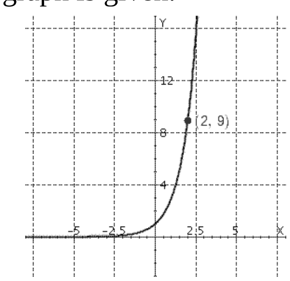
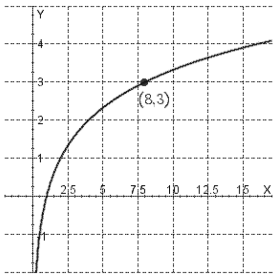
1. Determine the end behavior of $P(x) = -x^4 + 5x^2 - 5x - 5$
   A) $y \to -\infty$ as $x \to \infty$ and $y \to \infty$ as $x \to -\infty$
   B) $y \to \infty$ as $x \to \infty$ and $y \to -\infty$ as $x \to -\infty$
   C) $y \to -\infty$ as $x \to \infty$ and $y \to -\infty$ as $x \to -\infty$
   D) $y \to \infty$ as $x \to \infty$ and $y \to \infty$ as $x \to -\infty$
   E) $y \to 0$ as $x \to \infty$ and $y \to -\infty$ as $x \to -\infty$
2. Find the quotient and remainder using synthetic division. $\dfrac{x^3 - 27}{x - 3}$
   (A) The quotient is $x^2 - 3x + 9$ the remainder is 2.
   (B) The quotient is $x^2 - 3x - 9$ the remainder is –1.
   (C) The quotient is $x^2 + 3x - 9$ the remainder is –2.
   (D) The quotient is $x^2 + 3x + 9$ there is no remainder.
   (E) The quotient is $x^2 - 3x + 9$ the remainder is 1.
3. Use synthetic division and the Remainder Theorem to evaluate $P(2)$, for $P(x) = 6x^5 + 4x^3 + x + 8$.
   A) 233 B) 234 C) 232
   D) 231 E) 237
4. Find all rational zeros of the polynomial. $P(x) = x^4 - 29x^2 + 100$
   A) $x$ = –5, 5, 2 B) $x$ = -4, 4, -2, 2
   C) $x$ = 5, -2, 2 D) $x$ = -21, 21, -2, 2
   E) $x$ = -5, 5, 2, -2
5. Find a polynomial of degree 3 that has zeros 7, –7, and 6.
   A) $x^3 - 6x^2 - 49x - 294$
   B) $x^3 - 6x^2 - 49x + 294$
   C) $x^3 - 6x^2 + 49x + 294$
   D) $x^3 + 6x^2 + 49x + 294$
   E) $x^3 + 6x^2 - 49x + 294$
6. Find a polynomial of degree 3 that has zeros of 2, –4, and 4, and where the coefficient of $x^2$ is 6.
   A) $-3x^3 + 6x^2 - 48x - 96$
   B) $-3x^3 + 6x^2 + 48x - 96$
   C) $-3x^3 + 6x^2 + 48x + 96$
   D) $3x^3 - 6x^2 - 48x - 96$
   E) $3x^3 + 6x^2 + 48x - 96$
7. List all possible rational zeros given by the Rational Zeros Theorem (but don't check to see which actually are zeros). $Q(x) = x^4 - 4x^3 - 5x + 8$
   A) 1, 8 B) ±1, ±2, ±4, ±8 C) ±1, ±8
   D) –1, –2, –4, –8 E) 1, 2, 4, 8
8. List all possible rational zeros given by the Rational Zeros Theorem (but don't check to see which actually are zeros). $f(x) = 6x^5 + 6x^3 - 2x + 12$
   A) $\pm1, \pm2, \pm3, \pm4, \pm6, \pm12$
   B) –1, –2, –3, –4, –6, –12
   C) $\pm1, \pm2, \pm3, \pm4, \pm6, \pm12, \pm\frac{1}{2}, \pm\frac{3}{2}, \pm\frac{1}{3}, \pm\frac{2}{3}, \pm\frac{4}{3}, \pm\frac{1}{6}$
   D) $1, 2, 3, 4, 6, 12, \frac{1}{2}, \frac{3}{2}, \frac{1}{3}, \frac{2}{3}, \frac{4}{3}, \frac{1}{6}$
   E) $-1, -2, -3, -4, -6, -12, -\frac{1}{2}, -\frac{3}{2}, -\frac{1}{3}, -\frac{2}{3}, -\frac{4}{3}, -\frac{1}{6}$
9. Solve the logarithmic equation for $x$.
   $log_2 2 + log_2 x = log_2 3 + log_2 (x - 5)$
   A) $x$ = 15 B) $x$ = 3.9 C) $x$ = 17
   D) $x$ = 30 E) $x$ = 12
10. Solve the inequality. $x^2e^x - 16e^x < 0$
    A) 0, 4) B) (-16, 16) C) (-4, 0)
    D) (-4, 4) E) (-4, 16)
11. State the range of the function. $h(x) = 2 + \left(\frac{1}{7}\right)^x$
    A) $(0, \infty)$ B) $(-2, \infty)$ C) $(-\infty, \infty)$
    D) $(2, \infty)$ E) $(-2, 2)$
12. Find the exponential function $f(x) = a^x$ whose graph is given.




    A) $f(x) = 3^x$
    B) $f(x) = 3^{x+3}$
    C) $f(x) = -3^x$
    D) $f(x) = 3^{-x}$
    E) $f(x) = x^3$
13. State the range of the function $y = 8 - e^x$.
    A) $(-8, \infty)$ B) $(-\infty, 8)$ C) $(-\infty, \infty)$
    D) $[8, \infty)$ E) $(0, \infty)$
14. What is the asymptote of the function $y = e^{x-2} + 3$?
    A) $x = 2$ B) $y = 3$ C) $y < 3$
    D) $y = 2$ E) $x > 2$
15. Express the equation $ln(x + 1) = 4$ in exponential form.
    A) $x = e^1 - 4$ B) $x = e^4 - 1$ C) $x = e^1 + 4$
    D) $x = e^4 + 1$ E) none of these
16. Express the equation in logarithmic form. $3^4 = 81$
    A) none of these B) $log_4 3 = 81$ C) $log_3 81 = 4$
    D) $log_4 81 = 3$ E) $log_{81} 3 = 4$
17. Evaluate the expression. $e^{ln 5}$
    A) $5e$ B) none of these C) $ln\ 5$
    D) 5 E) $e^5$

18. Find the function of the form $y = log_a x$ whose graph is given.




A) $y = log_5 x$
B) $y = log_2 x$
C) $y = log_8 x$
D) $y = log_3 x$
E) none of these

19. Use the Laws of Logarithms to rewrite the expression below in a form with no logarithm of a product, quotient, or power. $log_a\left(\frac{x^2}{yz^7}\right)$

(A) $-2\ log_a x + log_a y + 7\ log_a z$
(B) $\frac{2\,log_a x}{log_a(7y)\,log_a z}$
(C) $2\ log_a x - log_a y - 7\ log_a z$
(D) $2\ log_a x + log_a y + 7\ log_a z$
(E) $2\ log_a x - log_a y + 7\ log_a z$

20. Use the Laws of Logarithms to rewrite the expression below in a form with no logarithm of a product, quotient, or power. $ln\left(x\sqrt[9]{\frac{y}{z}}\right)$

A) $ln\,x + \frac{1}{9}ln\,y + \frac{1}{9}ln\,z$
B) $ln\,x + \frac{1}{9}ln\,y - \frac{1}{9}ln\,z$
C) $ln\,x - \frac{1}{9}ln\,y - \frac{1}{9}ln\,z$
D) $ln\,x - \frac{1}{9}ln\,y + \frac{1}{9}ln\,z$

21. Use the Laws of Logarithms to rewrite the expression below in a form with no logarithm of a product, quotient, or power. $log\sqrt[6]{x\sqrt[6]{y\sqrt[6]{z}}}$

A) $\frac{1}{216}log\,x + \frac{1}{36}log\,y + \frac{1}{6}log\,z$
B) $\frac{1}{216}(log\,x + log\,y + log\,z)$
C) $\frac{1}{6}log\,x + \frac{1}{36}log\,y + \frac{1}{216}log\,z$
D) $\frac{1}{216}log\,x - \frac{1}{36}log\,y - \frac{1}{6}log\,z$

22. Rewrite the expression as a single logarithm.
$log_3 2 + 2\,log_3 2$

A) $log_3 8$
B) $log_8 3$
C) $log_3 4$
D) 1
E) $ln\,8$

23. Rewrite the expression below as a single logarithm.
$log\,14 + \frac{1}{2}log\,3 - log\,2$

A) $ln\,3\sqrt{7}$
B) $log\,\frac{1}{3}\sqrt{7}$
C) $log\,\frac{1}{7}\sqrt{3}$
D) $log\,21$
E) $log\,7\sqrt{3}$

24. Solve the equation. $e^{2x} - 5e^x + 4 = 0$

A) $x = -4, x = 1$
B) $x = ln\,5$
C) $x = ln\,5, x = 0$
D) $x = 4, x = 1$
E) $x = ln\,4, x = 0$

25. Solve the logarithmic equation for $x$. $log(8x+6) = 2$

A) $x = \frac{47}{3}$
B) $x = \frac{47}{4}$
C) $x = \frac{95}{8}$
D) none of these
E) $x = \frac{47}{8}$

26. Solve the logarithmic equation for $x$.
$log_2 2 + log_2 x = log_2 3 + log_2(x-5)$

A) $x = 15$
B) $x = 3.9$
C) $x = 17$
D) $x = 30$
E) $x = 12$

Short Answer

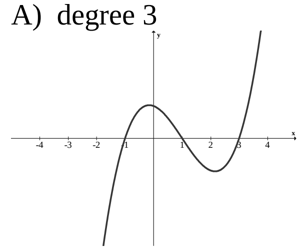
27. Find all the real zeros of the polynomial.
$P(x) = 24x^3 - 76x^2 + 2$

28. Find all the real zeros of the polynomial.
$P(x) = 5x^4 + 36x^3 + 47x^2 - 52x - 12$

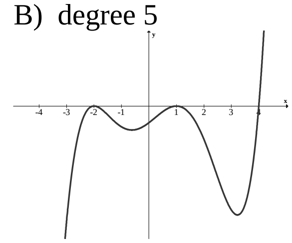
29. Use synthetic division and the Remainder Theorem to evaluate $P(c)$. $P(x) = 3x^3 + 7x^2 - 4x + 2$, $c = \frac{2}{3}$

30. Find all rational zeros of the polynomial, and then find the irrational zeros, if any. Whenever appropriate, use the Rational Zeros Theorem, the Upper and Lower Bounds Theorem, Descartes' Rule of Signs, the quadratic formula, or other factoring techniques. $2x^4 - x^3 - 17x^2 + x + 15 = 0$

31. Find the equation of the graph in factored form.
A) degree 3



B) degree 5



32. Find the remainder given $\frac{x^{23} + 12x^{10} - 15}{x+1}$

33. Factor completely and graph.
$f(x) = x^3 - 4x^2 - 17x + 60$

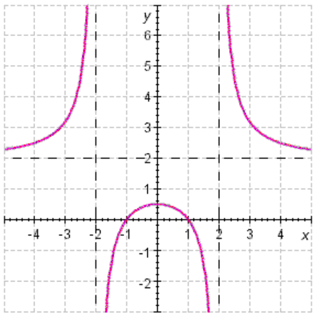
34. Factor completely and graph.
$f(x) = x^3 - 11x^2 + 38x - 40$

35. Factor completely and graph.
$f(x) = x^4 + x^3 - 3x^2 - 5x - 2$

36. Factor completely and graph.
$f(x) = x^6 - 10x^5 + 40x^4 - 82x^3 + 91x^2 - 52x + 12$

37. Factor completely and graph.
$f(x) = 2x^3 + 3x^2 - 32x + 15$

38. Determine the equation of the function whose graph is:




39. Find all asymptotes (if any). $r(x)=\dfrac{x^3+4x^2}{x^2-4}$

For problems 40-42, find the following:

(a) Determine the *x*-intercept(s).
(b) Determine the *y*-intercept(s).
(c) Determine the vertical asymptote(s).
(d) Determine the horizontal asymptote(s).

40. $s(x)=\dfrac{5x-5}{(x-5)(x+1)}$

41. $r(x)=\dfrac{x^2-18x+81}{x^2+6x+9}$

42. $r(x)=\dfrac{3x^2+9}{x^2-2x-3}$

Graph the following:

43. $s(x)=-\dfrac{3}{x+2}$

44. $r(x)=\dfrac{3x-11}{x-4}$

45. $r(x)=\dfrac{x-4}{x^2-9x}$

46. . $r(x)=\dfrac{5x^2+7}{x^2-2x-8}$

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

48. $f(x)=\dfrac{2}{2x^2-x-3}$

49. $f(x)=\dfrac{x^2-4}{x^2-4x+4}$

50. $f(x)=\dfrac{4x-2}{x^2+5x-6}$

51. $f(x)=\dfrac{x-2}{x^2-2x-3}$

52. $f(x)=\dfrac{3x^2-12}{4-x^2}$

53. $f(x)=\dfrac{3x^2-x-4}{x^2-4}$

54. $f(x)=\dfrac{2x^3+7x^2-4x}{x^2+2x-3}$

55. $f(x)=\dfrac{2x^2-4x-3}{x-2}$

56. Solve for *x*. $log(8x+6)=2$

57. Solve the equation. $x^2 2^x-2^x=0$

58. Solve the equation. $x^2 7^x-x7^x=6(7^x)$

59. State the range of the function. $h(x)=2+\left(\dfrac{1}{7}\right)^x$

60. State the range of the function $y=8-e^x$

61. Determine the domain and range of the function $h(x)=5-2^x$

62. Graph $f(x)=log_2(x-2)-2$.

63. Graph the function $y=11^{x+3}$. State the domain, range, and asymptote.

64. Graph $y=4^{x+2}$.

65. Use the definition of the logarithmic function to find *x*.

(a) $log_3 x=4$

(b) $log_{10} 0.000001=x$

66. Find the domain of the function. $f(x)=log_8(x+3)$

67. Use the Laws of Logarithms to expand the expression. $log_3(AB^5)$

68. Use the Laws of Logarithms to expand the expression. $ln\dfrac{3x^5}{(x+1)^9}$

69. Use the Laws of Logarithms to combine the expression. $5log\,x-\dfrac{1}{3}log(x^2+1)+4log(x-1)$

70. Use the Laws of Logarithms to combine the expression. $2(log_3 x+2log_3 y-4log_3 z)$

71. Given that $log_7 a=4$ and $log_7 c=-5$, find the following:

A) $log_7 ac$ B) $log_7 \dfrac{c}{a}$

C) $log_7 a^8$ D) $log_7 \sqrt[4]{c}$

Find the general solution for θ (degrees) to 2 decimal places or *x* (radians) to 4 decimal places.

79. $\theta=sin^{-1}0.3$

80. $x=cos^{-1}(-0.2)$

81. $\theta=tan^{-1}6$

82. $\theta=sec^{-1}(1.5)$

83. $5sin\,x+4=0$

Find the first three positive answers for problem 84-86

84. $x=\pm 6.52+11n$

85. $x=-2.54+2n$ and $x=3.12+2n$

86. $x=6.3+2\pi n$ and $x=-9.7+2\pi n$

87. The number of hours of darkness in a coastal town can be modeled by $f(x)=12.1+6.1cos\dfrac{\pi}{6}(x-2)$, where *x* is the month and *x* = 1 corresponds to January. Approximate the number of hours of darkness in April, to the nearest tenth of an hour.

88. Given: $f(x)=6+8cos\dfrac{\pi}{7}(x-4)$

a) Find $f(17)$.

b) Find the first three positive values of *x* for which $f(x)=11$.

89. As you ride a bicycle, the distance between your foot and the pavement varies sinusoidally with the horizontal distance the bicycle has gone. Suppose that you start with your right foot somewhere between a high point and a low point, and push down. When you have gone 5 m, your right foot first reaches its lowest point, 11 cm above the pavement The high points are 45 cm above the pavement The bicycle moves a horizontal distance of 16.4 m for each complete revolution of the pedals,
   a) Sketch the graph of the sinusoid
   b) Write a particular equation of the sinusoid,
   c) How high was your right foot when you first started?

90. The distance between Earth and Mars is (approximately) a sinusoidal function of time whose equation is $d = 228 + 93\cos\frac{\pi}{390}(t - 560)$ where *t* is the number of days after today, and *d* is in millions of miles.
   a) Sketch the graph.
   b) How far apart are the two planets today?
   c) What is the farthest they are apart? the closest?
   d) How much time elapses between times of closest approach?
   e) What are the first two positive times between which Mars will be within 200 million miles of Earth?

91. The maximum monthly average temperature in Smithville is 87° in July, and the minimum is 33° in January. Determine $f(x)$ that models the monthly average temperature in Smithville, where *x* is the month and *x* = 1 corresponds to January.

92. Astronomers believe that the radius of a variable star increases and decreases with the brightness of the star. The certain variable star has an average radius of 25 million miles and changes by a maximum of 1.5 million miles from this average during a single pulsation. The time between periods of maximum brightness is 5.4 days. Find an equation that describes the radius of this star as a function of time.

93. In a predator/prey model, the predator population is modeled by the function $y = 7000 + 800\cos 3t$ where *t* is measured in years.
   a) What is the maximum population?
   b) Find the length of time between successive periods of maximum population. Please round the answer to the nearest hundredth.

94. The original Ferris wheel, built by George Ferris for the 1893 World's Fair, was much larger and slower than its modern counterparts. It had a diameter of 250 feet and contained 36 cars, each of which held 40 people. It made one revolution every 10 minutes and reached a maximum height of 264 feet. Grover Cleveland was given a private ride. He got on and the wheel starting slowly turning.
   a.) Sketch a graph of this sinusoid.
   b.) Write an equation expressing Grover's height above the ground in terms of time (in minutes) since the Ferris wheel started turning.
   c.) How high was Grover after 16 minutes?
   d.) When was Grover 200 feet above the ground for the 4th time?

Graph

95. $y = \frac{1}{2} + \frac{1}{\pi}\arccos 6\left(x - \frac{1}{6}\right)$

96. $y = \frac{\pi}{3} + \arcsin\frac{1}{8}\ \ x + 2$

97. $y = \frac{2\pi}{3} + 2\arctan 10\ \ x - 1$

98. $y = -\frac{2}{5} + \frac{5}{\pi}\arcsin\frac{1}{6}\ \ x - 5$

99. Two ranger towers at points *P* and *Q*, located 12 kilometers apart, receive a distress signal from campers at campsite *C*. The campsite is at an angle of 71° from the first tower and 100° from the second, each angle having as one side the line segment connecting the towers. Which tower is closer, and how far is it from the campsite?

100. An airplane is sighted simultaneously from two towns that are 3 miles apart. The angle of elevation of town *A* is 40.8° and the angle of elevation of town *B* is 75°. If the airplane is directly above a straight line between the two towns, how far is the airplane from each town?

101. An airplane pilot leaves San Francisco on her way to San Luis Obispo. Unfortunately, she flies 30° off course for 50 miles before discovering her error. If the direct air distance between the two cities is 200 miles, how far is the pilot from San Luis Obispo when she discovers her error?

102. Two planes start from the same point at the same time and fly on courses which diverge by 48°. If one plane averages 320 miles per hour and the other plane averages 480 miles per hour, how far apart are the planes after 24 minutes?

103. Each of two legs of a stepladder is 12 feet long. If the angle formed by the legs measures 13°, bow far apart are the feet of the stepladder?

104. A triangular parking lot has sides of lengths 420 feet, 350 feet, and 150 feet. Find the smallest of the three angles of the parking lot.

105. An isosceles triangle has base of length 20 centimeters. If the vertex angle of the triangle measures 30°, find the perimeter of the triangle.

106. Two planes, one flying at 300 miles per hour and the other at 450 miles per hour, left the same airport at noon. At 3 pm they were 1200 miles apart. What was the measure of the angle between their flight paths?

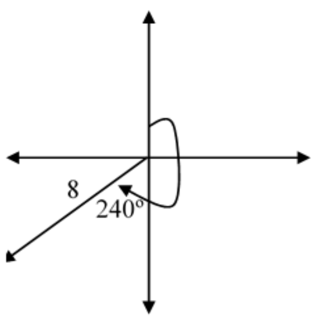
107. An object moves 12 meters along a bearing of 90º and then turns and moves 18 more meters along a bearing of 150º. Find the resultant of these two displacement vectors as a distance and bearing (clockwise from north).

108. Two vectors, $\vec{a}$ and $\vec{b}$, have magnitudes of 10 and 15 respectively. The angle between them is 50º.

a. Find $\left|\vec{a}-\vec{b}\right|$, and the angle this difference makes with $\vec{a}$.

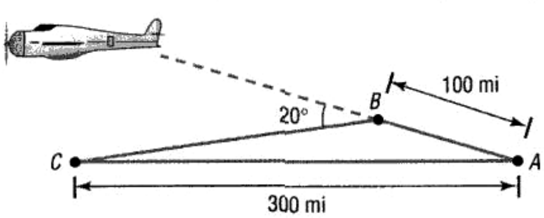
b. Find $\left|\vec{a}+\vec{b}\right|$, and the angle this sum makes with $\vec{a}$.

109. Resolve the vector into horizontal and vertical components.




110. A ship sails 90 miles on a bearing of 225º then turns and sails 100 miles on a bearing of 315º. Find the resultant displacement vector as a distance and bearing.

111. An airplane flies from city A to city B, a distance of 100 miles, and then turns through an angle of 20° and heads toward city C. as indicated in the figure. If the distance from A to C is 300 miles, how far is it from city B to city C?




112. The angle of elevation to the top of a mountain is 35 degrees. If a tour guide states that the base of the mountain is 2.5 miles from the center of town, how high is the mountain?

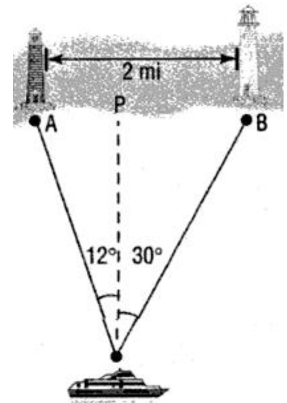
113. An airplane is flying at a speed of 675 kph. At the same time, the air is moving with respect to the ground at an angle of 35º to the plane's path through the air with a speed of 60 kph. Find the plane's ground speed if it is flying with the wind.

114. A ship sails 50 miles on a bearing of 200°, then turns and sails on a bearing of 280° for 25 more miles. Find its displacement vector

a. as the sum of two components, and

b. as a magnitude and direction

115. Rebecca, the navigator of a ship at sea, spots two lighthouses that she knows to be 2 miles apart along a straight shoreline. She determines that the angles formed between two line-of-sight observations of the lighthouses and the line from the ship directly to shore are 12° and 30°. See the illustration.




(a) How far is the ship from lighthouse A?

(b) How far is the ship from lighthouse B?

(c) How far is the ship from shore?

116. The *Majesty* leaves the Port at Boston for Bermuda with a bearing of 100° at an average speed of 10 knots. After 1 hour, the ship turns 90° toward the south west. After 2 hours at an average speed of 20 knots, what is the bearing of the ship from Boston?

117. A car dealer sells a used car for $18,000. He offers the buyer payments of $405 per month for 5 years. Find the interest rate the car dealer is charging?

118. Find how much money should be invested monthly at 6% per year, compounded monthly, to have $2000 in 8 months?

119. If $3,000 is invested in an account for which interest is compounded quarterly, find the amount of the investment at the end of 3 years for 6%.

120. A sum of $4,000 is invested at an interest rate of 9% per year, compounded semiannually. Find the value $25,000 of the investment after *t* years.

121. Solve for *x*: $5^x = 3^{x+2}$

Answer Section

| | | | | | |
|---|---|---|---|---|---|
| 1) C | 6) B | 11) D | 16) C | 21) C | 26) A |
| 2) D | 7) B | 12) A | 17) D | 22) A | |
| 3) B | 8) C | 13) B | 18) B | 23) E | |
| 4) E | 9) A | 14) B | 19) C | 24) E | |
| 5) B | 10) D | 15) B | 20) B | 25) B | |

27) $x=\frac{1}{6},\ x=\frac{3\pm\sqrt{11}}{2}$

28) $x=-3,\ x=-\frac{1}{5},\ x=-2\pm2\sqrt{2}$

29) $P\left(\frac{2}{3}\right)=\frac{10}{3}$

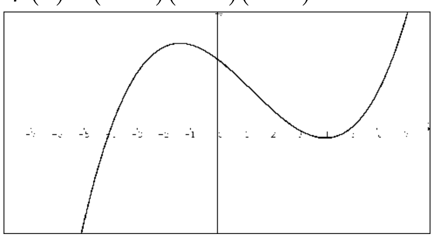
30) $\pm1,\ 3,\ -\frac{5}{2}$

31) A) $P(x)=a(x+1)(x-1)(x-3)$

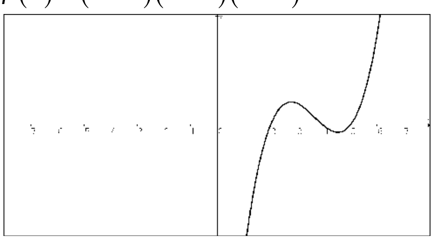
B) $P(x)=a(x+2)^2(x-1)^2(x-4)$

32) –4

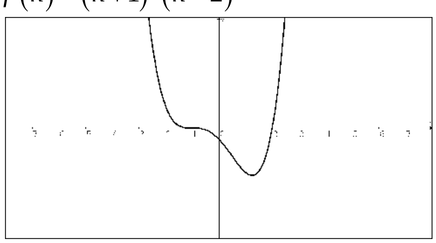
33) $f(x)=(x+4)(x-3)(x-5)$



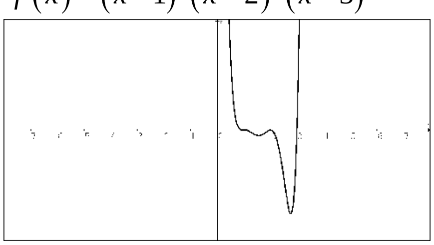
34) $f(x)=(x-4)(x-2)(x-5)$



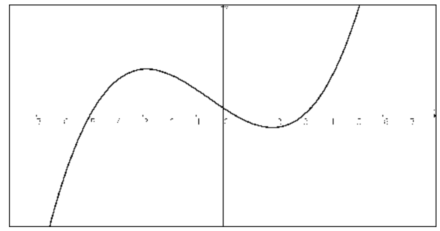
35) $f(x)=(x+1)^3(x-2)$



36) $f(x)=(x-1)^3(x-2)^2(x-3)$



37) $f(x)=(2x-1)(x+5)(x-3)$



38) $f(x)=\frac{2(x-1)(x+1)}{(x-2)(x+2)}$

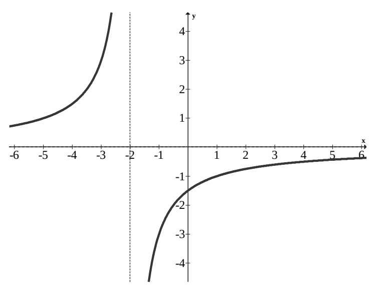
39) VA: $x$ = 2, $x$ = –2; SA: $y = x + 4$

40) (A) $x$ = 1; (B) $y$ = 1; (C) $x$ = –1, $x$ = 5; (D) $y$ = 0

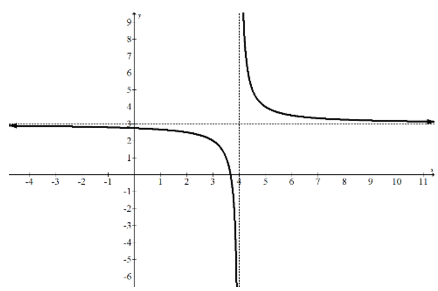
41) (A) $x$ = 9; (B) $y$ = 9; (C) $x$ = –3; (D) $y$ = 1

42) (A) no solution; (B) $y$ = –3; (C) $x$ = –1, $x$ = 3; (D) $y$ = 3

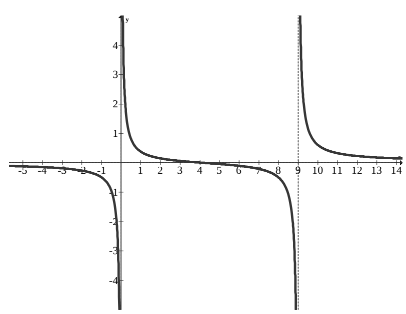
43)

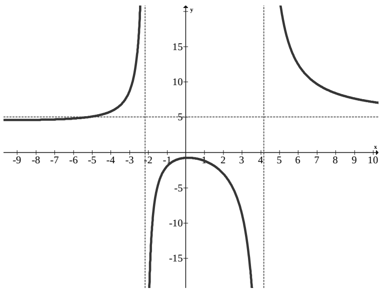


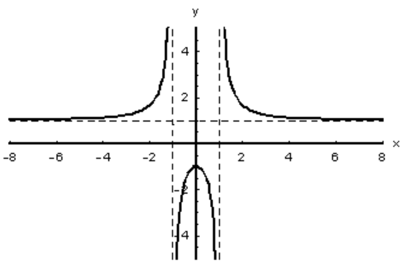
44)

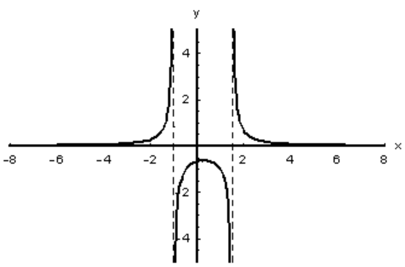


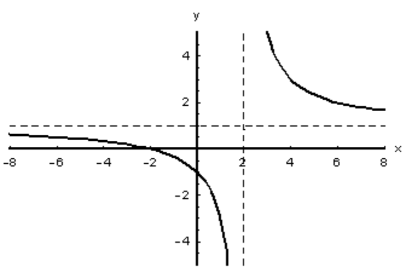
45)

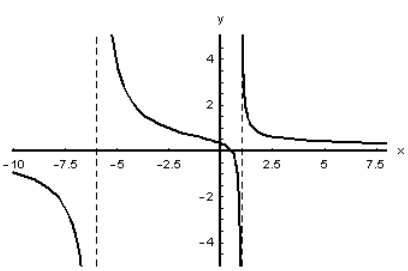


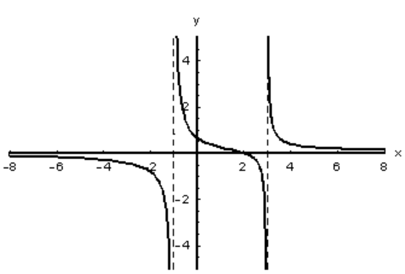
46) 

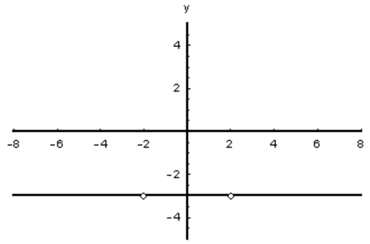

47) 

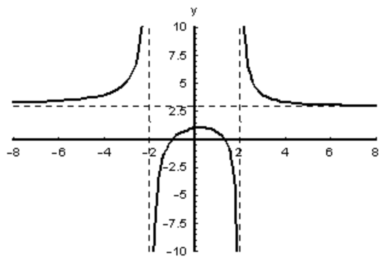

48) 

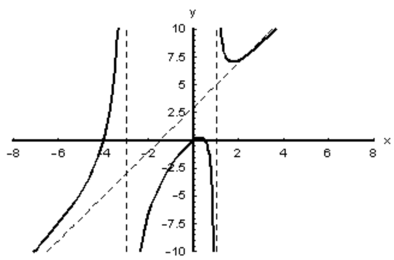

49) 

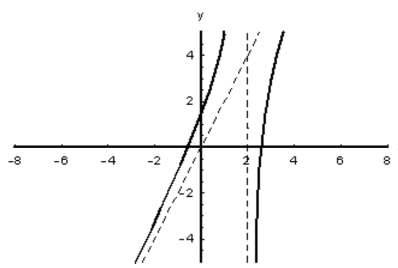

50) 


51) 


52) 


53) 


54) 


55) 


56) $\frac{47}{4}$

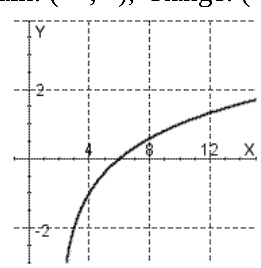
57) 1, -1

58) 3, -2

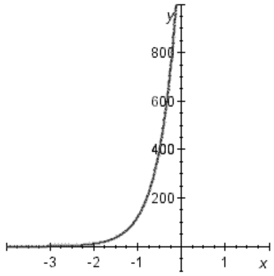
59) (2, ∞)

60) (-∞, 8)

61) Domain: (-∞,∞); Range: (-∞, 5)

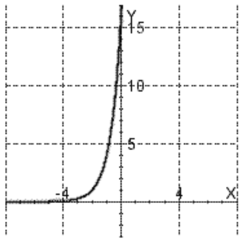
62) 

63)




Domain: $(-\infty, \infty)$.
Range: $(0, \infty)$.
Asymptote: y = 0.

64)

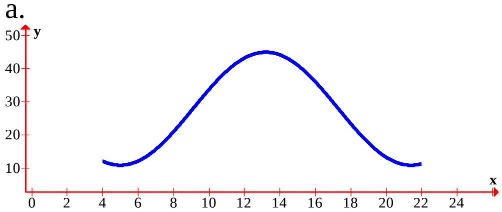



65) (A) 81; (B) –6
66) $(-3, \infty)$
67) $\log_3 A + 5\log_3 B$
68) $\ln 3 + 5\ln x - 9\ln(x+1)$
69) $\log\left(\frac{x^5(x-1)^4}{\sqrt[3]{x^2+1}}\right)$
70) $\log_3\left(\frac{x^2y^4}{z^8}\right)$

71) A) -1 B) -9 C) 32 D) $-\frac{5}{4}$

79. 17.46 + 360$n$ and 162.54 + 360$n$
80. ±1.772 + 2$\pi n$
81. 80.54 + 180$n$
82. ±48.19 + 360$n$
83. -0.9273 + + 2$\pi n$ and 4.0689 + 2$\pi n$
84. 4.48, 6.52, 15.48
85. 1.12, 1.46, 3.12
86. 0.017, 2.867, 6.3
87. 15.2 hours
88. a. 13.208
b. 5.996 + 14$n$ and 2.004 + 14$n$
2.004, 5.996, 16.004

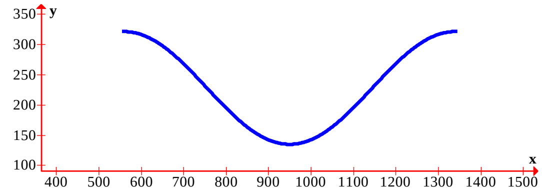
89) a.




b. $y = 28 - 17\cos\frac{\pi}{8.2}(x-5)$

c. 33.75 cm

90) a.



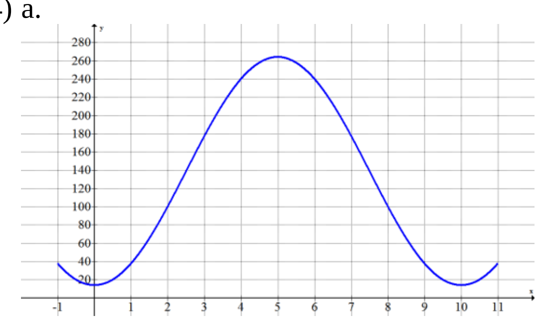

b. when t = 0, 209 millions miles
c. Farthest 321 million miles
Shortest 135 million miles
d. 780 days
e. Between 13 and 327 days

91) $f(x) = 60 + 27\cos\frac{\pi}{6}(x-7)$

92) $R(t) = 25 + 1.5\sin\left(\frac{2\pi}{5.4}t\right)$, where $R$ is in millions of miles and $t$ is in days.

93) a. 7,800
b. 2.09

94) a.

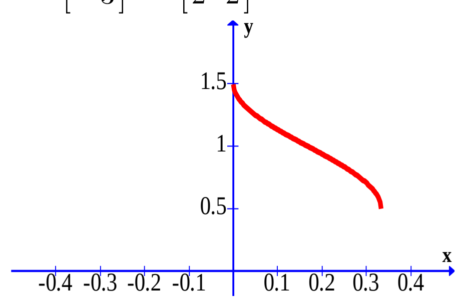



b. $y = 139 - 125\cos\frac{\pi}{5}t$ or

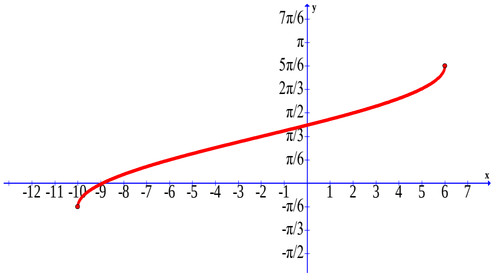
$y = 139 + 125\cos\frac{\pi}{5}(t-5)$

c. $y$ = 240.127 ft
d. $t$ = 16.689 min.

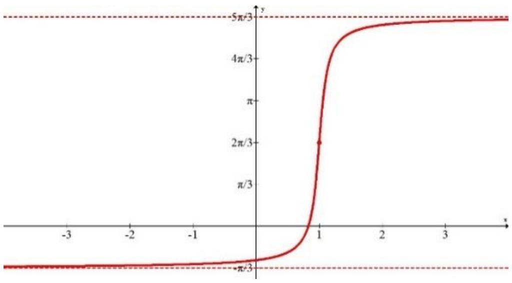
95). D: $\left[0, \frac{1}{3}\right]$ R: $\left[\frac{1}{2}, \frac{3}{2}\right]$



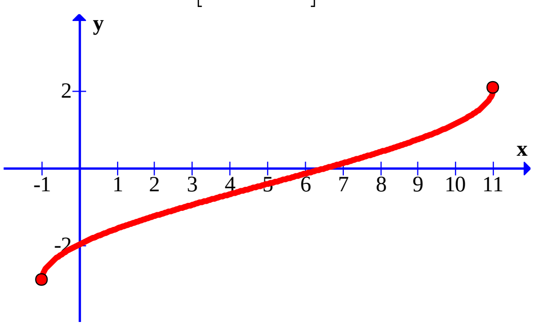
96) D: $-10, 6$ R: $\left[-\frac{\pi}{6}, \frac{5\pi}{6}\right]$




97) D: $-\infty, \infty$ R: $\left[-\frac{\pi}{3}, \frac{5\pi}{3}\right]$




98) D: $-1, 11$ R: $\left[-\frac{29}{10}, \frac{21}{10}\right]$




99) Tower Q is closer; 72.53 km from C
100) (A) 3.22 mi; (B) 2.18 mi
101) 159 mi
102) 142.68 mi
103) 2.7 ft.
104) 19.92°
105) 97.27 cm
106) 60.61°
107) 26.153 bearing 126.586
108) a. 11.496 at 88.215º
b. 22.756 at 30.328º
109) $\langle -6.928, -4 \rangle$
110) 134.536 bearing 273.013º
111) 204.07 mi
112) 1.751 mi
113) 724.966 kph
114) a. $\langle -41.721, -42.643 \rangle$
b. 59.658 bearing 224.374º
115) a. 2.59 mi
b. 2.92 mi
c. 2.53 mi
116) 176°
117) 12.504%
118) $245.66
119) $3586.85
120) 20.817
121) 4.301