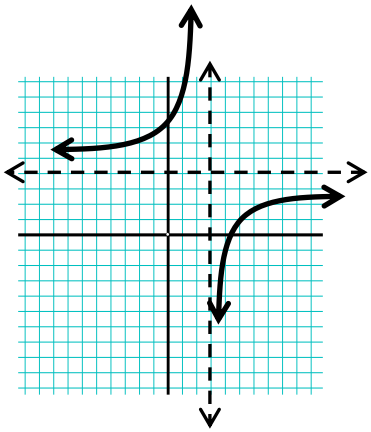
Name: _____ Precalculus 40

* Denotes Calculator Allowed Midterm Review

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:

a.

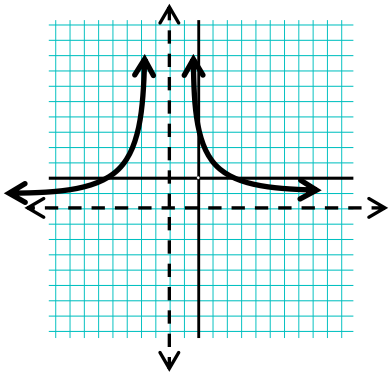


Domain: VA:

Range: HA:

End Behavior:_____

b.



Domain: VA:

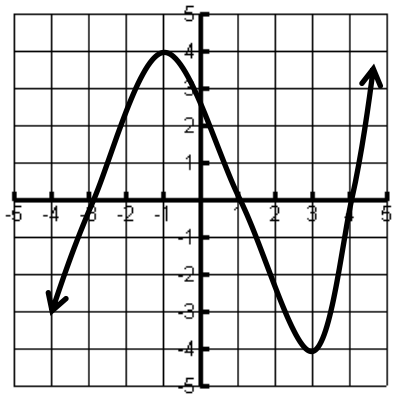
Range: HA:

End Behavior: _____

3. Write the function whose graph is the graph of f(x) =lnx, but is
   a. Shifted up 4 units _____
   b. Shifted left 3 units _____

4. Determine the inverse of the following functions. Determine their Domain.
   a. $f(x) = 3x + 1$ b. $f(x) = \frac{2}{x-1}$

5. 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:

6. Graph the function: $f(x) = -x^3(x+2)^2(x-1)$

Indicate the degree: _____

Indicate the end behaviors:

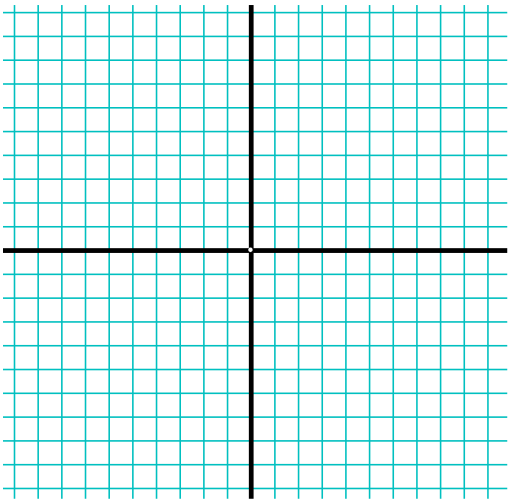
_____

Indicate the zeros and the multiplicities

Zero: _____ Mult.: _____

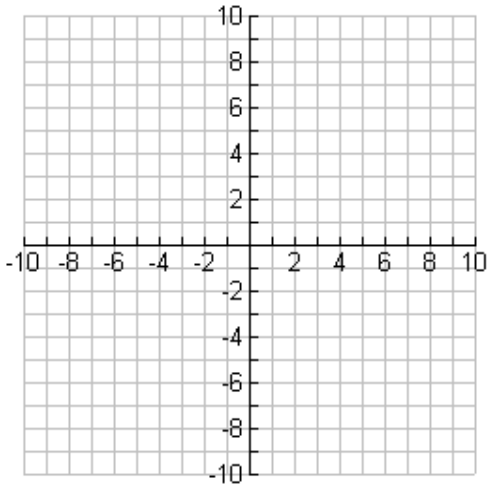
Zero: _____ Mult: _____

Zero: _____ Mult.: _____

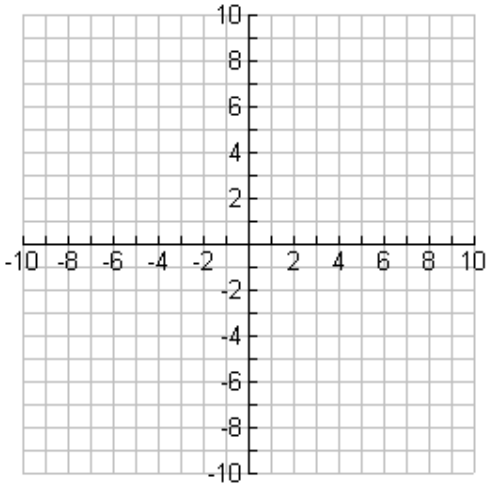


7. Graph the following functions using their parent functions $f(x) = log_3 x$.
   a. $f(x) = log_3(x-2)$ b. $f(x) = log_3(x)$-6

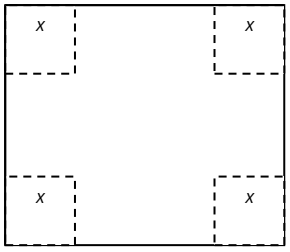
Transformations:



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.
   a. Express the volume *V* of the box as a function of the length *x* of the side of the square cut from each corner.
   _____



   b. For what value of *x* is *V* the largest?_____
   c. What is this value of *V*? _____

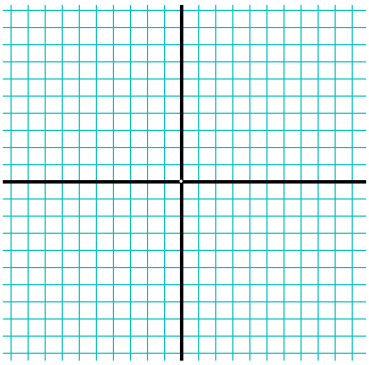
9. *The height of a flare can be modeled by the equation $h(t) = -16t^2 + 25t + 10$, where *h* is in feet and *t* is in seconds.
   a. What will be the maximum height of the flare? _____
   b. How long will it take for the flare hit the ground? _____

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

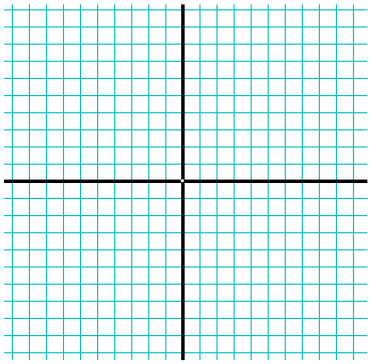
   a. $f(x) = x^4 + 2x^2$ b. $f(x) = \frac{1}{3}x^5 - 3x^2$ c. $f(x) = -\frac{2}{x}$

11. Draw a graph that is

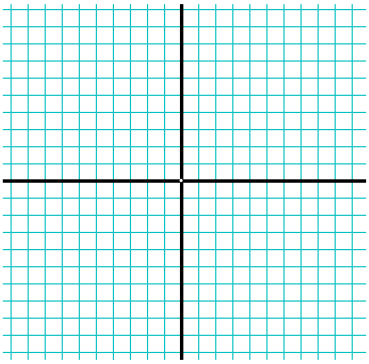
a. Odd.



b. Even



c. one-to-one



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

16. Solve:

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

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

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

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

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

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

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

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

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

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

23. Solve the inequality

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

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

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

24. Find the error during the simplification process

(x – 3)(x + 2)(x + 3i)(x-3i)

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

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

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

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

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

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

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

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

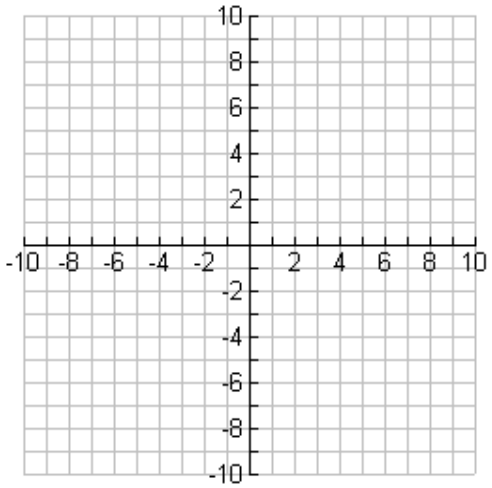
a. $g(x)=\dfrac{x+2}{x^2+2x-3}$ b. $k(x)=\dfrac{2x^2+5x-1}{5x^2}$ c. $h(x)=\dfrac{x^2+5x-6}{2x^2-5x+3}$

28.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.



29. Write as a log:

a. $6^3 = 216$ b. $e^5 = 148.413$ c. $4^4 = 64$

30. Evaluate:

a. $\log_{16} 4$ b. $\log_3 \frac{1}{9}$ c. $\ln e^6$

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

a. f(x)=$log_5(x+5)$ b. f(x)=$log_3(x) - 7$ c. $y = 2^{x-3} + 5$

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

b. 5.5% Compounded Monthly b. 4.7% Compounded Continuously

33. *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?

34. *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.

35. *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?

36. *How long will it take for Henry to triple his investment if the account he is using earns 2.8% compounded continuously?

37. *What rate will Henrietta need to invest her money in to double her investment in 5 years if the account is compounded continuously?

Evaluate/simplify the following complex number expressions. Leave in a + bi form.

38. i^{15} = _____

39. $8i^6 + 4i^5 - 16i^2 + 3i^7 - i^{24}$ = _____

Simplify the complex expressions. Leave in a + bi form.

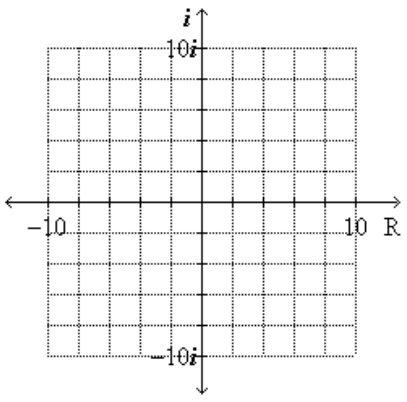
40. $4i(2 + i) + (5 - 2i)$

41. $(3 + 4i) - (-4 + i)$

42. $(2 - 2i)(3 + i)$

43. $\frac{2+3i}{-3+4i}$

44. Graph the number $-3 + 4i$ in the complex plane and find its absolute value.



$A = \begin{bmatrix} -1 & 5 \\ 3 & 0 \end{bmatrix}$ $B = \begin{bmatrix} -4 & 2 & -1 \\ 0 & -5 & 3 \end{bmatrix}$ $C = \begin{bmatrix} -1 & 0 & -4 \\ 3 & -2 & 1 \end{bmatrix}$

*45. Evaluate each of the following.

a. $AB + C$ b. $3AC - B$

*46. Solve the system of equations.

$3x - y + 2z = -3$
$-x + 2y - z = 2$
$2x - 3y + z = -1$

$x =$ _____ $y =$ _____ $z =$ _____

47. Find the value of the variables: $\begin{bmatrix} x & -2 \\ 2y & 16 \end{bmatrix} = \begin{bmatrix} 4 & -z+4 \\ 36 & 16 \end{bmatrix}$.

*48. Sanjay was in Canada this summer. He made phone calls from within Canada as well as to the US and Mexico while he was there. The charges are 28¢/min within Canada, 30¢/min to the U.S., and 84¢/min to Mexico. Sanjay's total bill for the month was $90.96. He talked twice as long to Mexico as he did to the U.S. The total number of minutes spent talking within Canada and to Mexico was 122. How much money did Sanjay have to spend on phone calls to the US?

Answers:

1.a. x = 2 & 3

1.b. x = -1.5 & 3

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

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

VA: x = 3

HA: y = 4

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

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

Range: $(-2, \infty)$

VA: x = -2

HA: y = -2

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

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

b $f(x) = \ln(x + 3)$

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

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

5. 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

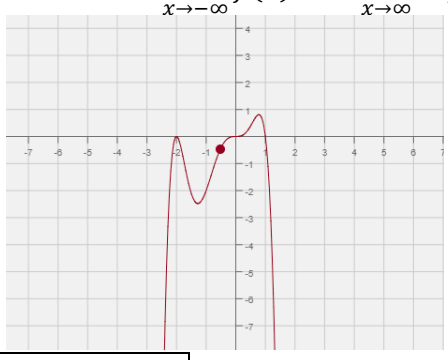
Absolute maximum: Not applicable Absolute minimum: Not applicable

Increasing: $(-\infty, -1)U(3, \infty)$ Decreasing: (-1, 3)

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

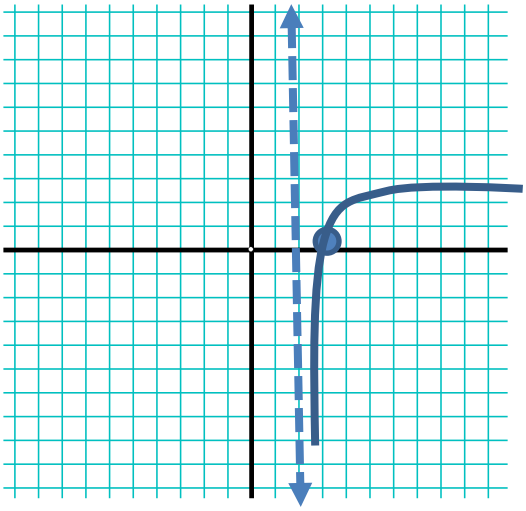
6. Degree: 6

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

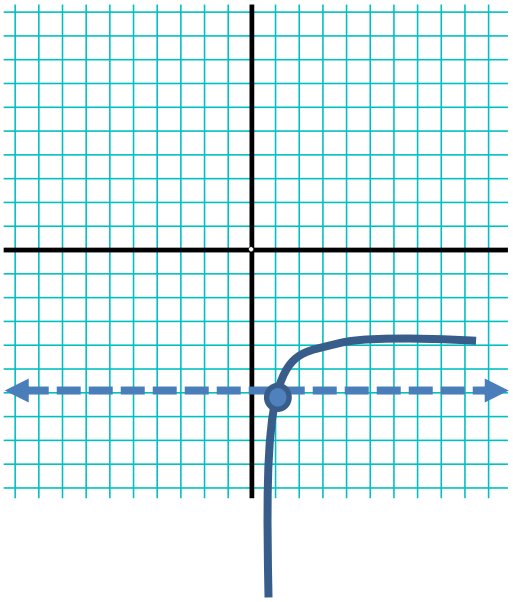


Zero	Multiplicity
0	3
-2	2
1	1

7. a.



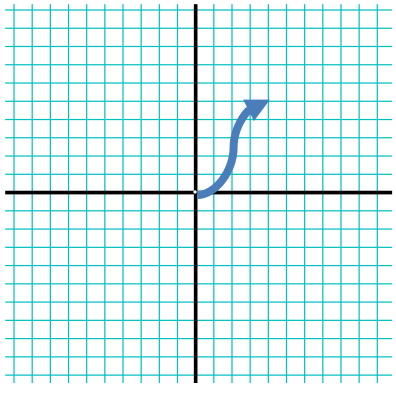
b.



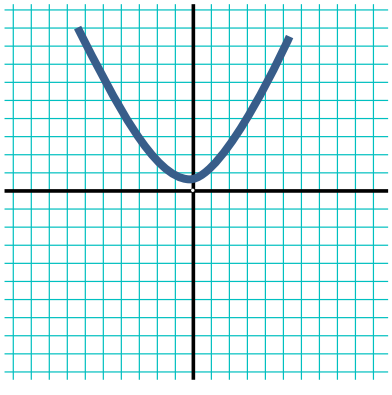
8. a. $V = (24 - 2x)(24 - 2x)x$
   b. $x = 4\ in$
   c. $V = 1024\ in^3$
9. a. 19.77 feet
   b. 1.89 seconds
10. a. y-axis b. neither c. Origin

11. Many Answers

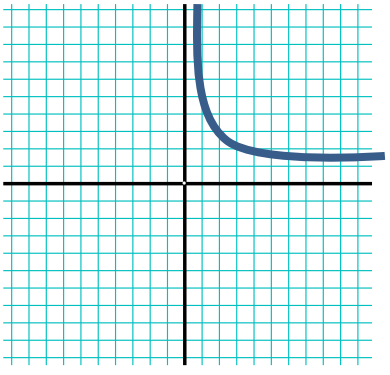
Odd



Even



One-to-One



12.

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

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

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

aiv. $\frac{2}{x+4}$ D: $(-\infty, -5)U(-5, -4)U(-4, \infty)$

av. $2x^2 + 18x + 50$

avi. $4x^2 + 58x + 210$

avii. 154

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

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

biii. $\frac{x+1}{x}$ D: $(-\infty, 0)U(0,1)U(1, \infty)$

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

bv. $\frac{x}{x^2 - x - 1}$

bvi. $\frac{-x^2 + 2x}{x^3 - 2x^2 + x}$

bvii. -1

13. a. 6
    b. 51
    c. 12
    d. 21
    e. 37

14. 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

15. 47

16. a. x = -6 & 2

    b. x = -1 & 3

17. a. $\lim_{x\to-\infty} f(x) = -\infty$ $\lim_{x\to\infty} f(x) = -\infty$

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

18. x = -1 (multiplicity 2) & 2

19. -11

20. $2x^2$+2x+1 R$\frac{-6}{3x+1}$

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

22. x = -2.21, .54 and 1.68

23. a. [.5,2] b. $(-\infty,-3)U(-1,2]U[5,\infty)$ c. $(-\infty,-2]U(1,3]$

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

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

25. k = 3

26.

a.		b.	
Domain	$(-\infty,-1)U(-1,\infty)$	Domain	$(-\infty,-3U(-3,.5)U.5,\infty)$
x-intercept:	(0,0)	x-intercept:	(-2,0)
y-intercept:	(0,0)	y-intercept:	(0,-2)
VA:	X = -1	VA:	X = .5
HA:	Y = 4	HA:	Y = .5
Holes	None	Holes	(-3, $\frac{1}{7}$)

27.

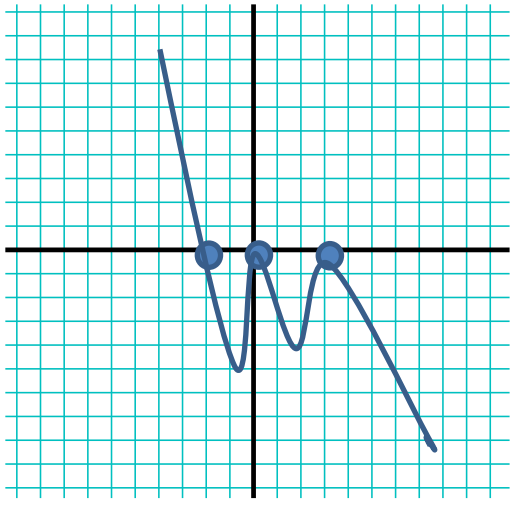
a.		b.		c.	
VA:	X = 1 & x = -3	VA:	X = 0	VA:	X = 1.5
HA:	Y = 0	HA:	Y = .4	HA:	Y = .5
Holes:	none	Holes:	none	Holes:	(1, -7)

28. *a.* $\lim_{x\to-\infty} f(x) = \infty$ $\lim_{x\to\infty} f(x) = -\infty$

    b.

Zero	Multiplicity
0	2
-2	1
3	2

    c.



29. $a.\ log_6 216 = 3$ b. $ln 148.413 = 5$ c. $log_4 64 = 4$

30. a. 1/2 b. -2 c. 6

31. a. x = -5 b. x = 0 c. y = 5

32. a. t = 12.63 years b. t = 14.748 years

33. A(5) = $361.22

34. Nicolette needs $3,897.03 to deposit

35. 2.5% compounded continuously equals 2.53% compounded annually, so 6.5% compounded annually is a better investment.

36. 39.236 years

37. 13.86%

38. -i

39. 7 + i

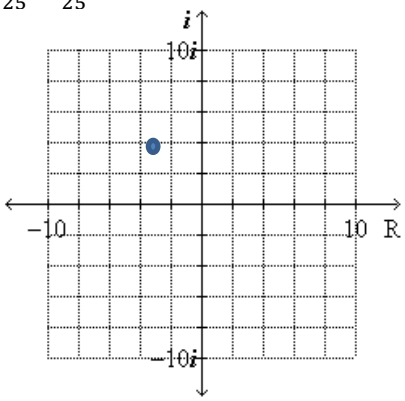
40. 1 + 6i

41. 7+3i

42. 8-4i

43. $\frac{6}{25} - \frac{17}{25}i$

44.



45. a. $\begin{bmatrix} 3 & -27 & 12 \\ -9 & 4 & -2 \end{bmatrix}$ b. $\begin{bmatrix} 52 & -32 & 28 \\ -9 & 5 & -39 \end{bmatrix}$

46. x = 1 y = 0 z = -3

47. x = 4 y = 18 z =6

48. Canada = 42 mins, US = 40 mins, M = 80 mins US = 40(.3) = **$12**