maximum height? What is the maximum height? $h(t) = -16t^2 + 136t + 8$

    (find the vertex)

    The rocket will reach its maximum height in ___4.25___ second(s). $h = \frac{-136}{2(-16)} = 4.25$ sec

    The maximum height reached by the rocket is ___297___ feet. $K = h(4.25) = -16(4.25)^2 + 136(4.25) + 8$

                                                                        $= 297$ feet

35. For the given rational function, answer parts a-c.   (y-int)

    $f(x) = \dfrac{x^2 - 121}{x}$

    $f(0) = \dfrac{0^2 - 121}{0}$ $\dfrac{x^2 - 121}{x} = \dfrac{0}{1}$

    DNE $x^2 - 121 = 0$
                                         $x^2 = 121$
                                         $x = \pm 11$

    a) Determine the domain.
    b) Determine the y-intercept (if any).
    c) Determine the x-intercepts.

    a) The domain of f(x) is $(-\infty, 0) \cup (0, \infty)$
    (Type your answer in interval notation. Use integers or fractions for any numbers in the expression.)

    b) Select the correct choice below and fill in any answer boxes within your choice.

    ○ **A.** The y-intercept is y = _does not exist_
        (Type an integer or a simplified fraction.)

    ● **B.** There is no y-intercept.

    c) Select the correct choice below and fill in any answer boxes within your choice.

    ● **A.** The x-intercepts are x = __±11__ .
        (Type an integer or a simplified fraction. Use a comma to separate answers as needed.)

    ○ **B.** There is no x-intercept.

36. Follow the nine-step graphing strategy to sketch the graph of the rational function.

$$f(x) = \frac{5}{x^2 - 16} \neq 0$$

$x^2 \neq 16 \quad x \neq \pm 4$

1. Find the domain.

The domain of f is $(-\infty, -4) \cup (-4, 4) \cup (4, \infty)$

(Type your answer in interval notation. Use integers or fractions for any numbers in the expression.)

2. Does f have any removable discontinuities? Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

○ A. There is a removable discontinuity at _____ . (Type an ordered pair.)
     The function simplifies to f(x) = _____ .

● B. There are no removable discontinuities.

3. Check for symmetry. Select all that apply.

$f(x) = f(-x)$
$x^2 - 16 = (-x)^2 - 16$
$x^2 - 16 = x^2 - 16$
y-axis symmetry

☐ A. The graph of f is symmetric about the origin.
☒ B. The graph of f is symmetric about the y-axis.
☐ C. The graph has no symmetry.

4. Find the y-intercept. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● A. The y-intercept is y = $\frac{-5}{16}$. (Simplify your answer.) $f(0) = \frac{5}{0-16} = -\frac{5}{16}$

○ B. The function has no y-intercept.

5. Find any x-intercepts. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ A. The x-intercept(s) is(are) x = _____ .
     (Simplify your answer. Use a comma to separate answers as needed.)

● B. The function has no x-intercept.

$\frac{5}{x^2-16} = \frac{0}{1}$
$5 \neq 0$ no x-intercept

6. Find the equations of any vertical asymptotes. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● A. The vertical asymptote(s) is(are) $x = \pm 4$.
     (Type an equation. Use a comma to separate answers as needed.)

○ B. The function has no vertical asymptotes.

7. Determine whether the graph has a horizontal asymptote or a slant asymptote. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● A. The horizontal asymptote is $y = 0$. (Type an equation.)

○ B. The function has no horizontal asymptote. It has a slant asymptote of _____ .
     (Type an equation. Type your answer in slope-intercept form.)

○ C. The function has no horizontal asymptote and has no slant asymptote.

8. Plot points choosing values of x between each intercept and values of x on either side of the vertical asymptotes. Substitute the given values of x into f(x) and simplify. $f(-5) = \frac{5}{25-16} = \frac{5}{9}$
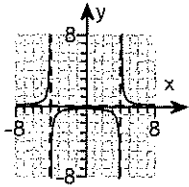
$(-5, f(-5)) = (-5, \frac{5}{9}$ _____)
$(0, f(0)) = (0, -\frac{5}{16}$ _____)
$(5, f(5)) = (5, \frac{5}{9}$ _____)

(Simplify your answers. Type an integer or a fraction.)

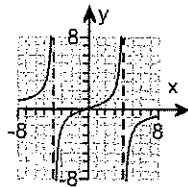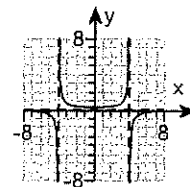**9.** Complete the sketch. Choose the correct graph below.

● **A.**   ○ **B.**   ○ **C.**   ○ **D.**
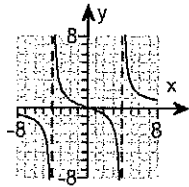
K	Y
−6	1/4
−5	5/9
−3	−5/7
0	−5/16
3	−5/7
5	5/9
6	1/4

---

*37. Find an equation of variation in which y varies jointly as x and z and <u>inversely</u> as the product of w and p, where

$y = \dfrac{5}{18}$ when x = 5, z = 15, w = 2, and p = 27.

The equation of variation is y = $\dfrac{1 \times z}{5 \, wp}$.
(Simplify your answer. Type an integer or a fraction.)

$$y = \frac{Kxz}{wp} \qquad \frac{5}{18} = \frac{(K)(5)(15)}{(2)(27)}$$

$$\frac{5}{18} = \frac{75K}{54} \qquad 1350K = 270 \qquad K = \frac{270}{1350} = \frac{1}{5}$$

---

38. Use the graph of $y = 2^x$ and transformations to sketch the exponential function. Determine the domain and range. Also, determine the y-intercept, and find the equation of the horizontal asymptote.

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

Use the graphing tool to graph the function.

$y = 2^x$

x	y
−1	1/2
0	1
1	2

What is the domain of f(x)?

$\left(-\infty, \infty \right)$

(Type your answer in interval notation.)
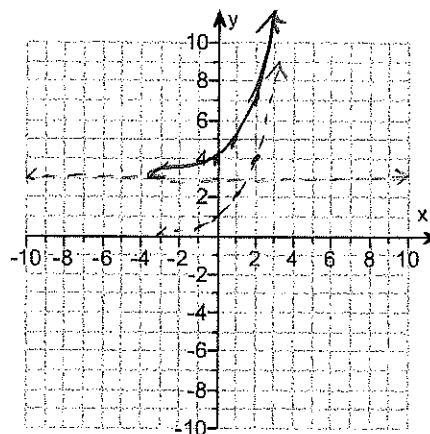
What is the range of f(x)?

$\left(3, \infty \right)$

(Type your answer in interval notation.)

What is the y-intercept?

4

(Simplify your answer. Type an integer or a fraction.)

What is the equation for the horizontal asymptote?
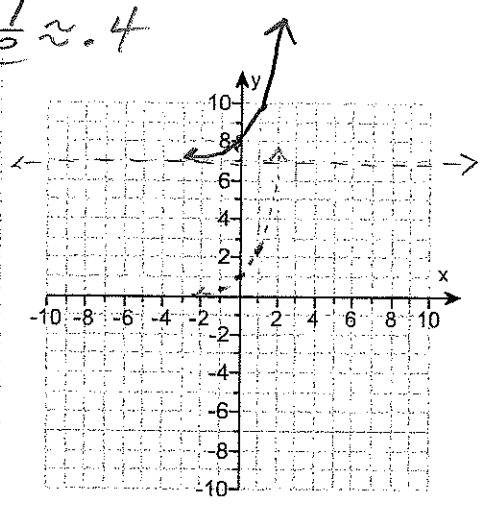
$y = 3$ (Type an equation.)

$e \approx 2.7$ $\frac{1}{e} \approx .4$

39. Use the graph of $y = e^x$ and transformations to sketch the exponential function $f(x) = e^x + 7$. Determine the domain and range. Also, determine the y-intercept, and find the equation of the horizontal asymptote.

Use the graphing tool to graph the function.

What is the domain of $f(x) = e^x + 7$?

$\left(-\infty, \infty \right)$

(Type your answer in interval notation.)

What is the range of $f(x) = e^x + 7$?

$\left(7, \infty \right)$

(Type your answer in interval notation.)

What is the y-intercept of $f(x) = e^x + 7$?

8

(Type an integer or a simplified fraction.)

What is the horizontal asymptote of $f(x) = e^x + 7$?

$y = 7$

(Type an equation.)

---

7. Solve the exponential equation using the method of "relating the bases" by first rewriting the equation in the form $b^u = b^v$.

$$2^{x-1} = \frac{1}{4}$$

$$2^{x-1} = 2^{-2}$$

$$x - 1 = -2$$

$$x = -1$$

$x = \underline{-1}$

---

41. Evaluate the logarithm without the use of a calculator.

$$\log_6 6^{-2} = -2$$

$$\log_6 \frac{1}{36}$$

$$\log_6 \frac{1}{36} = \underline{-2}$$

42. Sketch the logarithmic function. Label at least two points on the graph, and determine the domain and the equation of any vertical asymptotes.

$f(x) = \log(x - 2)$

Use the graphing tool to graph the function.

Two points on the graph of $f(x) = \log(x - 2)$ are
(__3__ ,0) and (__12__ ,1).
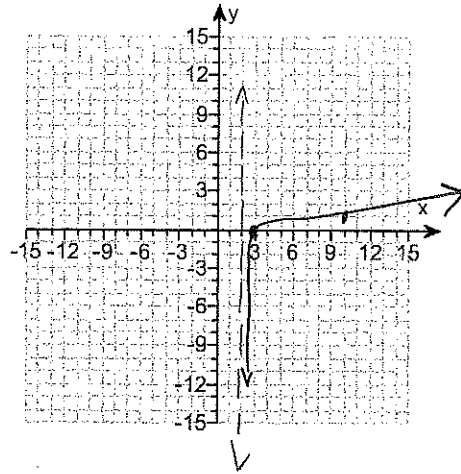(Type exact answers.)

Determine the domain of f(x).

The domain of f(x) is $\left(2, \infty\right)$.
(Type your answer in interval notation.)

Determine the equation of any vertical asymptotes. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** $x = 2$ (Type an equation.)

○ **B.** No vertical asymptotes

---

43. Use the properties of logarithms to expand the logarithmic expression. Wherever possible, evaluate logarithmic expressions.

$\ln\left(\dfrac{a^4 b^6}{c^9}\right)$

$\ln a^4 + \ln b^6 - \ln c^9$

$\boxed{4\ln a + 6\ln b - 9\ln c}$

$\ln\left(\dfrac{a^4 b^6}{c^9}\right) =$ _____ (Type an exact answer in simplified form.)

---

44. Use properties of logarithms to rewrite the expression as a single logarithm. Wherever possible, evaluate logarithmic expressions.

$\log_4 320 - \log_4 5$

$\log_4 320 - \log_4 5 =$ __3__

$\log_4\left(\dfrac{320}{5}\right) = \log_4(64) = \log_4(4^3) = 3 \cdot \log_4(4)$

$= 3 \cdot 1$

---

45. Use the properties of logarithms and the logarithm property of equality to solve the logarithmic equation.

$\log_3(2x + 3) = \log_3 9$

$x = $ __3__
(Type an integer or a simplified fraction.)

$2x + 3 = 9$
$2x = 6$
$x = 3$

---

46. Use the properties of logarithms and the logarithm property of equality to solve the logarithmic equation.

$\log_2(x + 2) + \log_2(x - 3) = \log_2(2x + 4)$

$x = $ __5__
(Type an integer or a simplified fraction. Use a comma to separate answers as needed.)

$\log_2((x+2)(x-3)) = \log_2(2x+4)$
$x^2 - x - 6 = 2x + 4$
$x^2 - 3x - 10 = 0$

$(x-5)(x+2) = 0$
$\boxed{x = 5} \quad x = -2$

47. Solve the logarithmic equation.

$\log_5(3x - 4) = 2$

(handwritten work:)
$3x - 4 = 5^2$
$3x - 4 = 25$
$3x = 29 \qquad x = \dfrac{29}{3}$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

● **A.** $x = \dfrac{29}{3}$ _____ (Simplify your answer. Use a comma to separate answers as needed.)

○ **B.** There is no solution.

---

48. Solve the system of equations by the substitution method.

$5x - y = 19$
$2x + 7y = -22$

(handwritten work:)
$5x - 19 = y$
$2x + 7(5x - 19) = -22$
$2x + 35x - 133 = -22$
$37x = 111$
$x = 3$

$5(3) - y = 19$
$15 - 19 = y$
$-4 = y$

The solution set is $(3, -4)$. (Simplify your answer. Type an ordered pair.)

---

49. Benjamin & Associates, a real estate developer, recently built 200 condominiums in McCall, Idaho. The condos were either two-bedroom units or three-bedroom units. If the total number of rooms in the entire complex is 516, how many two-bedroom units are there? How many three-bedroom units are there?

(handwritten work:)
$x = 2br \qquad y = 3br$
$x + y = 200$
$2x + 3y = 516$
$-2x - 2y = -400$
$y = 116$

There are ___84___ two-bedroom units and ___116___ three-bedroom units.

---

50. Solve the system of linear equations using the elimination method.

① $x + y + z = -2$
② $2x - y - 7z = -40$
③ $-x - y - 8z = -33$

The unique solution to the system is (___−4___ , ___−3___ , ___5___).
(Type an exact answer in simplified form.)

(handwritten work:)

① + ②
$x + y + z = -2$
$2x - y - 7z = -40$
④ $3x - 6z = -42$

① + ③
$x + y + z = -2$
$-x - y - 8z = -33$
$-7z = -35$
⑤ $z = 5$

Substitute ⑤ into ④
$3x - 6(5) = -42$
$3x - 30 = -42$
$3x = -12$
⑥ $x = -4$

Substitute ⑤ & ⑥ into ①
$-4 + y + 5 = -2$
$y + 1 = -2$
$y = -3$

(Check)
① $-4 - 3 + 5 = -2$
$-2 = -2$ ✓

② $2(-4) - (-3) - 7(5) = -40$
$-8 + 3 - 35$
$-43 + 3$
-40 ✓

③ $-(-4) - (-3) - 8(5) = -33$
$4 + 3 - 40$
$7 - 40$
-33 ✓

51.)

Sketch a graph with the following characteristics:
- ❖ The graph is a function
- ❖ The function has range: [-5, ∞)
- ❖ The function has x-intercept of (3, 0)
- ❖ The function has a relative minimum value = -2

answers may vary.

(3,0)

(7,-2)

(-4,-5)

-5
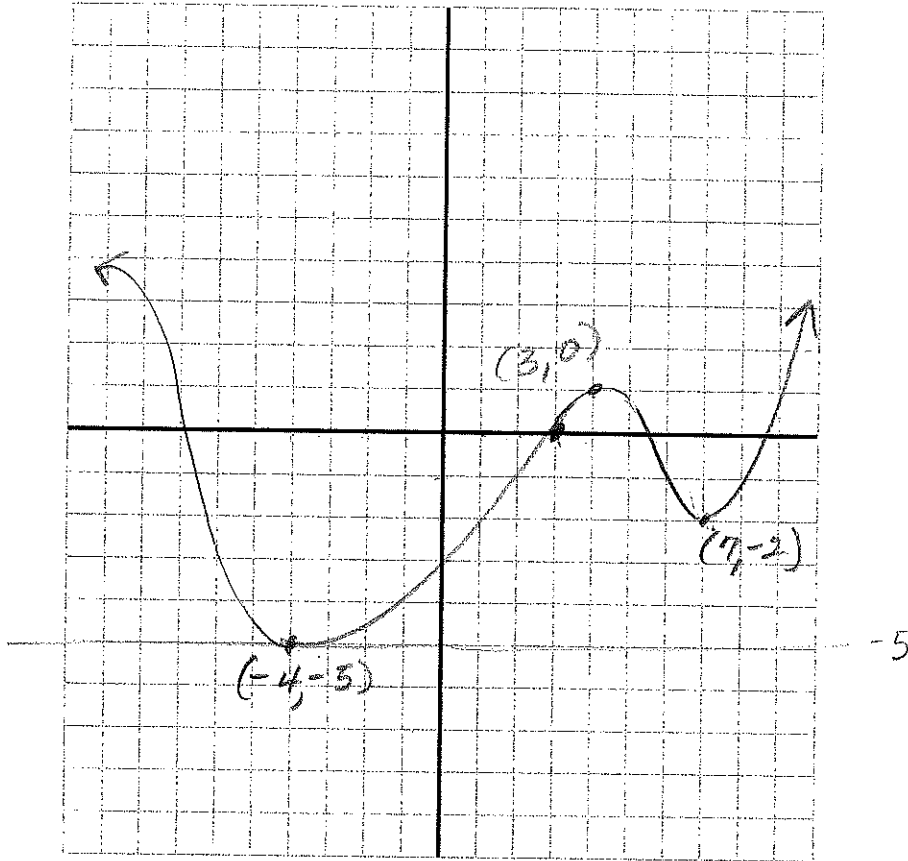
1)   State the domain of your function in interval notation $(-\infty, \infty)$

2)   Does your function have a relative maximum value(s)?   ⟨Yes⟩   No

If yes, state the maximum value(s)   1

3)   State the interval(s) on which your function is:

Increasing: $(-4, 4), (7, \infty)$

Decreasing: $(-\infty, -4), (4, 7)$

Constant: none