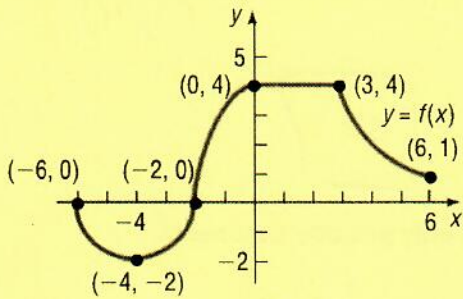


Name: Key Period: _____

SM2H Unit 1 – Unit 4 Cumulative Review

Use the graph to find the following information:

1.



Domain: $[-6, 6]$ Range: $[-2, 4]$

x-intercepts: $(-6, 0)$ $(-2, 0)$ y-intercept: $(0, 4)$

Increasing: $(-4, 0)$

Decreasing: $(-6, -4) \cup (3, 6)$

Constant: $(0, 3)$

Positive: $(-2, 6]$

Negative: $(-6, -2)$

Maximum/Minimum point(s): max: $(-6, 0)$ min: $(-4, -2)$; $(6, 1)$
max: $0, 4$

Maximum/Minimum value(s): min: $-2, 1$

2. Graph this function: $f(x) = -\sqrt{x+4} - 6$

List Transformations in order here:

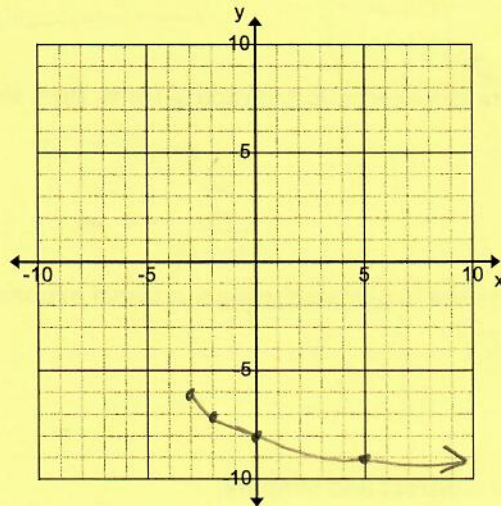
reflect over x-axis
shift left 4
shift down 6

Tables:

Parent Graph

$f(x) = \sqrt{x}$

| | | | | |
|----|---|------|----|----|
| -4 | x | f(x) | -1 | -6 |
| -4 | 0 | 0 | 0 | -6 |
| -3 | 1 | 1 | -1 | -7 |
| 0 | 4 | 2 | -2 | -8 |
| 5 | 9 | 3 | -3 | -9 |



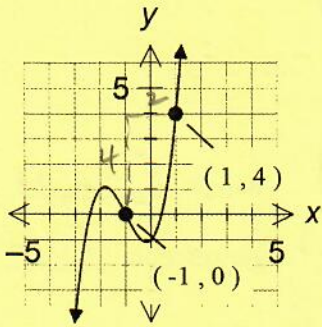
Endpoint: $(-4, -6)$

Domain: $[-4, \infty)$

Range: $(-\infty, -6]$

Find the average rate of change for each function on the specified interval. Show your work!

3. $f(x) = x^3 + 3x^2 + x - 1$, on $[-1, 1]$



Count: $m = \frac{4-0}{1-(-1)} = 2$

$$f(-1) = (-1)^3 + 3(-1)^2 + (-1) - 1 = -1 + 3 - 1 - 1 = 0$$

$(-1, 0)$

$$f(1) = 1^3 + 3(1)^2 + 1 - 1 = 1 + 3 + 1 - 1 = 4$$

$(1, 4)$

$$m = \frac{4-0}{1-(-1)} = \frac{4}{2} = 2$$

Simplify the following expressions. Your answers should contain only positive exponents.

4. $4a^{-3} \cdot 2a^2r^4$
 $8a^{-1}r^4 = \frac{8r^4}{a}$

5. $\frac{18y^{-5}}{9y^2}$
 $\frac{2}{y^7}$

6. $(3x^{-3})^{-3}$
 $3^{-3}x^9 = \frac{x^9}{27}$

7. $a^{\frac{1}{4}} \cdot a^{\frac{2}{3}}$
 $a^{\frac{1}{4} + \frac{2}{3}} = a^{\frac{11}{12}}$

Simplify each radical expression.

8. $3\sqrt{56x^3y^2}$
 $6x^2y\sqrt{14x}$

9. $\sqrt[3]{40x^3y^8}$
 $2xy^2\sqrt{5y^2}$

10. $\sqrt{-64}$
 $8i$

Rewrite the expression in radical form, then simplify if possible.

11. $4^{\frac{5}{2}}$
 $\sqrt{4^5} = 2^5 = 32$
 or $\sqrt{1024}$

Rewrite the expression using a rational exponent.

12. $9\sqrt[3]{x^7}$
 $9x^{\frac{7}{3}}$

Add or subtract and simplify.

13. $\sqrt{7} + \sqrt{28} - \sqrt{63}$
 $\sqrt{7} + 2\sqrt{7} - 3\sqrt{7} = 6\sqrt{7}$

14. $(5-i) - (-6+12i)$
 $5-i+6-12i = 11-13i$

Multiply and simplify.

15. $4\sqrt{3}(5+\sqrt{6})$

$20\sqrt{3} + 4\sqrt{18}$

$20\sqrt{3} + 12\sqrt{3}$

17. $7i(11-6i)$

$77i + 42i^2$

$-42 + 77i$

Simplify.

19. $\frac{5\sqrt{5}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{5\sqrt{15}}{3}$

Simplify.

21. $(8w^2 + 8w) - (14w^2 + w)$

$-6w^2 + 7w$

16. $\sqrt{-30} \cdot \sqrt{-100}$

$i\sqrt{30} \cdot i\sqrt{100}$

$i^2\sqrt{300}$

$-10\sqrt{3}$

18. $(-6-2i)(-6-2i)$

$36 + 12i + 12i + 4i^2$

$32 + 24i$

20. $\frac{6-5i}{6+3i} \cdot \frac{6-3i}{6-3i} = \frac{36 - 18i - 30i + 15i^2}{36 - 18i + 18i - 9i^2}$

$\frac{21 - 48i}{45} = \frac{7 - 16i}{15}$

22. $(6x+6)(7x-3)$

$42x^2 - 18x + 42x - 18$

$42x^2 + 24x - 18$

Factor completely. Don't forget to factor out a GCF if there is one. If the leading coefficient is negative, factor out a negative GCF. If the polynomial is prime, say so.

23. $10x^2 - 5x$

$5x(2x-1)$

24. $x^2 + 6x + 14$

prime

25. $z^2 - 4$

$(z+2)(z-2)$

26. $4r - 8r + t - 2$

$4r(t-2) + 1(t-2)$

$(4r+1)(t-2)$

27. $w^2 + 3w - 10$

$(w+5)(w-2)$

28. $7t^2 + 15t - 4$

prime

$$29. -10y^2 + 35y + 20$$

$$-5(2y^2 - 7y - 4) \cdot 1$$

$$\begin{array}{r} 2y^2 - 8y + y - 4 \\ \hline 2y(y-4) + 1(y-4) \end{array}$$

$$\boxed{-5(2y+1)(y-4)}$$

$$30. 49m^2 - 16$$

$$(7m+4)(7m-4)$$

$$31. m^2 - 6m + 9$$

$$(m-3)(m-3)$$

or

$$(m-3)^2$$

Find all solutions (real and imaginary) to each equation by taking square roots. Write all answers in simplest radical form and write complex answers in the form $a + bi$.

$$32. 2k^2 - 3 = -21$$

$$\begin{array}{r} +3 \quad +3 \\ \hline 2k^2 = -18 \\ \hline k^2 = -9 \\ \hline k = \pm 3i \end{array}$$

$$33. \frac{9(z-3)^2}{9} = \frac{36}{9}$$

$$\begin{array}{r} \sqrt{(z-3)^2} = \sqrt{4} \\ z-3 = \pm 2 \\ \hline z = 3 \pm 2 = \boxed{5, 1} \end{array}$$

Solve each equation by completing the square.

$$34. x^2 + 16x - 36 = 0$$

$$\begin{array}{r} x^2 + 16x + 64 = 36 + 64 \\ \hline \sqrt{(x+8)^2} = \sqrt{100} \\ x+8 = \pm 10 \\ \hline x = -8 \pm 10 = \boxed{2, -18} \end{array}$$

$$35. x^2 + 16 = 10x$$

$$\begin{array}{r} x^2 - 10x + 25 = -16 + 25 \\ \hline \sqrt{(x-5)^2} = \sqrt{9} \\ x-5 = \pm 3 \\ \hline x = 5 \pm 3 = \boxed{8, 2} \end{array}$$

Solve the equation using the quadratic formula.

$$36. x^2 - 5x - 24 = 0$$

$$a=1$$

$$b=-5$$

$$c=-24$$

$$x = \frac{5 \pm \sqrt{25 - 4(1)(-24)}}{2(1)} = \frac{5 \pm \sqrt{121}}{2} = \frac{5 \pm 11}{2}$$

$$= \frac{16}{2}, \frac{-6}{2}$$

$$= \boxed{8, -3}$$

Fill in the requested information. Then graph the function. Plot at least 5 points.

37. $f(x) = -(x+2)(x-4)$

$p = -2$ $q = 4$

$\frac{p+q}{2} = \frac{-2+4}{2} = \frac{2}{2} = 1$

Vertex: (1, 9)

$-(1+2)(1-4)$
 $-(3)(-3) = 9$

Axis of Symmetry: $x = 1$

Direction of Opening: down

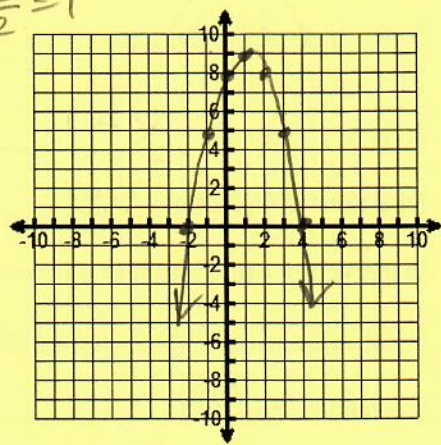
Is the vertex a maximum or a minimum? maximum

What is the maximum/minimum value? 9

y-intercept: (0, 8)

zeros: -2, 4

What are the x-intercepts? (-2, 0) (4, 0)



38. $f(x) = x^2 + 6x + 3$

Vertex: (-3, -6)

$-\frac{b}{2a} = \frac{-6}{2(1)} = -3$

Axis of Symmetry: $x = -3$

$(-3)^2 + 6(-3) + 3$
 $9 - 18 + 3 = -6$

Direction of Opening: up

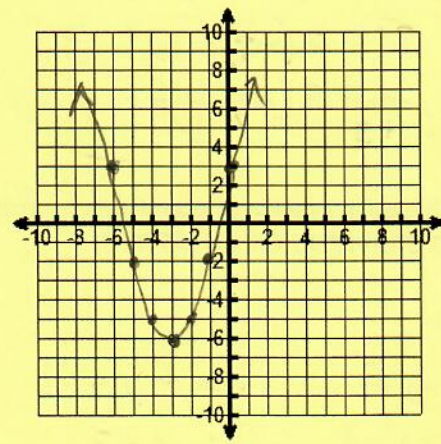
Is the vertex a maximum or a minimum? minimum

What is the maximum/minimum value? -6

y-intercept: (0, 3)

zeros: $-3 \pm \sqrt{6}$

What are the x-intercepts? $(-3 + \sqrt{6}, 0)$ $(-3 - \sqrt{6}, 0)$



$a = 1$
 $b = 6$
 $c = 3$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{36 - 4(1)(3)}}{2} = \frac{-6 \pm \sqrt{36 - 12}}{2} = \frac{-6 \pm \sqrt{24}}{2} < 12 < \textcircled{2} < \textcircled{3}$$

$$= \frac{-6 \pm 2\sqrt{6}}{2} = -3 \pm \sqrt{6}$$

39. $f(x) = (x-1)^2 + 2$

Vertex: (1, 2)

Axis of Symmetry: $x = 1$

Direction of Opening: up

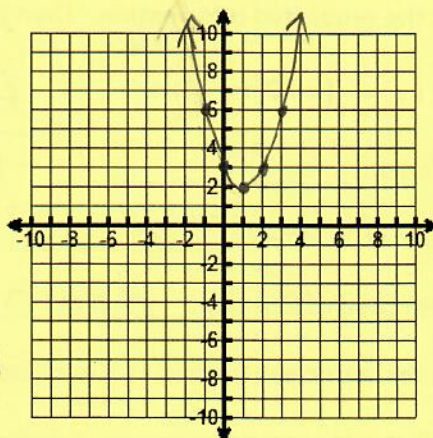
Is the vertex a maximum or a minimum? minimum

What is the maximum/minimum value? 2

y-intercept: (0, 3)

zeros: $-1 \pm i\sqrt{2}$

What are the x-intercepts? none



$$0 = (x-1)^2 + 2 \rightarrow \pm i\sqrt{2} = x - 1$$

$$\sqrt{-2} = \sqrt{(x-1)^2} \rightarrow \boxed{-1 \pm i\sqrt{2} = x}$$

40. Write a quadratic equation in **vertex form** with vertex: $(-12, -3)$ and passes through $(-8, 21)$.

$$y = a(x+12)^2 - 3$$

$$21 = a(-8+12)^2 - 3$$

$$21 = a(4)^2 - 3$$

$$+3 \quad +3$$

$$\frac{24}{16} = a \frac{(16)}{16}$$

$$\frac{3}{2} = a$$

$$\boxed{y = \frac{3}{2}(x+12)^2 - 3}$$

Solve each system of equations by graphing. Write the solutions as ordered pairs.
NO GRAPHING CALCULATOR!!!

41.

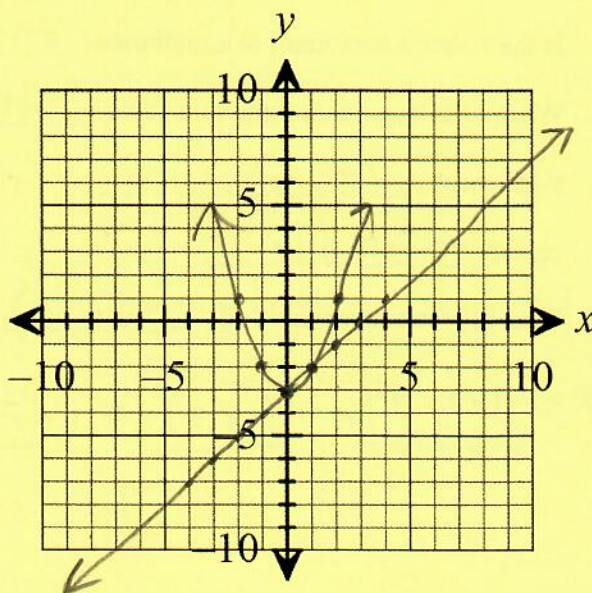
$$x - y = 3$$

$$y = x^2 - 3$$

$$-y = -x + 3$$

$$y = x - 3$$

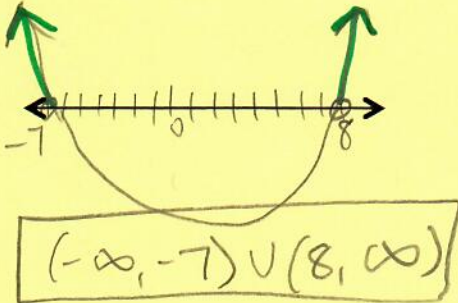
$$\boxed{\begin{matrix} (0, -3) \\ (1, -2) \end{matrix}}$$



Solve the following inequalities. Write your answers in interval notation.
NO GRAPHING CALCULATORS!!!

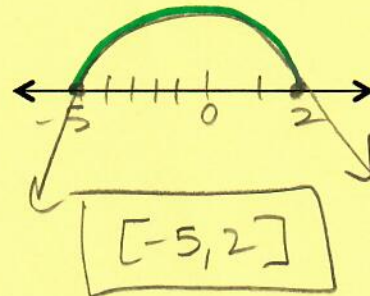
42. $(x-8)(x+7) > 0$

zeros: 8, -7



43. $-(x+5)(x-2) \geq 0$

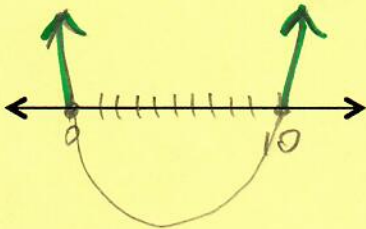
zeros: -5, 2



44. $x^2 - 10x \geq 0$

$x(x-10)$

zeros: 0, 10



45. $x^2 < 25$

$x^2 - 25 < 0$

$(x+5)(x-5) < 0$

zeros: -5, 5

