

Name: _____

Block: _____

ALGEBRA 2 W/ TRIGONOMETRY - MIDTERM REVIEW

Algebra 1 Review

- Find Slope and Rate of Change
- Graph Equations of Lines
- Write Equations of Lines
- Absolute Value Functions
- Transformations
- Piecewise Functions
- Perform Basic Matrix Operations
- Multiply Matrices

Chapter 2

- Use Properties of Exponents (2.1)
- Evaluate and Graph Polynomial Functions (2.2)
- Add, Subtract, and Multiply Polynomials (2.3)
- Factor and Solve Polynomial Equations (2.4)
- Apply the Remainder and Factor Theorems (2.5)
- Find Rational Zeros (2.6)
- Apply the Fundamental Theorem of Algebra (2.7)
- Analyze Graphs of Polynomial Functions (2.8)

Chapter 1

- Graph Quadratic Functions in Standard Form (1.1)
- Graph Quadratic Function in Vertex or Intercept Form (1.2)
- Solve $x^2 + bx + c$ by factoring (1.3)
- Solve $ax^2 + bx + c$ by factoring (1.4)
- Solve Quadratic Equations by Finding Square Roots (1.5)
- Performing Operations with Complex Numbers (1.6)
- Completing the Square (1.7)
- Use the Quadratic Formula and the Discriminant (1.8)

Chapter 3

- Evaluate nth Roots and Use Rational Equations (3.1)
- Apply Properties of Rational Exponents (3.2)
- Perform Function Operations and Composition (3.3)
- Use Inverse Functions (3.4)
- Graph Square Root and Cube Root Functions (3.5)
- Solve Radical Equations (3.6)

A 1-page handwritten reference sheet is allowed on the midterm exam.

ALGEBRA 2 W/ TRIGONOMETRY - MIDTERM REVIEW

Algebra 1 Review

Tell whether the lines are parallel, perpendicular, or neither.

1. Line a goes through $(-7, 3)(-4, 1)$

Line b goes through $(-4, 6)(-1, 8)$

$$m = \frac{1-3}{-4+7} = -\frac{2}{3}$$

neither

$$m = \frac{8-6}{-1+4} = \frac{2}{3}$$

2. Line a goes through $(-2, -9)(6, -3)$

Line b goes through $(7, 5)(10, 1)$

$$m = \frac{-3+9}{6+2} = \frac{6}{8} = \frac{3}{4}$$

$$m = \frac{1-5}{10-7} = -\frac{4}{3}$$

perpendicular

Write the equation of the line that goes through the following points.

3. $(-7, 9)(-5, -3)$

$$m = \frac{-3-9}{-5+7} = \frac{-12}{2} = -6$$

$$9 = -6(-7) + b$$

$$9 = 42 + b$$

$$-42 - 42$$

$$-33 = b$$

$$y = -6x - 33$$

4. $(4, 2)(3, 5)$

$$m = \frac{5-2}{3-4} = \frac{3}{-1} = -3$$

$$2 = -3(4) + b$$

$$2 = -12 + b$$

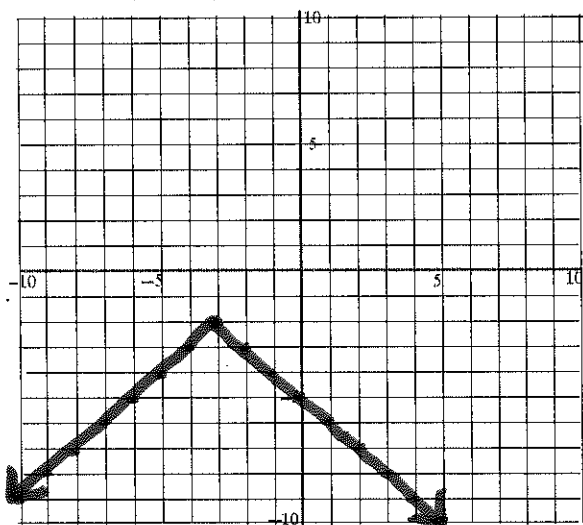
$$+12 + 12$$

$$14 = b$$

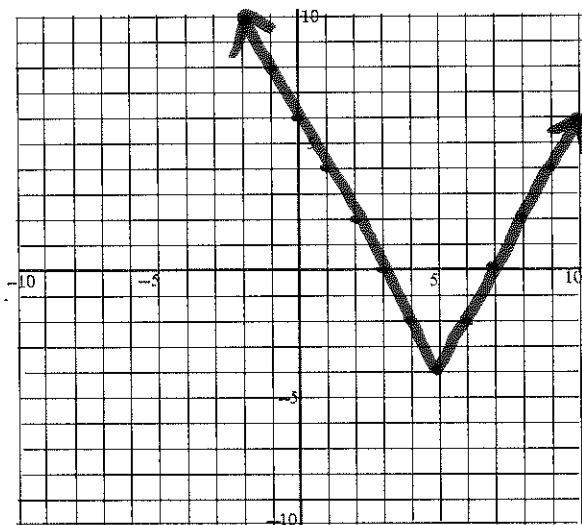
$$y = -3x + 14$$

Graph.

5. $f(x) = -|x+3| - 2$



6. $f(x) = 2|x-5| - 4$



Solve for x and y.

7.

$$2 \begin{bmatrix} 2x & 0 \\ 3 & -3y \end{bmatrix} = \begin{bmatrix} -12 & 0 \\ y & -6y \end{bmatrix}$$

$$2(2x) = -12 \quad 2(3) = y$$

$$\frac{4x}{4} = \frac{-12}{4}$$

$$(6 = y)$$

$$(x = -3)$$

8.

$$3 \begin{bmatrix} 3 & -2x \\ 2 & 4 \\ -y & 2 \end{bmatrix} - \begin{bmatrix} 2 & -2x \\ 0 & 5 \\ -2y & -2 \end{bmatrix} = \begin{bmatrix} 7 & 8 \\ 6 & 7 \\ 0 & 8 \end{bmatrix}$$

$$3(-2x) - (-2x) = 8$$

$$-6x + 2x = 8$$

$$\frac{-4x}{-4} = \frac{8}{-4}$$

$$x = -2$$

$$3(-y) - (-2y) = 0$$

$$-3y + 2y = 0$$

$$\frac{-y}{-1} = \frac{0}{-1}$$

$$(y = 0)$$

Use matrices A, B, and C to evaluate the matrix expression.

$$A = \begin{pmatrix} 2 & -5 \\ 7 & 2 \end{pmatrix} \quad B = \begin{pmatrix} 4 & -1 \\ 1 & -3 \end{pmatrix} \quad C = \begin{pmatrix} -9 & -2 \\ 5 & 0 \end{pmatrix}$$

9. $3AB$

$$3 \begin{bmatrix} 2 & -5 \\ 7 & 2 \end{bmatrix} \begin{bmatrix} 4 & -1 \\ 1 & -3 \end{bmatrix}$$

$$3 \begin{bmatrix} 8-5 & -2+15 \\ 28+2 & -7-6 \end{bmatrix}$$

$$3 \begin{bmatrix} 3 & 13 \\ 30 & -13 \end{bmatrix}$$

$$\begin{bmatrix} 9 & 39 \\ 90 & -39 \end{bmatrix}$$

10. $A(B+C)$

$$\begin{bmatrix} 2 & -5 \\ 7 & 2 \end{bmatrix} \begin{bmatrix} -5 & -3 \\ 6 & -3 \end{bmatrix}$$

$$\begin{bmatrix} -10-30 & -6+15 \\ -35+12 & -21-6 \end{bmatrix}$$

$$\begin{bmatrix} -40 & 9 \\ -23 & -27 \end{bmatrix}$$

11. $(A-B)C$

$$\begin{bmatrix} -2 & -4 \\ 6 & 5 \end{bmatrix} \begin{bmatrix} -9 & -2 \\ 5 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 18-20 & 4+0 \\ -54+25 & -12+0 \end{bmatrix}$$

$$\begin{bmatrix} -2 & 4 \\ -29 & -12 \end{bmatrix}$$

PARENT GRAPH: $y = f(x)$

TRANSFORMATION FUNCTION: $y = a \cdot f(x - h) + k$

12. Graph the transformation function.
In the space provided, identify the value of a , h , and k and describe the related transformation.

PARENT FUNCTION:

$$y = x^2$$

TRANSFORMATION FUNCTION: $y = (x + 5)^2 + 4$

$a =$ 1

Description:

$h =$ -5

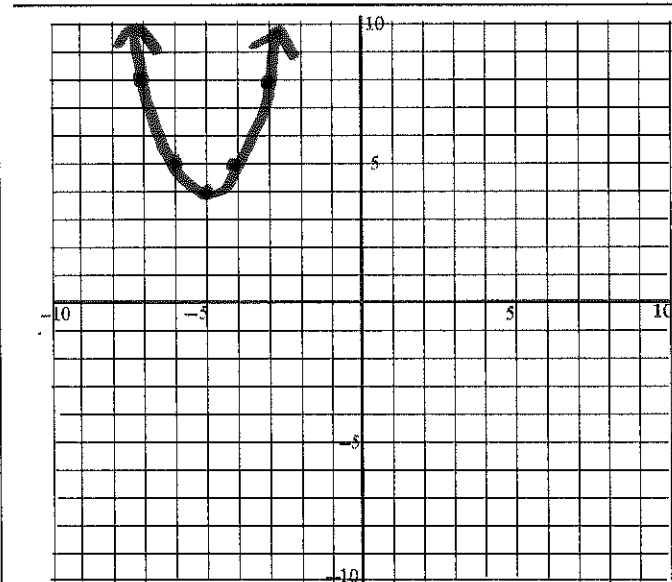
Description:

left 5

$k =$ 4

Description:

up 4



13. Based on the transformations described, write in the transformation function.

PARENT FUNCTION:

$$y = |x|$$

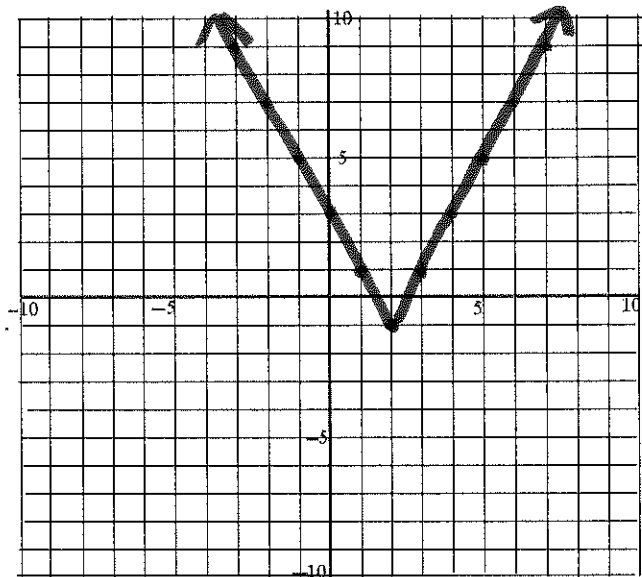
Description:

- Translated right 2 units $h = 2$
- Translated down 1 unit $k = -1$
- Stretched vertically by a factor of 2 $a = 2$

TRANSFORMATION FUNCTION:

$$y = 2|x - 2| - 1$$

Graph the transformation function.



PARENT GRAPH: $y = f(x)$

TRANSFORMATION FUNCTION: $y = a \cdot f(x-h) + k$

14. Graph the transformation function.

In the space provided, identify the value of a , h , and k and describe the related transformation.

PARENT FUNCTION:

$$y = x^2$$

TRANSFORMATION FUNCTION:

$$y = -(x+4)^2 - 2$$

$$a = \underline{-1}$$

Description:

reflect horizontally

$$h = \underline{-4}$$

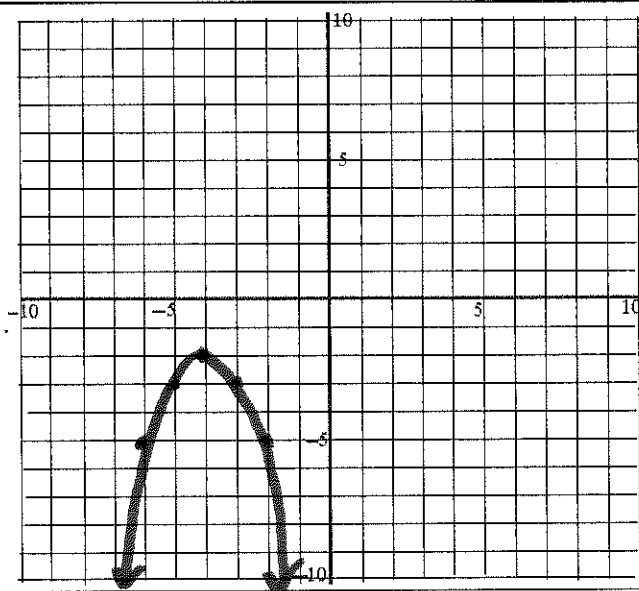
Description:

left 4

$$k = \underline{-2}$$

Description:

down 2



15. Based on the transformations described, write in the transformation function.

PARENT FUNCTION:

$$y = |x|$$

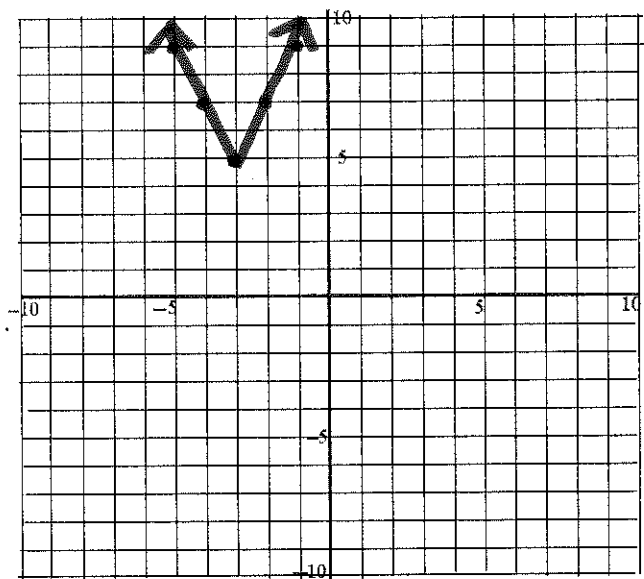
Description:

- Translated left 3 units $h = -3$
- Translated up 5 units $k = 5$
- Stretched vertically by a factor of 2 $a = 2$

TRANSFORMATION FUNCTION:

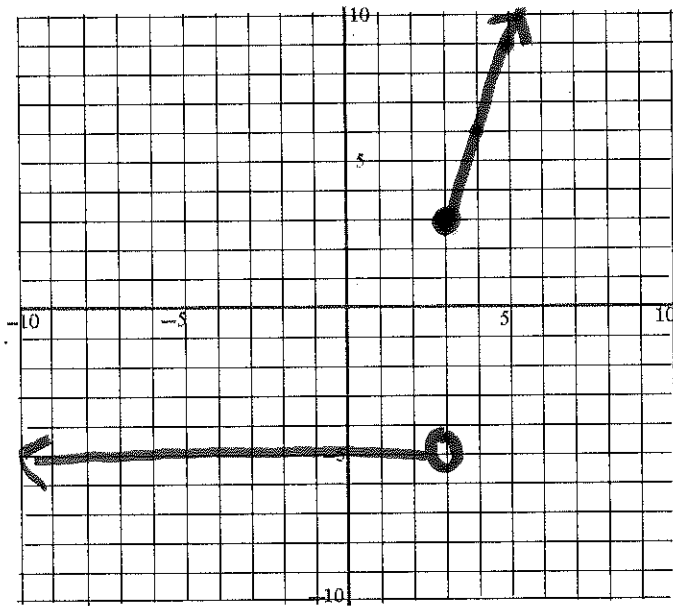
$$\underline{y = 2|x+3|+5}$$

Graph the transformation function.

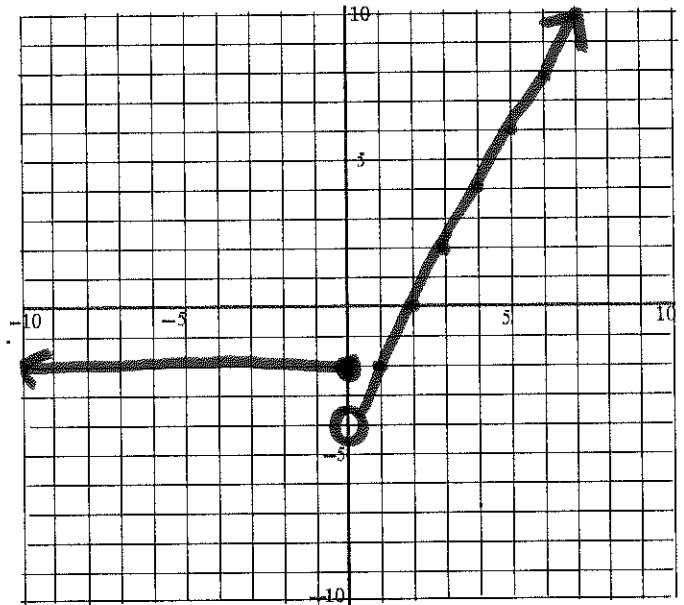


Graph the piecewise function.

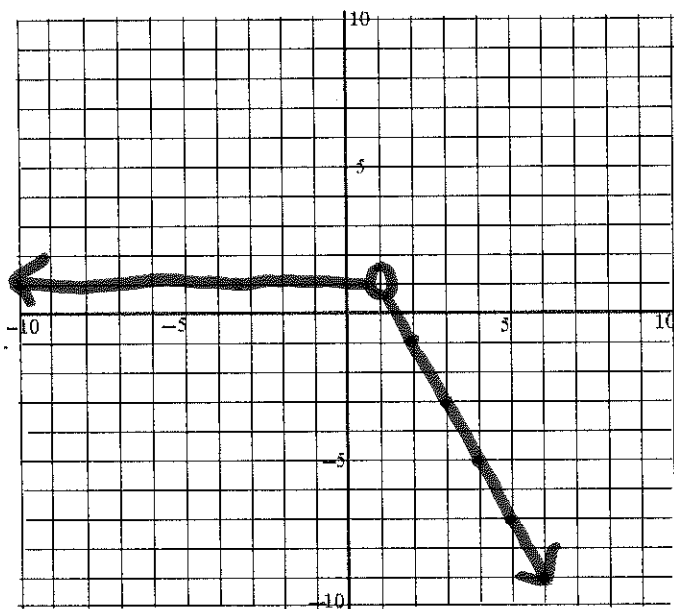
$$16. f(x) = \begin{cases} 3x - 6 & \text{if } x \geq 3 \\ -5 & \text{if } x < 3 \end{cases}$$



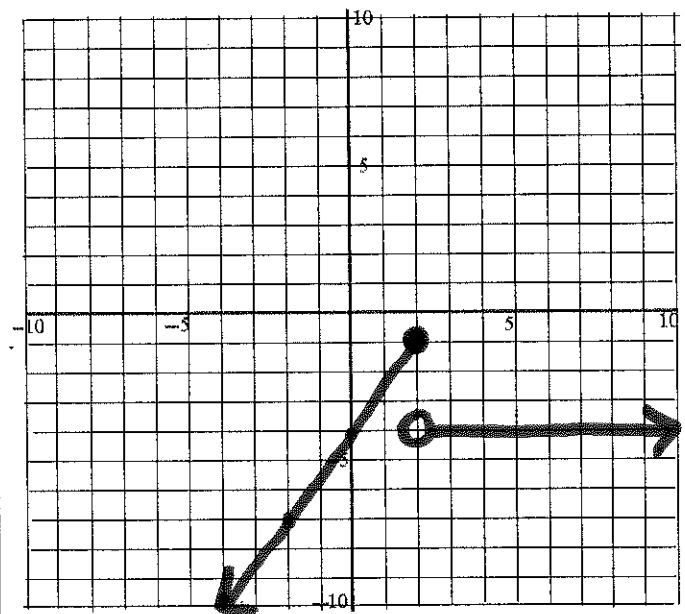
$$17. f(x) = \begin{cases} 2x - 4 & \text{if } x > 0 \\ -2 & \text{if } x \leq 0 \end{cases}$$



$$18. f(x) = \begin{cases} -2x + 3 & \text{if } x \geq 1 \\ 1 & \text{if } x < 1 \end{cases}$$



$$19. f(x) = \begin{cases} -4 & \text{if } x > 2 \\ \frac{3}{2}x - 4 & \text{if } x \leq 2 \end{cases}$$



ALGEBRA 2 W/ TRIGONOMETRY - MIDTERM REVIEW

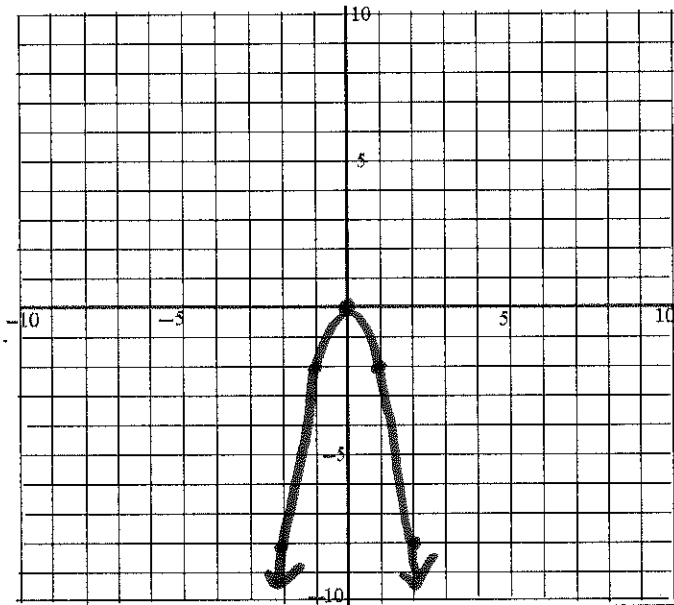
Chapter 1 Review

Graph the function. Label the vertex and the axis of symmetry.

20. $y = -2x^2$

vertex: (0, 0)

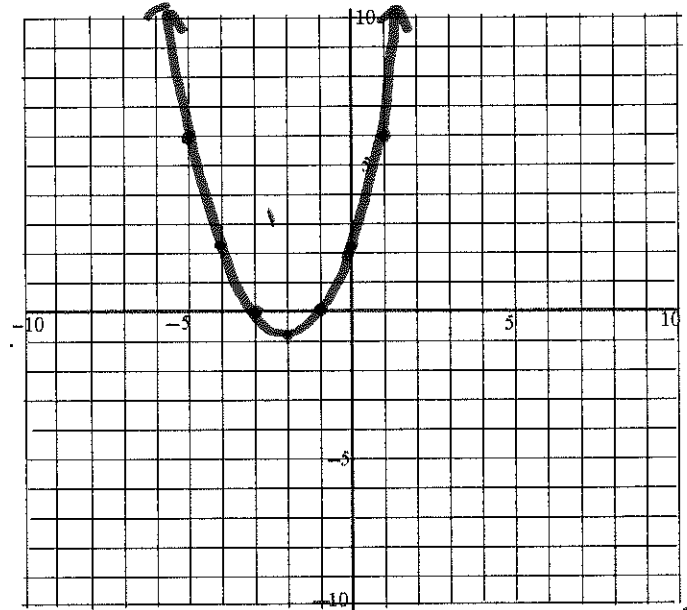
a.o.s.: $x = 0$



21. $y = \frac{3}{4}x^2 + 3x + \frac{9}{4}$

vertex: (-2, -7.5)

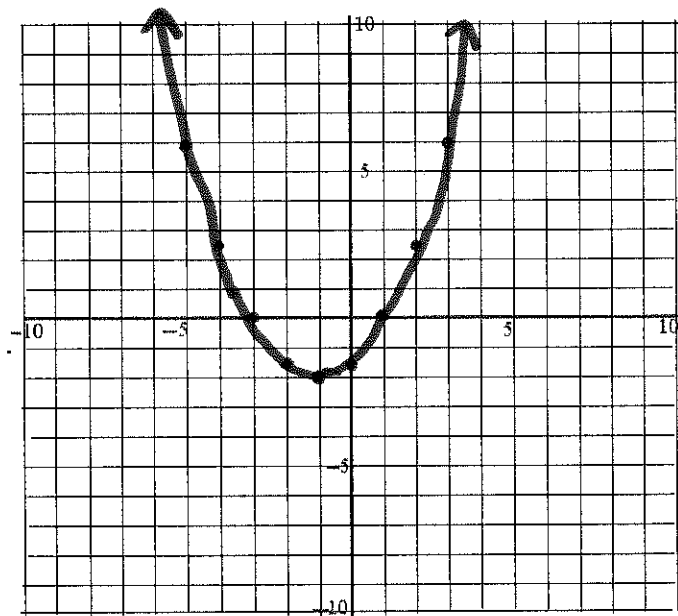
a.o.s.: $x = -2$



22. $y = \frac{1}{2}(x+1)^2 - 2$

vertex: (-1, -2)

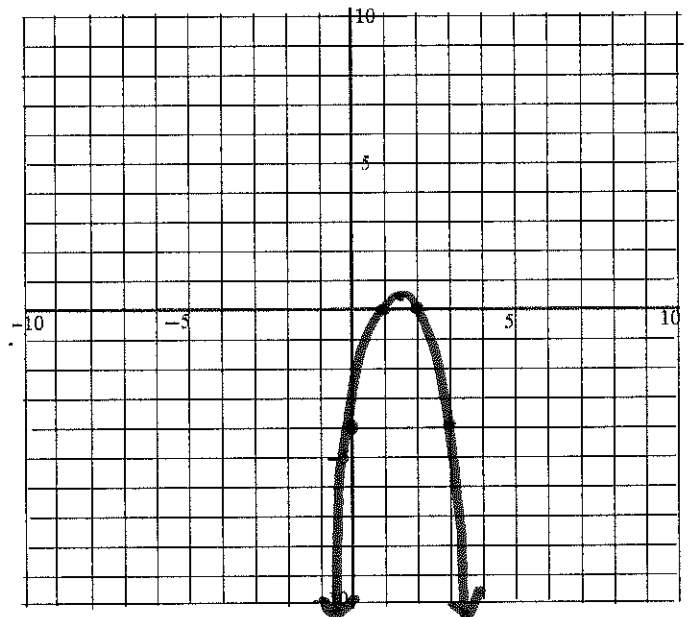
a.o.s.: $x = -1$



23. $y = -2(x-1)(x-2)$

vertex: (1.5, .5)

a.o.s.: $x = 1.5$



24. A thrown ball hits the ground and bounces along a parabolic path given by $y = -\frac{2}{9}x^2 + \frac{52}{9}x - \frac{320}{9}$ where x is measured in feet. What is the maximum height that the ball reaches on this bounce?



2 feet

Factor the expression.

25. $j^2 - 3j - 10$

$(j-5)(j+2)$

26. $-2x^2 + 6x + 56$

$-2(x^2 - 3x - 28)$
 $-2(x-7)(x+4)$

Write the following as a complex number in standard form.

27. $(3-2i) - (-11-9i)$

$3-2i+11+9i$

$14+7i$

28. $\frac{(1-3i)(2-5i)}{(2+5i)(2-5i)}$

$= \frac{2-5i-6i+15}{4-10i+10i-25}$

$= \frac{2-11i-15}{4-25} = \frac{-13-11i}{-21}$

$\frac{13}{21} + \frac{11}{21}i$

Solve by factoring.

29. $-3u = u^2$

$+3u + 3u$

$u^2 + 3u = 0$

$(u)(u+3) = 0$

$u=0$ $u=-3$

30. $r^2 = 18 - 7r$

$r^2 + 7r - 18 = 0$

$(r+9)(r-2) = 0$

$r=-9$ $r=2$

Solve by using square roots.

$$31. \frac{25x^2}{25} = \frac{16}{25}$$

$$\sqrt{x^2} = \sqrt{\frac{16}{25}}$$

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

$$32. \frac{2(x+8)^2}{2} = \frac{108}{2}$$

$$\sqrt{(x+8)^2} = \sqrt{54}$$

$$x+8 = \pm 3\sqrt{6}$$

$$x = -8 \pm 3\sqrt{6}$$

Solve by using the quadratic formula.

$$33. x^2 - 3x + 5 = 0$$

$$x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(5)}}{2(1)}$$

$$x = \frac{3 \pm \sqrt{-11}}{2}$$

$$x = \frac{3 \pm i\sqrt{11}}{2}$$

$$34. 2x^2 - 5x + 8 = 0$$

$$x = \frac{5 \pm \sqrt{(-5)^2 - 4(2)(8)}}{2(2)}$$

$$x = \frac{5 \pm \sqrt{-39}}{4}$$

$$x = \frac{5 \pm i\sqrt{39}}{4}$$

Solve by completing the square.

$$35. x^2 + 8x + 9 = 0$$

$$x^2 + 8x + 16 = -9 + 16$$

$$\sqrt{(x+4)^2} = \sqrt{7}$$

$$x+4 = \pm \sqrt{7}$$

$$x = -4 \pm \sqrt{7}$$

$$36. x^2 + 10x + 17 = 0$$


$$x^2 + 10x + 25 = -17 + 25$$

$$\sqrt{(x+5)^2} = \sqrt{8}$$

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

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


Solve using the method of your choice (table, graph, algebraic).

$$37. x^2 + 8x + 12 > 0$$


$$x < -6$$

or

$$x > -2$$

$$38. 2x^2 - 11x + 5 \leq 0$$


$$.5 \leq x \leq 5$$

ALGEBRA 2 W/ TRIGONOMETRY - MIDTERM REVIEW

Chapter 2 Review

Simplify.

39. $(q^2u^4)^{-2}$

$$q^{-4}u^{-8} = \frac{1}{q^4u^8}$$

40. $(a^{-6}b^8)^{-5}$

$$a^{30}b^{-40} = \frac{a^{30}}{b^{40}}$$

41. $(2x^5y^{-3})(5x^9y^{-2})$

$$10x^{14}y^{-5} = \frac{10x^{14}}{y^5}$$

42. $\frac{\cancel{30}x^5y^4}{\cancel{1}x^4y^6} \cdot \frac{\cancel{44}x^3y^{10}}{\cancel{6}x^6y^3}$

$$\frac{24x^8y^{14}}{x^{10}y^9} = \frac{24y^5}{x^2}$$

Use synthetic substitution to evaluate:

43. $2x^4 - 4x^2 + x - 20$ for $x = 2$

$$\begin{array}{r|rrrrr} 2 & 2 & 0 & -4 & 1 & -20 \\ & \downarrow & & & & \\ & & 4 & 8 & 8 & 18 \\ \hline & 2 & 4 & 4 & 9 & \textcircled{-2} \end{array}$$

44. $5x^3 - 2x^2 + 10x - 15$ for $x = -1$

$$\begin{array}{r|rrrr} -1 & 5 & -2 & 10 & -15 \\ & \downarrow & & & \\ & & -5 & 7 & -17 \\ \hline & 5 & -7 & 17 & \textcircled{-32} \end{array}$$

Perform the indicated operation.

45. $(y^5 - 2y^2 - y^4) + (3y^2 - y^4)$

$$y^5 - 2y^2 - y^4 + 3y^2 - y^4$$

$$(y^5 - 2y^4 + y^2)$$

46. $(x^2 - 2x + 4)(3 - x)$

	x^2	$-2x$	$+4$
3	$3x^2$	$-6x$	$+12$
$-x$	$-x^3$	$2x^2$	$-4x$

$$(-x^3 + 5x^2 - 10x + 12)$$

47. $(2y - 3) - (3y^2 + 4y + 6)$

$$2y - 3 - 3y^2 - 4y - 6$$

$$(-3y^2 - 2y - 9)$$

48. $(x^2 - 3x + 5)(3x - 2)$

	x^2	$-3x$	$+5$
$3x$	$3x^3$	$-9x^2$	$15x$
-2	$-2x^2$	$6x$	-10

$$(3x^3 - 11x^2 + 21x - 10)$$

Factor the polynomial completely using any method.

49. $4x^2 - 81$

$$(2x + 9)(2x - 9)$$

50. $y^3 + 6y^2 - 3y - 18$

$$y^2(y + 6) - 3(y + 6)$$

$$(y^2 - 3)(y + 6)$$

51. $363x^4 - 12$

$$3(121x^4 - 4)$$

$$3(11x^2 + 2)(11x^2 - 2)$$

52. $28x^3 - 7x^2 + 36x - 9$

$$7x^2(4x - 1) + 9(4x - 1)$$

$$(7x^2 + 9)(4x - 1)$$

Divide using polynomial long division or synthetic division.

53. $(x^3 - 13x - 12) \div (x - 4)$

$$\begin{array}{r|rrrr} 4 & 1 & 0 & -13 & -12 \\ & \downarrow & 4 & 16 & 12 \\ \hline & 1 & 4 & 3 & 0 \end{array}$$

$x^2 + 4x + 3$

54. $(x^3 + 6x^2 - 9x - 54) \div (x - 3)$

~~$$\begin{array}{r|rrrr} 3 & 1 & 6 & -9 & -54 \\ & \downarrow & 3 & 27 & 54 \\ \hline & 1 & 9 & 18 & 0 \end{array}$$~~

$x^2 + 9x + 18$

~~$$\begin{array}{r|rrrr} 3 & 1 & 6 & -9 & -54 \\ & \downarrow & 3 & 27 & 54 \\ \hline & 1 & 9 & 18 & 0 \end{array}$$~~

55. Find the other zeros of $f(x) = x^3 + 5x^2 - 18x - 72$ given that one zero is 4.

$$\begin{array}{r|rrrr} 4 & 1 & 5 & -18 & -72 \\ & \downarrow & 4 & 36 & 72 \\ \hline & 1 & 9 & 18 & 0 \end{array}$$

$x^2 + 9x + 18 = 0$

$(x + 6)(x + 3) = 0$

-6 -3

completely

56. Factor $f(x) = x^3 - 10x^2 + 19x + 30$ given that $(x - 6)$ is a factor.

$$\begin{array}{r|rrrr} 6 & 1 & -10 & 19 & 30 \\ & \downarrow & 6 & -24 & -30 \\ \hline & 1 & -4 & -5 & 0 \end{array}$$

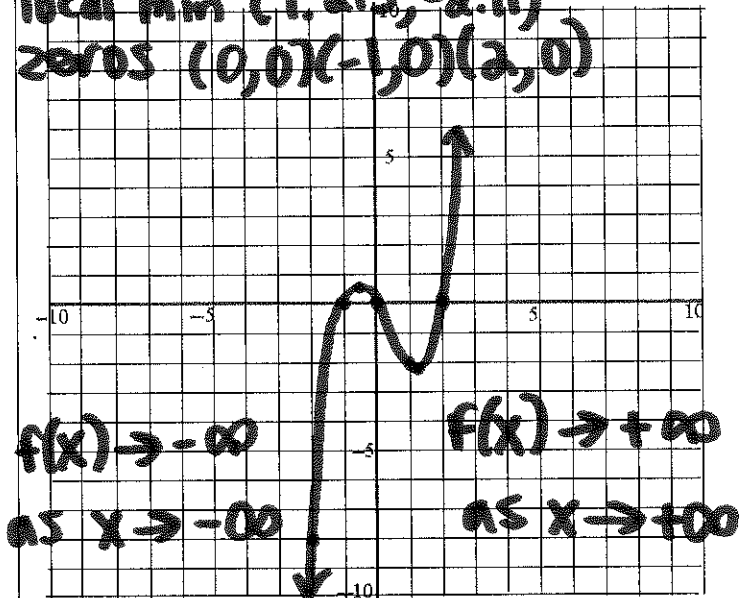
$x^2 - 4x - 5$

$f(x) = (x - 5)(x + 1)(x - 6)$

Graph the function. Calculate all local minimums, local maximums, and zeros. Indicate the end behavior.

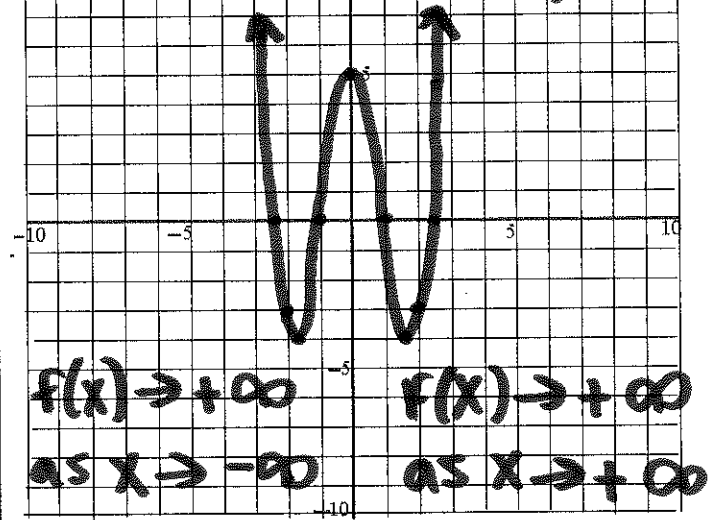
57. $f(x) = x(x+1)(x-2)$

local max $(-0.549, .63)$
 local min $(1.215, -2.11)$
 zeros $(0, 0)(-1, 0)(2, 0)$



58. $f(x) = (x^2 - 1)(x^2 - 5)$

local max: $(0, 5)$
 local min: $(-1.732, -4)$ $(1.732, -4)$
 zeros: $(-2.236, 0)(-1, 0)(1, 0)(2.236, 0)$



59. Suppose you have 250 cubic inches of clay with which to make a sculpture shaped as a rectangular prism. You want the height and width each to be 5 inches less than the length. What should the dimensions of the prism be?

$$(x)(x-5)(x-5) = 250$$

$$(x)(x^2 - 10x + 25) = 250$$

$$x^3 - 10x^2 + 25x = 250$$

$$x^3 - 10x^2 + 25x - 250 = 0$$

$$x^2(x-10) + 25(x-10)$$

$$(x^2 + 25)(x-10) = 0$$

$$x^2 + 25 = 0 \quad x - 10 = 0$$

$$\sqrt{x^2} = \sqrt{-25}$$

$$x = \pm 5i$$

$$x = 10$$

10 in x 5 in x 5 in

ALGEBRA 2 W/ TRIGONOMETRY - MIDTERM REVIEW

Chapter 3 Review

Write the expression in simplest form.

60. $(27x^8)^{\frac{2}{3}}$
 $(27)^{\frac{2}{3}} (x^8)^{\frac{2}{3}}$
 $9x^{\frac{16}{3}}$

61. $(8x^6)^{\frac{7}{3}}$
 $(8)^{\frac{7}{3}} (x^6)^{\frac{7}{3}}$
 $128x^{14}$

Simplify the expression. Assume all variables are positive.

62. $\sqrt{80} - \sqrt{245}$
 $4\sqrt{5} - 7\sqrt{5}$
 $= -3\sqrt{5}$

63. $\sqrt[3]{-125x^5}$
 $-5 \sqrt[3]{x^3} \sqrt[3]{x^2}$
 $-5x \sqrt[3]{x^2}$

64. $-x^3 \sqrt{4x^3} + 4\sqrt{81x^9}$
 $(-x^3)(2)(\sqrt{x^2})(\sqrt{x}) + 4(9)(\sqrt{x^2})(\sqrt{x})$
 $(-x^3)(2)(x)(\sqrt{x}) + (36)(x^4)(\sqrt{x})$
 $-2x^4\sqrt{x} + 36x^4\sqrt{x} = 34x^4\sqrt{x}$

65. $\sqrt[3]{-27y^{10}}$
 $-3 \sqrt[3]{y^9} \sqrt[3]{y}$
 $-3y^3 \sqrt[3]{y}$

Let $f(x) = x^2 - 4$ and $g(x) = -x^3$. Perform the indicated operation and state the domain.

66. $f(x) - g(x)$
 $(x^2 - 4) - (-x^3)$
 $x^3 + x^2 - 4$
 domain: \mathbb{R}

67. $g(x) \cdot g(x)$
 $(-x^3)(-x^3)$
 x^6
 domain: \mathbb{R}

68. $g(f(x))$

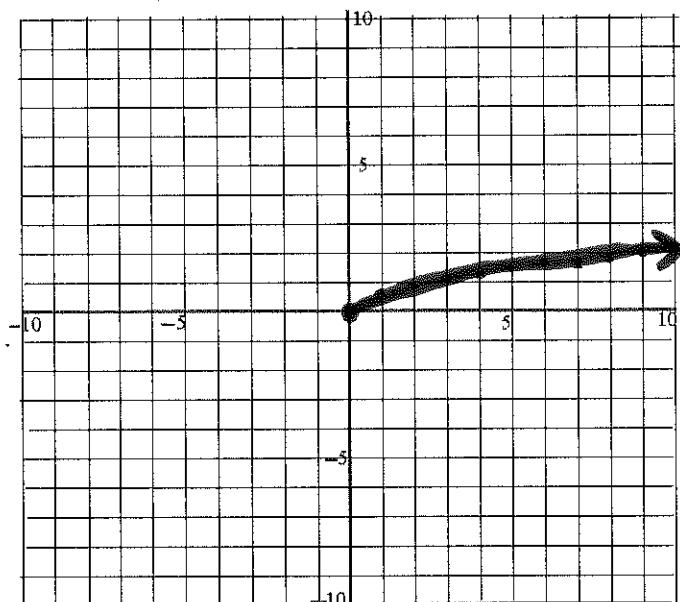
x^2	$-x^2$	16
x^6	$-8x^4$	$16x^2$
$-4x^4$	$32x^2$	-64

$-(x^2 - 4)^3$
 $-(x^2 - 4)(x^2 - 4)(x^2 - 4)$
 $-(x^4 - 8x^2 + 16)(x^2 - 4)$
 $-x^6 + 12x^4 - 48x^2 + 64$

69. $g(f(4))$
 $g(4^2 - 4)$
 $g(12) = -(12)^3$
 $= -1,728$

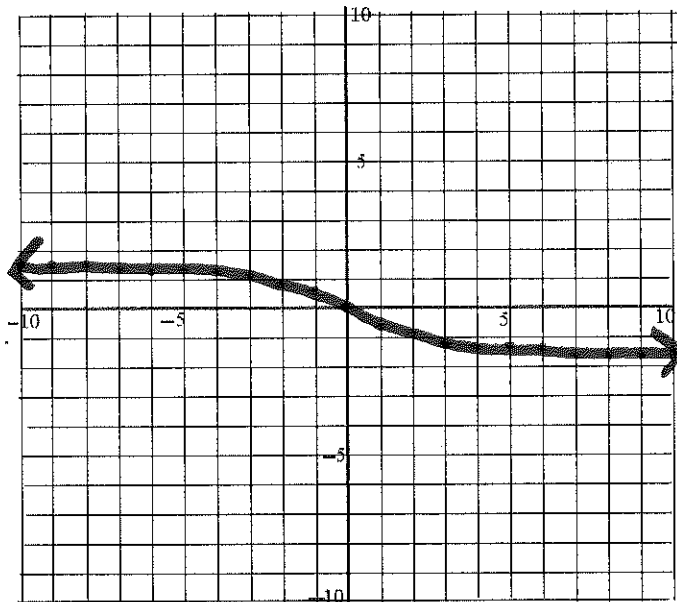
Graph the function. State the domain and range.

70. $f(x) = \frac{2}{3}\sqrt{x}$



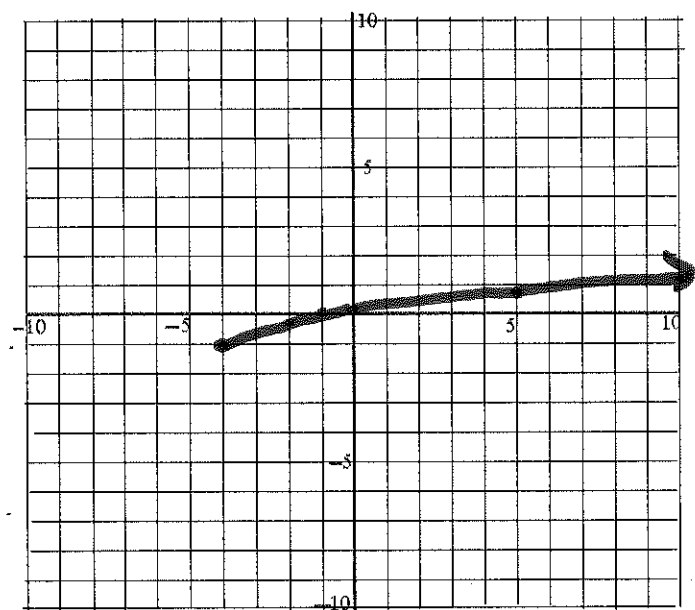
domain: $x \geq 0$
range: $y \geq 0$

71. $g(x) = -\frac{3}{4}\sqrt[3]{x}$



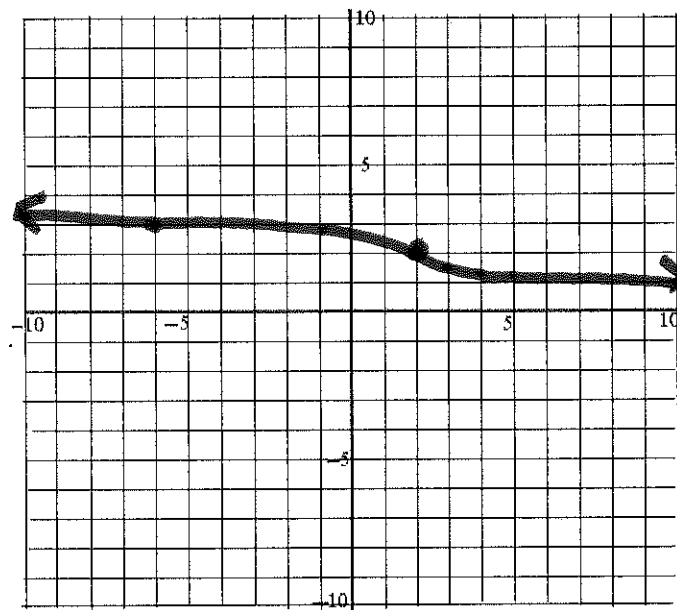
domain: \mathbb{R}
range: \mathbb{R}

72. $f(x) = \frac{3}{5}\sqrt{x+4} - 1$



domain: $x \geq -4$
range: $y \geq -1$

73. $f(x) = -\frac{1}{2}\sqrt[3]{x-2} + 2$



domain: \mathbb{R}
range: \mathbb{R}

Solve the equation.

$$74. (\sqrt[4]{3-8x^2})^4 = (2x)^4$$

$3-8x^2 = 16x^4$
 $16x^4 + 8x^2 - 3 = 0$
 $(4x^2 - 1)(4x^2 + 3) = 0$
 $(2x+1)(2x-1)(4x^2+3) = 0$
 $(-\frac{1}{2}) (\frac{1}{2}) \sqrt{x^2} = \sqrt{\frac{3}{4}} \pm \frac{i\sqrt{3}}{2}$

$$75. (\sqrt[5]{5x-4})^5 = (2)^5$$

$$5x-4 = 32$$

+4 +4

$$\frac{5x}{5} = \frac{36}{5}$$

$$x = \frac{36}{5}$$

$$76. 5x^3 - 80 = 1000$$

+80 +80

$$\frac{5x^3}{5} = \frac{1080}{5}$$

$$\sqrt[3]{x^3} = \sqrt[3]{216}$$

$$x = 6$$

$$77. (x+2)^3 + 3 = 7$$

-3 -3

$$(x+2)^{\frac{2}{3}} = 4^{\frac{2}{3}}$$

$$x+2 = \pm 8$$

-2 -2

$$x = -2 \pm 8 \quad (6) \quad (-10)$$

Find the inverse of the function.

$$78. f(x) = \frac{1}{4}x^3$$

$$y = \frac{1}{4}x^3$$

$$4(x) = \left(\frac{1}{4}y^3\right)4$$

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

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

$$f^{-1}(x) = \sqrt[3]{4x}$$

$$79. g(x) = \frac{3}{2}x^3 + 4$$

$$y = \frac{3}{2}x^3 + 4$$

$$x = \frac{3}{2}x^3 + 4$$

-4 -4

$$\left(\frac{2}{3}\right)(x-4) = \frac{3}{2}y^3 \left(\frac{2}{3}\right)$$

$$\sqrt[3]{\frac{2}{3}x - \frac{8}{3}} = \sqrt[3]{y^3}$$

$$f^{-1}(x) = \sqrt[3]{\frac{2x-8}{3}}$$