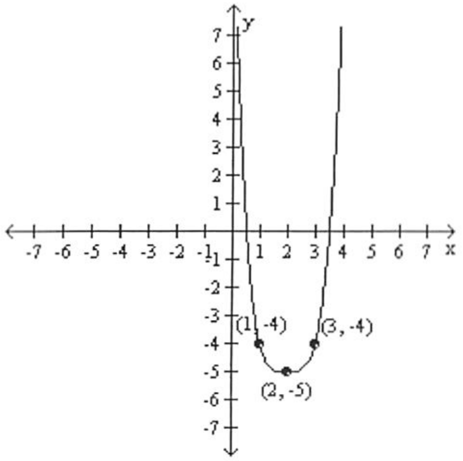
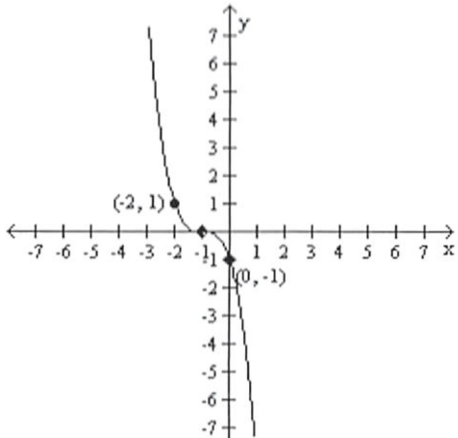
1.



right 2, down 5
rising on the left, rising on the right

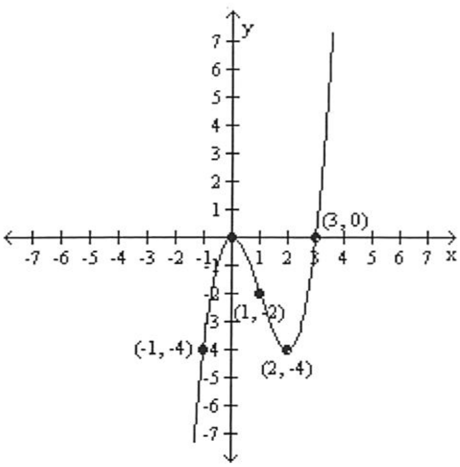
2.



left one, reflect over *x*-axis
rising on the left, falling on the right

3. $f(x) \to -\infty$ as $x \to -\infty$ $f(x) \to \infty$ as $x \to \infty$

4.



a)	x-intercepts:(0, 0) touches and (3, 0) crosses
b)	falls on the left and rises on the right
c)	maximum number of turning points is 2
d)	relative max at (0, 0) and relative min at (2, –4)
e)	see graph
f)	increasing on $(-\infty, 0)$ and $(2, \infty)$
	decreasing on (0, 2)

5. $f(x) = x^3 - x^2 - 16x - 20$

6. No positive real zeros and 4, 2 or 0 negative real zeros.

7. Since $f(1) = -1$ and $f(2) = 2$, the graph must cross the *x*-axis in order to go from a negative y-value to a positive y-value.

8. The <u>possible</u> rational zeros are $\pm\left\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{6}, 5, \frac{5}{2}, \frac{5}{3}, \frac{5}{6}\right\}$

9. When dividing $g(x)$ by 4 using synthetic division you obtain a zero remainder. Remember this means that $x = 4$ is a solution to the equation and that $(x - 4)$ is a factor of $g(x)$.

The zeros of the function are: $x = 4, x = -\frac{1}{3}, x = \frac{3}{2}$

The linear factorization of $g(x)$: $g(x) = (x-4)(3x+1)(2x-3)$

10. The zeros are: $x = 2, x = 2, x = 7i, x = -7i$

The linear factorization of $h(x)$: $h(x) = (x-2)^2(x-7i)(x+7i)$

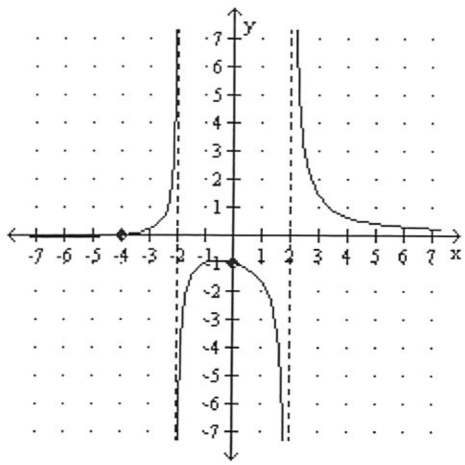
11. a) $(-\infty, \infty)$ b) $(-\infty, -3) \cup (-3, \infty)$ c) $[-3, \infty)$ d $(-3, \infty)$

12. a) $x = 1$ and $x = -1$ b) $x = 1$

13. a) $y = 0$ b) $y = 3$

14. $y = -2x - 2$

15.



a) The vertical asymptotes are $x = 2, x = -2$.

b) The horizontal asymptote is $y = 0$.

c) The x-intercept is $(-4,0)$.

d) The y-intercept is $(0,-1)$.

e) $-\infty$

f) $+\infty$

g) 0

16. The hole is at the point (2, 4).

17. $(-\infty,-3)\cup(1,4)$

18. a) $f(g(x)) = -18x^4 - 48x^3 - 47x^2 - 20x + 7$

b) $f(g(-2)) = -45$

c) $f(x) - g(x) = -5x^2 - 9x + 7$

d) $\frac{f(x+h) - f(x)}{h} = -4x - 2h - 5$

19. $f^{-1}(x) = \dfrac{x^2+1}{3}$

	Domain	*Range*
$f(x)$	$\left[\frac{1}{3}, \infty\right)$	$[0, \infty)$
$f^{-1}(x)$	$[0, \infty)$	$\left[\frac{1}{3}, \infty\right)$

20. a) (0,1) $\lim\limits_{x\to-\infty} e^x = 0$

b) (0,3) $\lim\limits_{x\to-\infty} e^x + 2 = 2$

c) (0,–2) $\lim\limits_{x\to\infty} e^{-x} - 3 = -3$

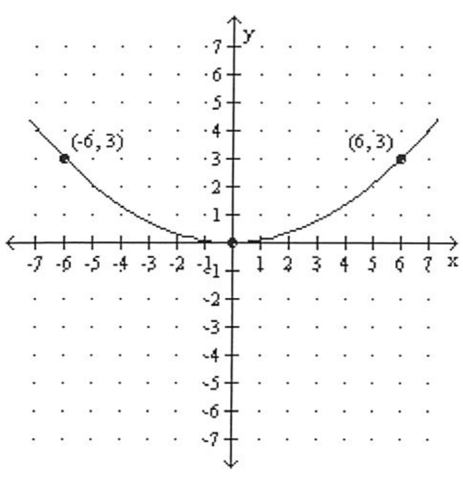
21. $3\ln x + \frac{1}{2}\ln(x+1) - 2\ln(x-2)$

22. $x = 4$ is in the domain, but $x = -1$ is not in the domain

23. Exact Form: $x = \dfrac{\log(40)}{\log(5)}$ Approximation: $x \approx 2.292$

24. Solve the equation
$80{,}000 = 25{,}000e^{.07t}$
$t \approx 16.6\, years$

25.



focus is (0, 3)

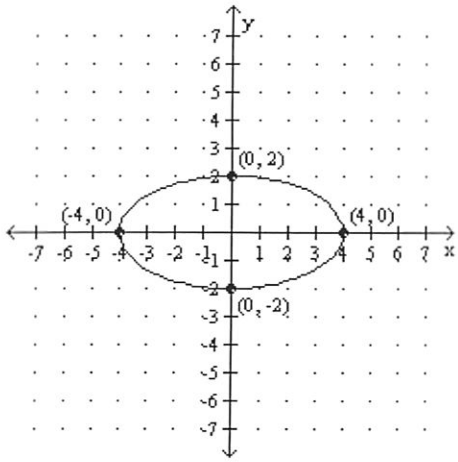
directrix is $y = -3$

The endpoints of the focal diameter are (–6,3) and (6, 3).

The direction of opening is upward.

26. $\dfrac{x^2}{48} + \dfrac{y^2}{64} = 1$

27.

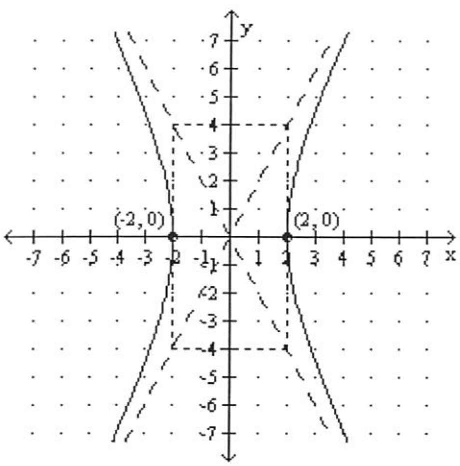


Foci: $\left(\pm 2\sqrt{3},0\right)$

Vertices of Major Axis: (–4, 0) and (4, 0)

Endpoints of Minor Axis are: (0, 2) and (0, –2)

28.



Foci: $\left(\pm 2\sqrt{5},0\right)$

Vertices of Major Axis: (–2, 0) and (2, 0)

Asymptotes are: $y = \pm 2x$

29. $(4,-3,1)$

30. a) $D = -10$

b)

$D_x = 20$

$D_y = -6$

$D_z = -24$

c) $\left(-2,\frac{3}{5},\frac{12}{5}\right)$

31. When you substitute each ordered pair in the equation $y = ax^2 + bx + c$ you obtain the system of three equations below:

$$a + b + c = -5$$
$$4a + 2b + c = -3$$
$$4a - 2b + c = 13$$

b) Using $X = A^{-1} \cdot B$ you obtain $a = 2$, $b = -4$ and $c = -3$.
c) The equation of the parabola is $y = 2x^2 - 4x - 3$.

32. Amount invested @ 3% is \$12,000
Amount invested @ 3.5% is \$20,000
Amount invested @ 4% is \$24,000

33. a) The determinant of A is $(-3)(2) - (-1)(4) = -6 + 4 = -2$.

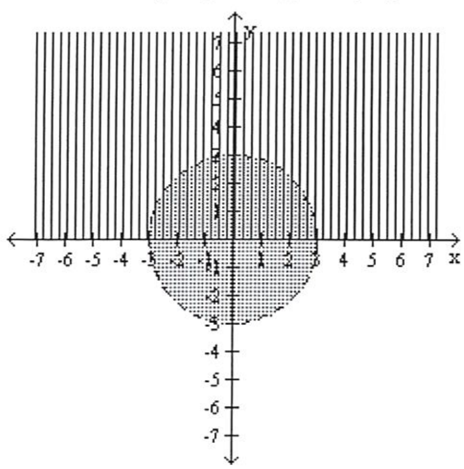
b) $A^{-1} = -\frac{1}{2}\begin{bmatrix} 2 & 1 \\ -4 & -3 \end{bmatrix} = \begin{bmatrix} -1 & -\frac{1}{2} \\ 2 & \frac{3}{2} \end{bmatrix}$

34. $\begin{bmatrix} 31 & 9 \\ 53 & -6 \end{bmatrix}$

35. a) $\begin{bmatrix} -13 & -9 \\ 3 & 2 \end{bmatrix}$ b) $\begin{bmatrix} -14 & 12 \\ 6 & -8 \end{bmatrix}$ c) $\begin{bmatrix} -48 & 105 \\ 21 & -45 \end{bmatrix}$ d) $\begin{bmatrix} -78 & 27 \\ 45 & -15 \end{bmatrix}$

36. $(-8,-6), (6,8)$

37. The purple region (top half of the circle) is the answer.



38. $-3, -5, -9, -17, -33$

39. $a_n = \dfrac{n+4}{n^2}$

40. This sequence is not arithmetic or geometric so you just substitute the indicated values of k into the summation formula to obtain $\sum_{k=0}^{4}(k^2 - 4) = 10$.

41. The sequence is arithmetic with $a_1 = 4$ and $d = 5$.

a) $a_n = 5n - 1$

b) $a_{50} = 249$

c) $S_{50} = 6325$

42. a) $a_n = 2(3)^{n-1}$

b) $a_{13} = 1{,}062{,}882$

c) $S_{13} = 1{,}594{,}322$

43. Since $\left|-\dfrac{3}{4}\right| < 1$, we can find the sum of the infinite geometric sequence. $S_\infty = \dfrac{4}{7}$

44. a) $a_n = \$56{,}000$ b) $S_7 = \$329{,}000$

45. The first three terms of the sequence is represented by 2000, 2080, 2163.2, . . .

The sequence is geometric with $a_1 = 2000$ and $r = 1.04$. By finding the 11th term of the sequence you can determine approximately how many bacteria there will be in the culture after 10 hours. $a_{11} = 2960$ bacteria

46. a) 455 b) $\dfrac{13(70)}{2} = 455$ c) $S_{13} = \dfrac{13}{2}(5+65) = 455$

d)

5	10	15	20	.	.	.	65
65	60	55	50	.	.	.	5
70							

The 5 is a_1 and the 65 is a_{13}. You have 13 70's and you divide by 2 because the sequence is added twice. This gives the formula $\dfrac{13}{2}(5+65)$ which is identical to the formula used for finding the sum of an arithmetic sequence. This method only works for arithmetic sequences.

47. $(2x + y)^6 = 64x^6 + 192x^5y + 240x^4y^2 + 160x^3y^3 + 60x^2y^4 + 12xy^5 + y^6$

48. Maximum at $\left(-\frac{3}{4},\frac{17}{4}\right)$

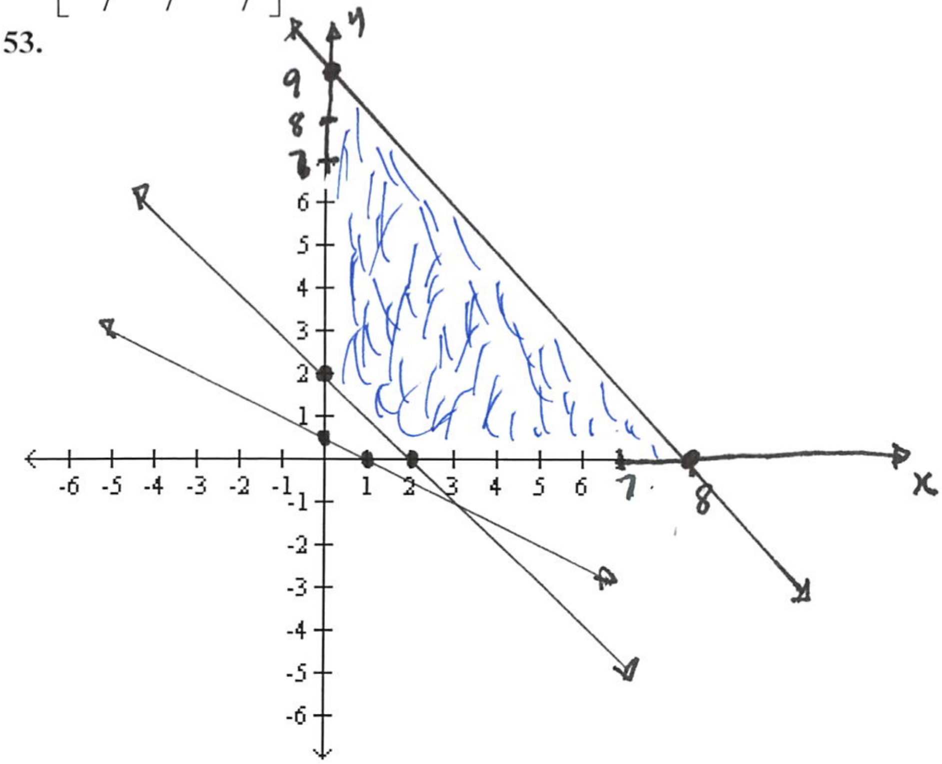
49. Minimum at $\left(\frac{4}{3},-\frac{10}{3}\right)$

50. $(-\infty,-1)\cup[0,1)\cup[2,\infty)$

51. $\left(-1,\frac{2}{3}\right)\cup(2,\infty)$

52. $\begin{bmatrix} \frac{3}{7} & -\frac{4}{7} & \frac{1}{7} \\ \frac{1}{7} & \frac{1}{7} & -\frac{2}{7} \\ -\frac{5}{7} & \frac{9}{7} & \frac{3}{7} \end{bmatrix}$

53.



54. $x^3+6\sqrt{2}x^{\frac{5}{2}}+30x^2+40\sqrt{2}x^{\frac{3}{2}}+60x+24\sqrt{2}x^{\frac{1}{2}}+8$

55. Converges to 6

56. $4i,-\frac{2}{3},-\sqrt{11},\sqrt{11}$

57. $\frac{3}{8(x-1)}+\frac{1}{2(x-1)^2}+\frac{5}{8(x+3)}$