

Answer each of the following questions to the best of your ability. Show all work on test paper for credit to be given.

1. Factor each expression completely.

a) $x^2 + 3x - 18$

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

b) $-7x^2 + 14x$

$-7x(x-2)$

c) $9x^2 - 16$

$(3x-4)(3x+4)$

d) $4x^2 - 11x - 3$

$(4x+1)(x-3)$

2. Solve each equation.

a) $x^2 - 4x - 1 = 0$

$$x = \frac{4 \pm \sqrt{16 - 4(1)(-1)}}{2(1)}$$

$$x = \frac{4 \pm \sqrt{20}}{2}$$

$$x = \frac{4 \pm 2\sqrt{5}}{2}$$

$$x = 2 \pm \sqrt{5}$$

c) $2x^2 + 11x = 6$ (use next page for work)

$$-\frac{1}{3}x + 4 = 0$$

b) $-\frac{1}{3}x + 4 = 0$

$$-\frac{1}{3}x = -4$$

$$x = 12$$

$$0 = 2x^2 + 11x - 6$$

$$0 = 2x^2 + 12x - x - 6$$

$$0 = 2x(x+6) - 1(x+6)$$

$$x+6=0 \quad 2x-1=0$$

$$x=-6 \quad x=\frac{1}{2}$$

$$5-x = -x+5$$

D 3.

Suppose we are given the graph of $y = f(x)$. Which functional expression below describes a graph that is reflected across the x -axis then shifted 3 units to the right and 5 units up?

- A. $3 - f(x-5)$ B. $f(3-x) + 5$ C. $f(x-3) + 5$ D. $5 - f(x-3)$
- $-f(x-5) + 3$ $f(-x+3) + 5$ $-f(x-3) + 5$
- $f(-(x-3)) + 5$

D 4.

What is the domain of the function $f(x) = \frac{4}{\sqrt{x+1}}$ over the set of real numbers?

- A. $\{x \mid x = 1\}$ B. $\{x \mid x \geq -1\}$ C. $\{x \mid x < -1\}$ D. $\{x \mid x > -1\}$

$-f(x)$ = reflect over x -axis
 $f(-x)$ " " y -axis

$$(\sqrt{x+1})^2 \neq 0^2$$

$$x+1 \neq 0$$

$$x \neq -1$$

$$x+1 \geq 0$$

$$x \geq -1$$

5. Which negative number is not in the domain of $f(x) = \frac{3}{x^2-9}$?

$$x = -3$$

$$x^2 - 9 = 0$$

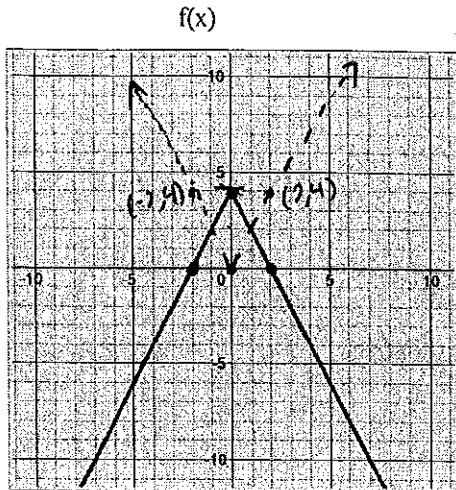
$$x^2 = 9$$

$$x = \pm 3$$

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

$$x = 3 \quad x = -3$$

6. Use the graph below to respond to parts a-d



a) Identify the parent function.

$$y = |x|$$

b) Describe any transformations in the graph of $f(x)$ from the parent graph.

- ① Reflection about the x-axis
- ② vertically stretched by a factor of 2 / horiz. comp. by factor of $\frac{1}{2}$
- ③ vertically shift up 4 units

c) Describe and changes in the coordinates of $f(x)$ from the parent graph.

- ① change sign of y-values (mult. by -1)
- ② mult. y-values by 2 / mult. x-values by $\frac{1}{2}$
- ③ add 4 to y-values

d) Write a rule for $f(x)$ using symbols. (i.e. Write equation for the function)

$$f(x) = -2|x| + 4 \quad F(x) = -|2x| + 4$$

e) State the domain and range of $f(x)$.

$$\{x \mid x \in \mathbb{R}\}$$

$$\{y \mid y \leq 4\}$$

$$y = |x|$$

x	y
-2	2
-1	1
0	0
1	1
2	2
-4	4
4	4

$$y = -2|x| + 4$$

$\frac{1}{2}x$	y
2	4
0	0
-2	4

$$y = -|2x| + 4$$

7. If the function $f(x)$ contains the set coordinates $\{(16, -1), (0, -4), (-3, 7)\}$ use the following function rule to determine the transformed set of coordinates.

a) $f(-2x) + 3 = \{(-8, 2), (0, -1), (\frac{3}{2}, 10)\}$

\uparrow add 3 to $\Delta y \downarrow$ y-values
 \uparrow Δx mult by $-\frac{1}{2}$

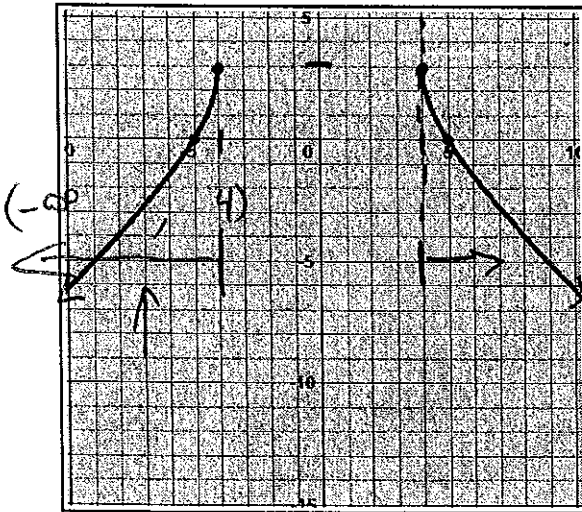
X	Y	$\frac{1}{2}x$	$Y+3$
16	-1	8	2
0	-4	0	-1
-3	7	-1.5	10

b) $-f(x+5) = \{(1, 1), (-5, 4), (-8, -7)\}$

\uparrow Δy change sign
 \uparrow Δx subtract 5

8. Use the graph below to respond to parts a-b

$h(x)$



a) State the domain and range of $h(x)$.

$$\{x \mid x \leq -4 \text{ or } x \geq 4\}$$

$$\{y \mid y \leq 3\}$$

b) Identify intervals of increasing, decreasing or constant.

increasing $(-\infty, 4)$
 decreasing $(4, \infty)$

} x-values only

Use each function to answer the following questions.

$$9) f(x) = -\left(\frac{1}{3}x\right)^2 - 1$$

\uparrow Δx mult x by 3

a) Describe the differences in appearance in the graph of $f(x)$ when compared to the parent graph $y = x^2$

- ① Reflected about x -axis
- ② Horizontally stretched by a factor of 3
- ③ Vertically shifted down one unit

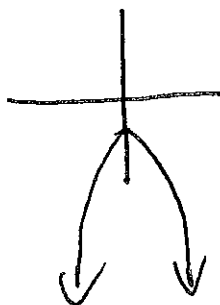
b) Describe the changes to the x and y coordinates of $f(x)$ when compared to the coordinates of $y = x^2$

- ① change the sign of y -values
- ② mult. x -values by 3
- ③ subtract 1 from y -values

c) Identify intervals of increasing decreasing or constant.

Decreasing $(0, \infty)$

Increasing $(-\infty, 0)$



10. Using the function $f(x) = \sqrt{x+2}$

a) State the domain and range of the $f(x)$

$$\{x | x \geq -2\}$$

$$\{y | y \geq 0\}$$

$$y = \sqrt{x+2}$$

↑

2

$$\begin{array}{r} \cancel{x}y \\ 2 \overline{) 73} \\ \underline{4} \\ 73 \\ \underline{70} \\ 30 \\ \underline{30} \\ 0 \end{array}$$

b) Graph $f(x)$

