

Name: _____

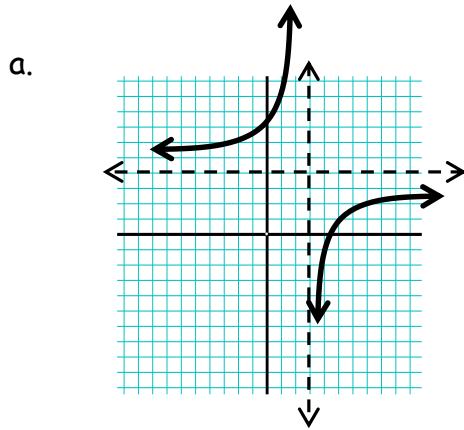
* Denotes Calculator Allowed

1. Solve the equations:

a. $x^2 - 5x + 6 = 0$

b. $2x^2 - 3x - 9 = 0$

2. Determine the Domain, Range, VA, HA and end behavior of the functions below:



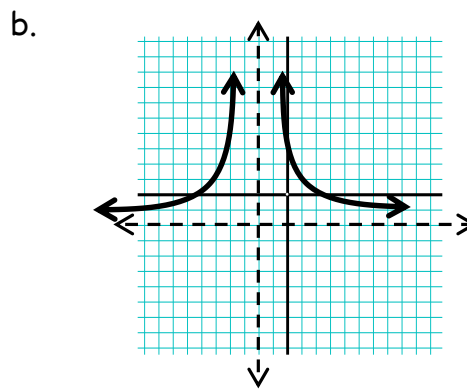
Domain: _____

VA: _____

Range: _____

HA: _____

End Behavior: _____



Domain: _____

VA: _____

Range: _____

HA: _____

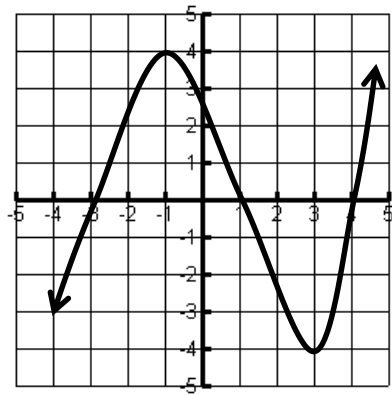
End Behavior: _____

3. Write the function whose graph is the graph of $f(x) = \ln(x)$, but is

a. Shifted up 4 units _____

b. Shifted left 3 units _____

4. Approximate the following from the graph.
 (The interval for both the x and y axis are by one)



a. Domain

b. Range

c. X-intercepts

d. Y-intercepts

e. Local maximum:

f. Local minimum:

g. Absolute Maximum:

h. Absolute Minimum:

i. Increasing:

j. Decreasing:

k. End behavior:

5. Graph the function: $f(x) = -x^3(x - 4)^2(x + 3)$

Indicate the degree: _____

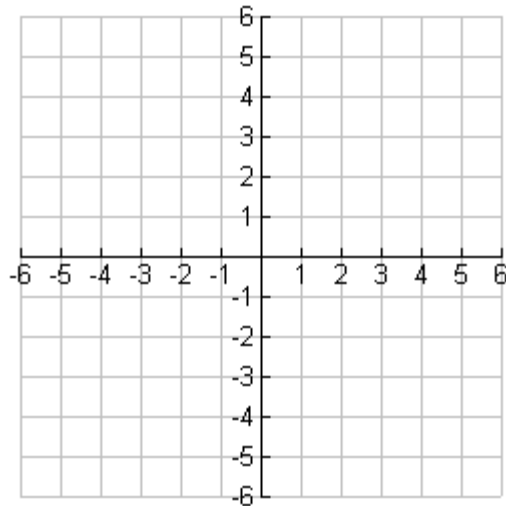
Indicate the end behaviors:

Indicate the zeros and the multiplicities

Zero: _____ Mult.: _____

Zero: _____ Mult.: _____

Zero: _____ Mult.: _____



6. Determine the inverse of the following functions. Determine their Domain.

a. $f(x) = 3x + 1$

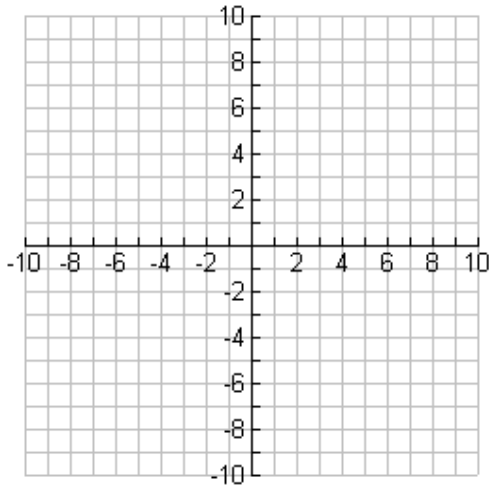
b. $f(x) = \frac{2}{x-1}$

7. Graph the following functions using their parent functions $f(x) = \log_3 x$

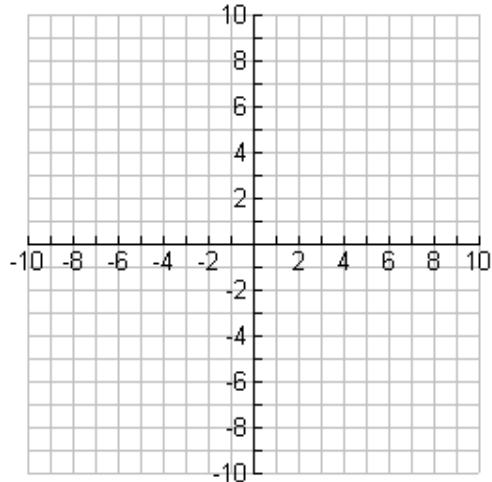
a. $f(x) = \log_3(x - 2)$

b. $f(x) = \log_3(x) - 6$

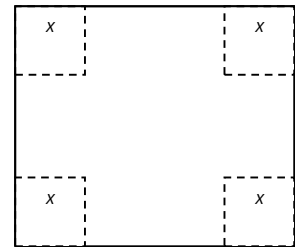
Transformations:



Transformations:



8. *An open box with a square base is to be made from a square piece of cardboard 24 inches on a side by cutting out a square from each corner and turning up the sides.
- Express the volume V of the box as a function of the length x of the side of the square cut from each corner.



- For what value of x is V the largest? _____
- What is this value of V ? _____

9. *The height of a flare can be modeled by the equation $h(t) = -16t^2 + 25t + 10$, where h is in feet and t is in seconds.

- What will be the maximum height of the flare? _____
- How long will it take for the flare hit the ground? _____

10. Evaluate (use change of base where necessary):

a. $\ln e^{(x-1)}$

b. $e^{3 \ln 2}$

c. $\log_8 3$

d. $\log_2 8$

11. Given the functions f and g determine each of the following:

a. $f(x) = 2x + 10$ $g(x) = x^2 + 9x + 20$

b. $f(x) = \frac{1}{x-1}$

$g(x) = \frac{x^2-1}{x}$

i. $(f + g) =$ Domain:

i. $(f + g) =$ Domain:

ii. $(f - g) =$ Domain:

ii. $(f - g) =$ Domain:

iii. $(f \cdot g) =$ Domain:

iii. $(f \cdot g) =$ Domain:

iv. $\left(\frac{f}{g}\right) =$ Domain:

iv. $\left(\frac{f}{g}\right) =$ Domain:

v. $[f \circ g](x)$

v. $[f \circ g](x)$

vi. $[g \circ f](x)$

vi. $[g \circ f](x)$

vii. $[f \circ g](4)$

vii. $[f \circ g](1)$

12. Determine if the following functions are symmetric to the x-axis, y-axis, origin or none.

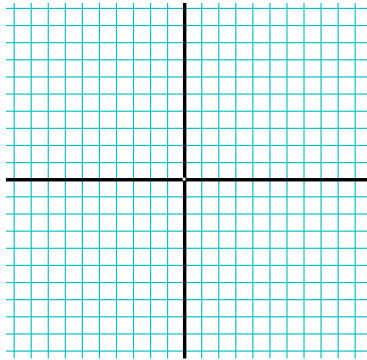
a. $f(x) = x^4 + 2x^2$

b. $f(x) = \frac{1}{3}x^5 - 3x^2$

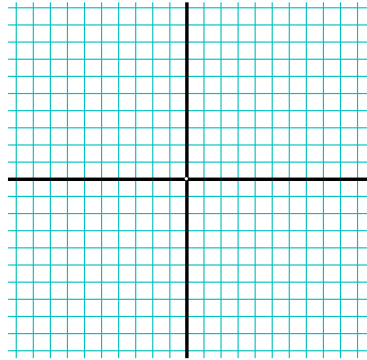
c. $f(x) = -\frac{2}{x}$

13. Draw a graph that is

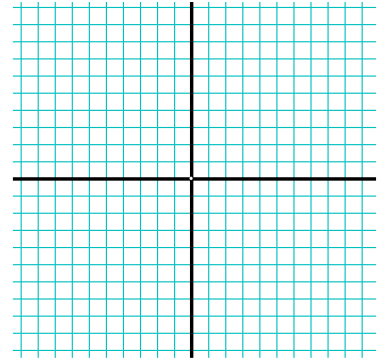
a. Odd.



b. Even



c. one-to-one



14. Given $f(x) = x^2 - 2x + 3$ and $g(x) = x + 6$. Determine:

a. $f(3)$

b. $(f \circ g)(2)$

c. $(g \circ f)(3)$

d. $(f + g)(4)$

e. $(f - g)(-5)$

15. Verify by composition that f and g are inverses.

a. $f(x) = \sqrt{x-1}$ $g(x) = x^2 + 1$

b. $f(x) = 2x + 1$ $g(x) = \frac{x-1}{2}$

16. The table below illustrates an invertible function $f(x)$. Determine $f^{-1}(23)$

x	$f(x)$
5	72
12	47
23	39
47	23

17. Solve:

a. $\frac{x}{x+5} + \frac{4}{x} = \frac{32}{x^2+5x}$

b. $\frac{x+4}{2x-1} - \frac{x-1}{x+2} = 1$

18. Describe the end behavior of the following polynomial functions.

a. $f(x) = -x^6 + 3x - 1$

b. $g(x) = 5x^7 + x^3 - x + 2$

19. Find all solutions of $x^3 - 3x - 2 = 0$

20. Determine the remainder when $5x^3 - 3x^2 + 2x - 1$ is divided by $x + 1$.

21. Divide $6x^3 - 4x^2 + x - 5$ by $3x + 1$

22. Write a polynomial of 4th degree given the roots 1, 3, and 4i.

23.* Use a graphing utility to approximate the solutions. Express the answer correctly to two decimal places. $x^3 - 4x + 2 = 0$

24. Solve the inequality

a. $2x^2 - 5x \leq -2$

b. $\frac{x^2 - 7x + 10}{x^2 + 4x + 3} \geq 0$

c. $\frac{(x-3)(x+2)}{(x-1)} \leq 0$

25. Simplify:

a. $5i^6 - 2i^5 + 7i^4 + 9i^3 - 4i^2 + i$

26. Find the error during the simplification process

$$(x - 3)(x + 2)(x + 3i)(x - 3i)$$

$$(x^2 - x - 6)(x^2 + 3ix - 3xi - 9i^2)$$

$$x^4 + 3ix^3 - 3x^3i - 9x^2i^2 - x^3 - 3ix^2 + 3x^2i - 9xi^2 - 6x^2 - 18ix + 18xi + 54i^2$$

$$x^4 - 9x^2i^2 - x^3 - 9xi^2 - 6x^2 + 54i^2$$

$$x^4 - 9x^2 - x^3 - 9x - 6x^2 + 54$$

$$x^4 - x^3 - 15x^2 - 9x + 54$$

27. If $(x-5)$ is a factor of $x^3 - 6x^2 + kx + 10$, then $k = ?$

28. For each of the following:

i. Determine the domain of the function.

ii. Determine the x and y intercepts.

iii. Determine the vertical asymptote(s).

iv. Determine the horizontal asymptote

v. Determine if there are any holes and if so, state the coordinates.

a. $f(x) = \frac{4x}{x+1}$

b. $f(x) = \frac{x^2+5x+6}{2x^2+5x-3}$

29. Determine the equations of the asymptotes and/or holes for the following functions:

a. $g(x) = \frac{x+2}{x^2+2x-3}$

b. $k(x) = \frac{2x^2+5x-1}{5x^2}$

c. $h(x) = \frac{x^2+5x-6}{2x^2-5x+3}$

30. *The following data represents the results of an experiment involving the growth of bacteria.

Time (x) (in minutes)	1	3	5	7	9	11
Number of Bacteria (y)	2	25	81	175	310	497

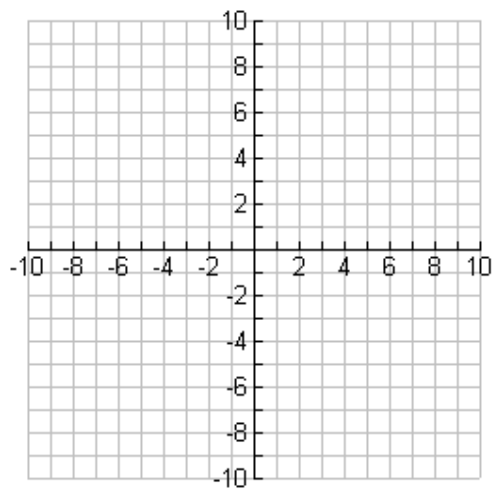
- a. Write a power regression equation for this set of data, rounding all values to *three decimal places*.
- b. Using this equation predict the bacteria's growth, to the nearest integer, after 15 minutes.

31. For the function $f(x) = -x^2(x + 2)(x - 3)^2$

a. Apply the leading term test to determine the end behavior.

b. Find the zeros and state the multiplicity of the zero.

c. Use the information from parts a and b to sketch a graph of the function.



32. Write as a log:

a. $6^3 = 216$

b. $e^5 = 148.413$

c. $4^4 = 64$

33. Solve for x:

a. $3^{x^2-x} = 9$

b. $\ln(3x-2) + \ln(x-1) = 2\ln x$

c. $\log_{16} \sqrt[3]{128} = x$

d. $\log_3(2x+5) - \log_3 x = 4$

e. $3^x = 81$

f. $9^{5x+2} = 27^{7x-6}$

34. Evaluate:

a. By hand: $\log_{16} \sqrt[3]{32}$

b. *Using Calculator: $\log_2 15$ (nearest hundredth)

35. Write as a single logarithm: $4\log_3 x - \frac{1}{3}\log_3 k + \frac{2}{5}\log_3 v - 2\log_3 w$

36. Use the properties of exponents to simplify $\frac{x^{-3}y^3z^4w^{-6}}{x^4y^{-5}z^{-2}w^{-7}}$

37. Use the properties of logarithms to express as a sum/difference of logs:

$$\log_k \frac{j^7 \sqrt[3]{b^2}}{t^2}$$

38. Give the equations of the asymptotes for the following functions:

a. $f(x) = \log_5(x + 5)$

b. $f(x) = \log_3(x) - 7$

39. How long will it take \$500 to double if it is invested at:

a. 5.5% Compounded Monthly

b. 4.7% Compounded Continuously

40. *Albert puts \$200 into an account to use for school expenses. The account earns 12% interest, compounded quarterly. How much will be in the account after 5 years?

41. *Determine the amount Nicolette needs to deposit today to have \$5000 for her wedding in 10 years if the account she is depositing in earns 2.5 % interest, compounded quarterly.

42. *Morgan has \$450 to deposit into an account for a 5-year investment. Account A earns 6.5% interest compounded annually and account B earns 2.5% compounded continuously, which account should Brittany choose?

43. *How long will it take for Henry to triple his investment if the account he is using earns 2.8% compounded continuously?
44. *What rate will Henrietta need to invest her money in to double her investment in 5 years if the account is compounded continuously?

Answers:

1.a. $x = 2$ & 3

1.b. $x = -1.5$ & 3

2.a. Domain: $(-\infty, 3) \cup (3, \infty)$

Range: $(-\infty, 4) \cup (4, \infty)$

VA: $x = 3$

HA: $y = 4$

End Behavior: $\lim_{x \rightarrow -\infty} f(x) = \lim_{x \rightarrow \infty} f(x) = 4$

2.b. Domain: $(-\infty, -2) \cup (-2, \infty)$

Range: $(-2, \infty)$

VA: $x = -2$

HA: $y = -2$

End Behavior: $\lim_{x \rightarrow -\infty} f(x) = \lim_{x \rightarrow \infty} f(x) = -2$

3. a. $f(x) = \ln(x) + 4$

c. $f(x) = \ln(x + 3)$

4. Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

x-intercept(s): $(-3, 0)$, $(1, 0)$, $(4, 0)$

y-intercept: $(0, 2.5)$

Local maximum: 4

Local minimum: -4

Absolute maximum: Not applicable

Absolute minimum: Not applicable

Increasing: $(-\infty, -1) \cup (3, \infty)$

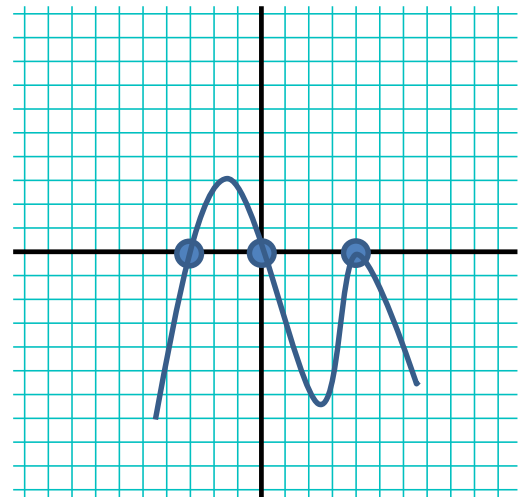
Decreasing: $(-1, 3)$

End Behavior $\lim_{x \rightarrow -\infty} f(x) = -\infty$ $\lim_{x \rightarrow \infty} f(x) = \infty$:

5. Degree: 6

End Behavior: $\lim_{x \rightarrow -\infty} f(x) = \lim_{x \rightarrow \infty} f(x) = -\infty$

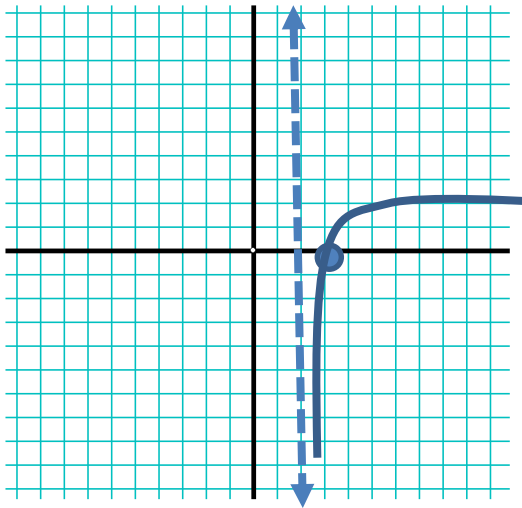
Zero	Multiplicity
0	3
4	2
-3	1



6. a. $f^{-1}(x) = \frac{x-1}{3}$

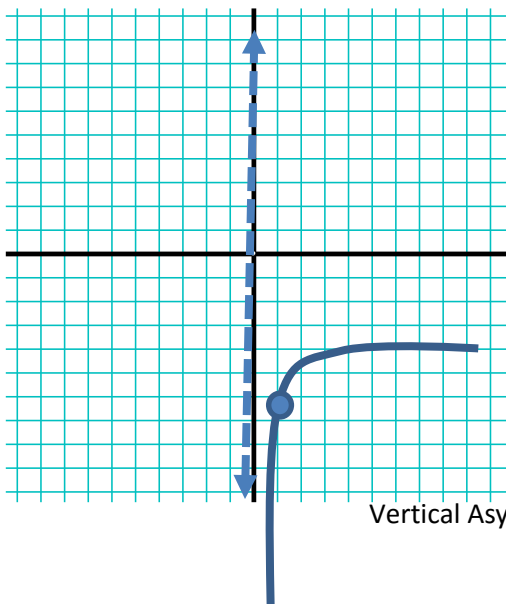
b. $f^{-1}(x) = \frac{2}{x} + 1$ or $f^{-1}(x) = \frac{2+x}{x}$

7. a.



Vertical Asymptotes shifts to $x = 2$

b.



Vertical Asymptote remains at $x = 0$

8. a. $V = (24 - 2x)(24 - 2x)x$

b. $x = 4 \text{ in}$

c. $V = 1024 \text{ in}^3$

9. a. 19.77 feet

b. 1.89 seconds

10. a. $x - 1$

b. 8

c. .528

d. 3

11.

ai. $x^2 + 11x + 30$ D: $(-\infty, \infty)$

a.ii. $-x^2 - 7x - 10$ D: $(-\infty, \infty)$

a.iii. $2x^3 + 28x^2 + 130x + 200$ D: $(-\infty, \infty)$

a.iv. $\frac{2}{x+4}$ D: $(-\infty, -5) \cup (-5, -4) \cup (-4, \infty)$

a.v. $2x^2 + 18x + 50$

a.vi. $4x^2 + 58x + 210$

a.vii. 154

b.i. $\frac{x^3 - x^2 + 1}{x^2 - x}$ D: $(-\infty, 0) \cup (0, 1) \cup (1, \infty)$

b.ii. $\frac{-x^3 + x^2 + 2x + 1}{x^2 - x}$ D: $(-\infty, 0) \cup (0, 1) \cup (1, \infty)$

b.iii. $\frac{x+1}{x}$ D: $(-\infty, 0) \cup (0, 1) \cup (1, \infty)$

b.iv. $\frac{x}{x^3 - x^2 - x + 1}$ D: $(-\infty, -1) \cup (-1, 0) \cup (0, 1) \cup (1, \infty)$

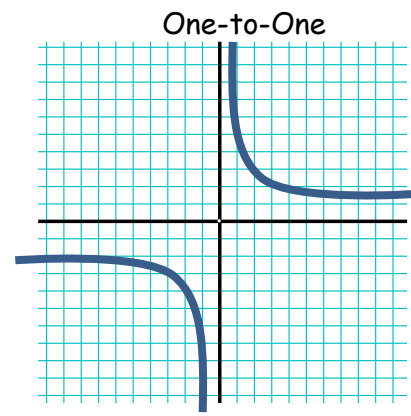
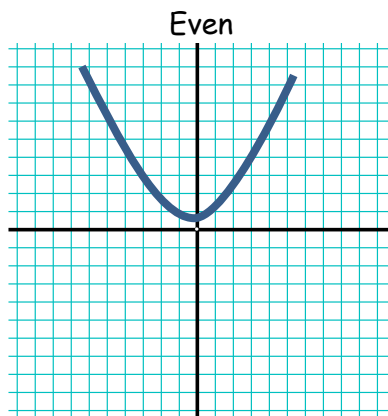
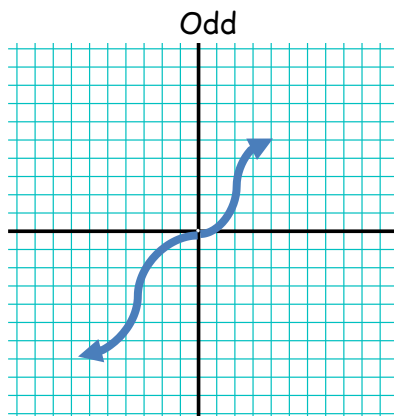
b.v. $\frac{x}{x^2 - x - 1}$

b.vi. $\frac{-x^2 + 2x}{x - 1}$

b.vii. -1

12. a. y-axis
b. neither
c. Origin

13. Many Answers



14. a. 6

b. 51

c. 12

d. 21

e. 37

15. a. $\sqrt{(x^2 + 1) - 1} = x$
 $(\sqrt{x - 1})^2 + 1 = x$

b. $2\left(\frac{x-1}{2}\right) + 1 = x$
 $\frac{(2x+1)-1}{2} = x$

16. 47

17. a. $x = -6$ & 2

b. $x = -1$ & 3

18. a. $\lim_{x \rightarrow -\infty} f(x) = \lim_{x \rightarrow \infty} f(x) = -\infty$

b. $\lim_{x \rightarrow -\infty} f(x) = -\infty$ $\lim_{x \rightarrow \infty} f(x) = \infty$

19. $x = -1$ & 2

20. -11

21. $2x^2 + 2x + 1 \mathbb{R} \frac{-6}{3x+1}$

22. $x^4 - 4x^3 + 19x^2 - 64x + 48$

23. $x = -2.21, .54$ and 1.68

24. a. $[.5, 2]$

b. $(-\infty, -3) \cup (-1, 2] \cup [5, \infty)$

c. $(-\infty, -2] \cup (1, 3]$

25. 6-10i

26. Line 5 should read $x^4 + 9x^2 - x^3 + 9x - 6x^2 - 54$

Line 6 should read $x^4 - x^3 + 3x^2 + 9x - 54$

27. $k = 3$

28.

a.
 Domain $(-\infty, -1) \cup (-1, \infty)$
 x-intercept: (0,0)
 y-intercept: (0,0)
 VA: $X = -1$
 HA: $Y = 4$
 Holes: None

b.
 Domain $(-\infty, -3) \cup (-3, .5) \cup (.5, \infty)$
 x-intercept: (-2,0)
 y-intercept: (0,-2)
 VA: $X = .5$
 HA: $Y = .5$
 Holes $(-3, \frac{1}{7})$

29.

a.
 VA: $X = 1 \text{ \& } x = -3$
 HA: $Y = 0$
 Holes: none

b.
 VA: $X = 0$
 HA: $Y = .4$
 Holes: none

c.
 VA: $X = 1.5$
 HA: $Y = .5$
 Holes: (1, -7)

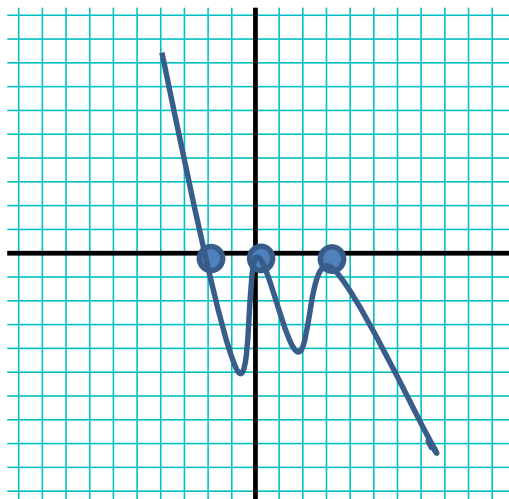
30.a. $f(x) = 2.001x^{2.298}$ b. 1009

31. a. $\lim_{x \rightarrow -\infty} f(x) = \infty$ $\lim_{x \rightarrow \infty} f(x) = -\infty$

b.

Zero	Multiplicity
0	2
-2	1
3	2

c.



32.a. $\log_6 216 = 3$

b. $\ln 148.413 = 5$

c. $\log_4 64 = 4$

33.a. $x = 2 \text{ \& } -1$

b. $x = .5 \text{ \& } 2$

c. $x = \frac{7}{12}$

d. $x = \frac{5}{79}$

e. $x = 4$

d. $x = 2$

34.a. $x = \frac{5}{12}$

b. 3.907

35. $\log_3 \frac{x^4 v^5}{k^3 w^2}$

36. $\frac{wy^8z^6}{x^7}$

37. $7\log_k j + \frac{2}{3}\log_k b - 2\log_k t$

38.a. VA: $x = -5$, HA: none

b. VA: $x = 0$, HA: none

39.a. $t = 12.63$ years

b. $t = 14.748$ years

40. $A(5) = \$361.22$

41. Nicolette needs \$3,897.03 to deposit

42. 2.5% compounded continuously equals 2.53% compounded annually, so 6.5% compounded annually is a better investment.

43. 39.236 years

44. 13.86%