ST. BRENDAN HIGH SCHOOL

Calculus Honors Summer Math Packet

Calculus Honors Name____________________________________ ID: 1

Summer Math Packet

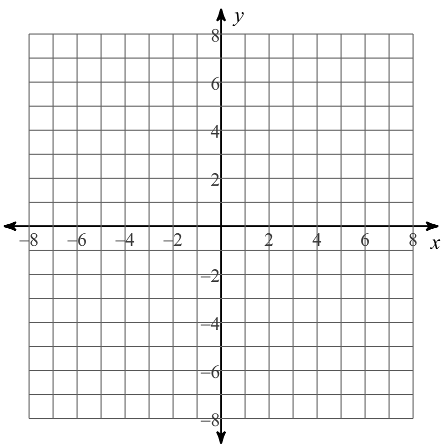
Date________________ Period____

QUADRATIC FUNCTIONS:

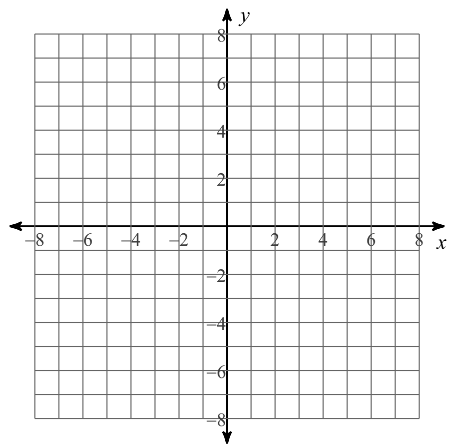
Identify the vertex, axis of symmetry, direction of opening, y-intercept, and x-intercepts of each. Then sketch the graph.

Reminder: If the equation is in vertex form the vertex (h,k) is easily identified. If the equation is in standard form, the x-coordinate of the vertex is -b/2a and the y-coordinate is found by evaluating the function using the x-coordinate of the vertex.

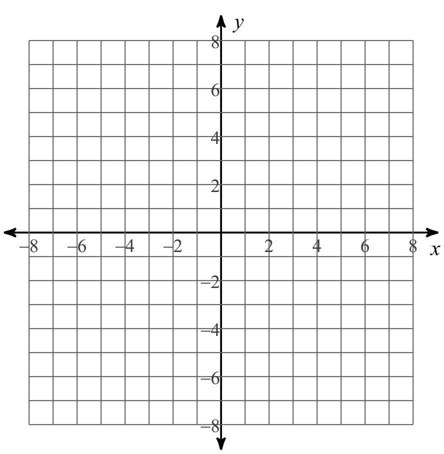
1) $y = x^2 - 8x + 19$



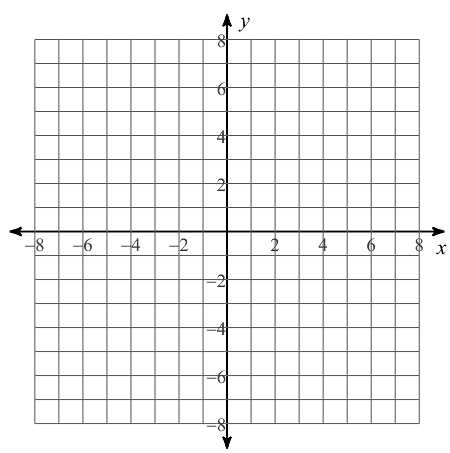
2) $y = 2x^2$



3) $y = -2(x + 5)^2 - 1$



4) $y = \frac{1}{2}(x - 3)^2 + 4$



Solve each quadratic equation.

Reminder: Quadratic equations can be solved by factoring, using the square root property, using the quadratic formula or completing the square. Leave exact solutions.

5) $x^2 - 4x + 3 = 0$

6) $x^2 - 7x + 12 = 0$

7) $x^2 + 2x + 1 = 0$

8) $x^2 - 5x + 6 = 0$

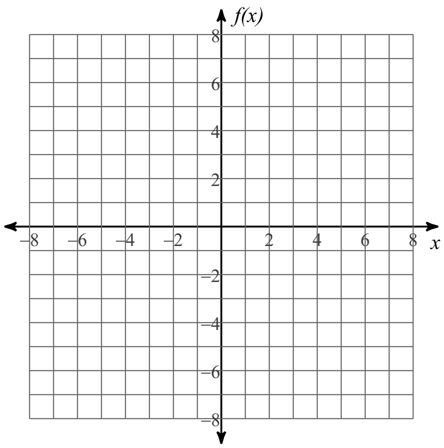
9) $x^2 - 4x + 5 = 0$

10) $x^2 + 8x - 31 = 0$

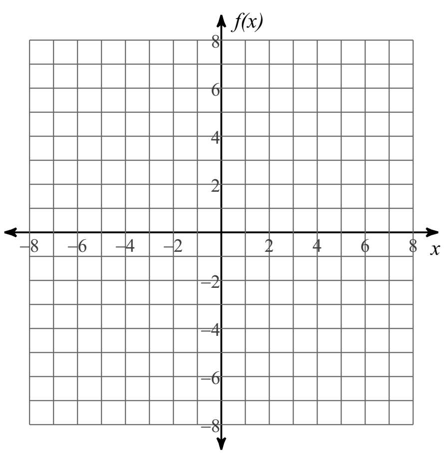
POWER FUNCTIONS

Consider each power function. Determine the power and constant of variation, domain and range, intercepts, end behavior, continuity, and regions of increase and decrease. Then sketch the graph.

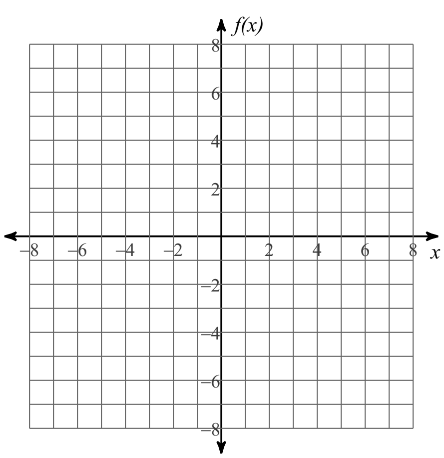
11) $f(x) = x^{\frac{1}{3}}$



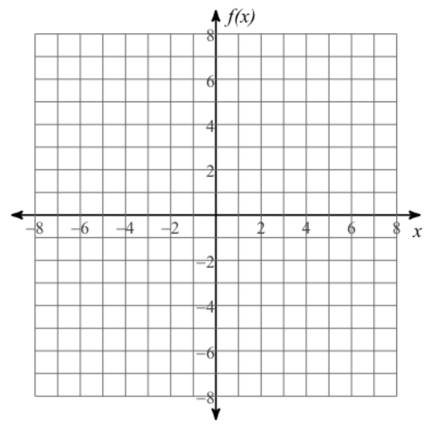
12) $f(x) = \frac{1}{2}x^{\frac{8}{7}}$



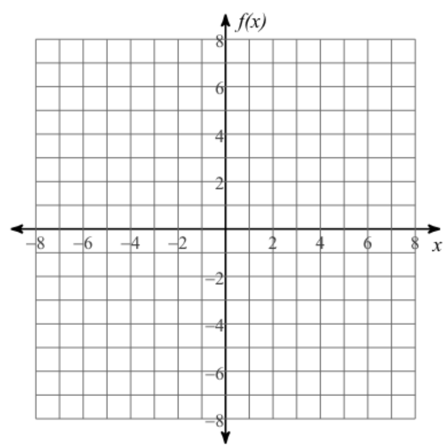
13) $f(x) = 3x^{\frac{4}{3}}$



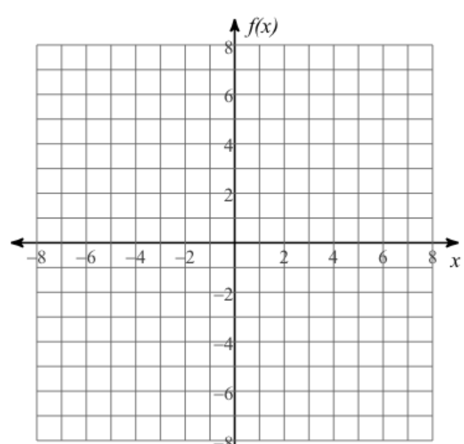
14) $f(x) = x^{\frac{1}{2}}$



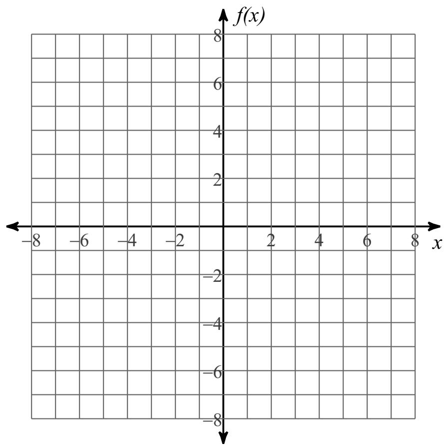
15) $f(x) = 6x^{\frac{7}{4}}$



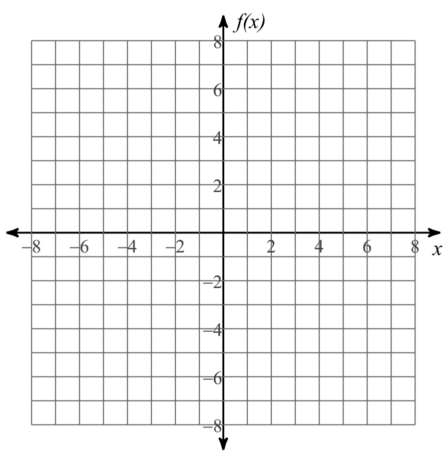
16) $f(x) = 4x^{6}$



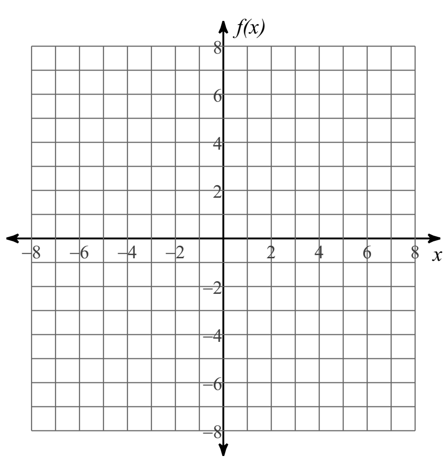
17) $f(x) = 4x^{8}$



18) $f(x) = x^{-3}$



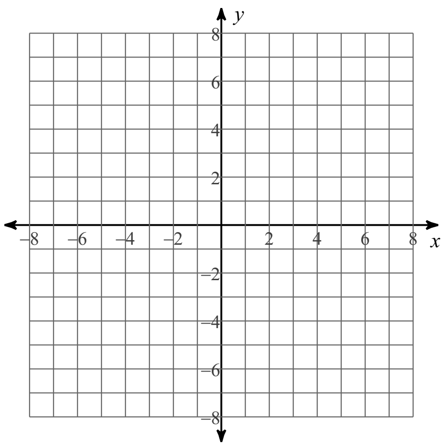
19) $f(x) = 4x^{-4}$



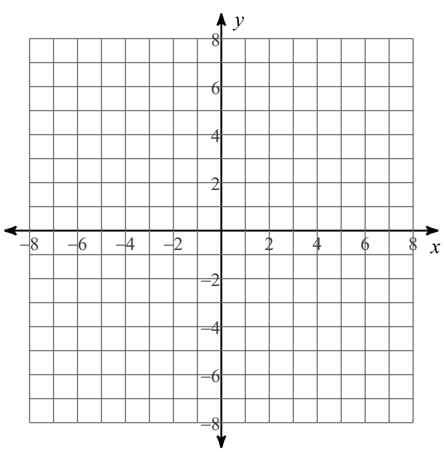
POLYNOMIAL FUNCTIONS

Reminder: To graph a function of degree three or higher you must first find the zeros of the function by factoring or if necessary by using the Rational Root Theorem and synthetic division. Identify the end behavior of the graph, multiplicity of each zero to determine whether the graph touches and turns or crosses the x-axis at the zero, find the y-intercept and then sketch the graph.

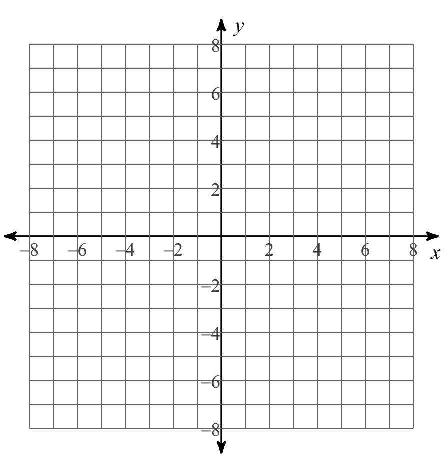
20) $f(x) = x^3 + 4x^2 + 4x$



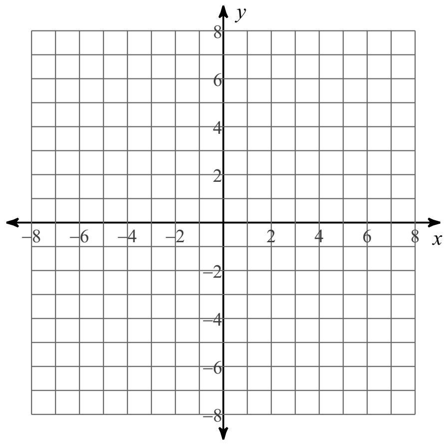
21) $f(x) = x^3 + 3x^2$



22) $f(x) = x^4 + x^3 - 2x^2$



23) $f(x) = x^3 + 6x^2 + 11x + 6$



Solve the equations by finding all roots.

Reminder: To solve equations of degree three or higher, start by attempting to factor the equation. If the equation cannot be factored then use the Rational Root Theorem and synthetic division to find one or more roots. Once you have reduced your polynomial to linear and quadratic factors, then you may use the quadratic formula to finish solving the equation.

24) $x^6 - 64 = 0$

25) $x^4 - 2x^2 - 15 = 0$

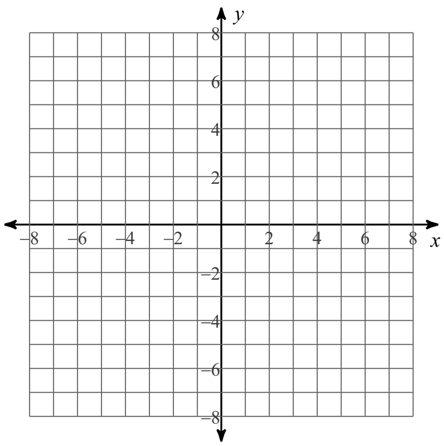
26) $x^6 - 2x^4 - 16x^2 + 32 = 0$

27) $x^3 - 7x^2 + 11x - 5 = 0$

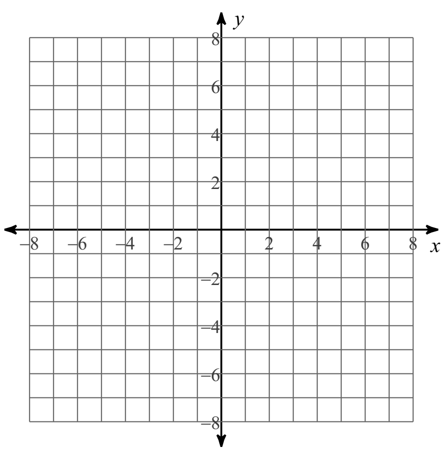
RATIONAL FUNCTIONS

Reminder: To graph rational functions identify holes, vertical, horizontal or slant asymptotes, intercepts, domain, limit behavior at all vertical asymptotes, and end behavior asymptote. Then sketch the graph.

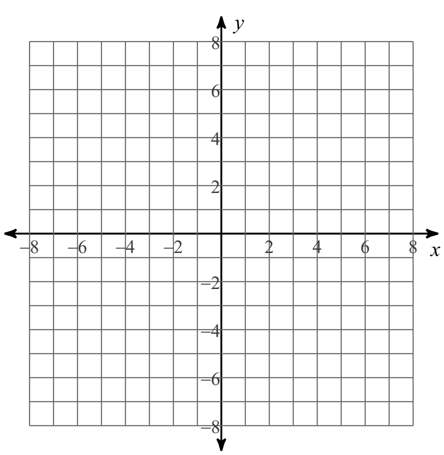
28) $f(x) = -\frac{4}{x} + 1$



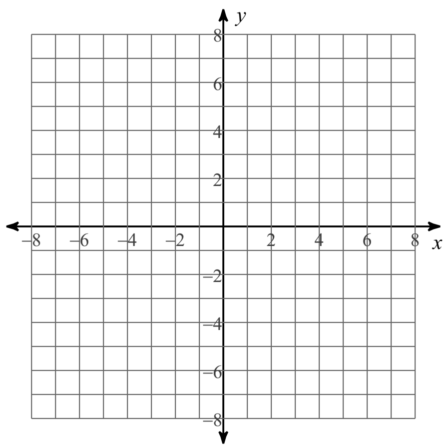
29) $f(x) = -\frac{1}{x-4} + 3$



30) $f(x) = \frac{x^2 - x - 6}{4x + 12}$



31) $f(x) = \dfrac{x^2 + 4x}{4x^2 + 28x + 48}$



Solve each equation. Remember to check for extraneous solutions.

Reminder: To solve rational equations first multiply both sides of the equation by the least common denominator. This will clear the fractions or rational expressions. To find the LCD factor the denominators.

32) $\dfrac{1}{6x} - \dfrac{1}{6x^2} = \dfrac{1}{2x^2}$

33) $\dfrac{5}{b^2 - 4b} = \dfrac{1}{b^2 - 4b} + \dfrac{1}{b}$

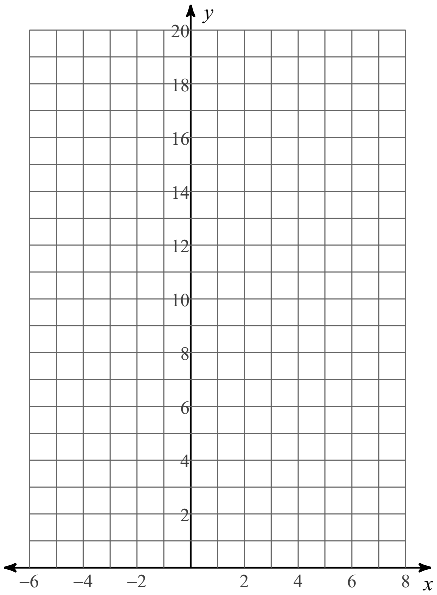
34) $\dfrac{1}{2r^2} = \dfrac{r^2 + r - 12}{4r^3} + \dfrac{r + 3}{2r^2}$

35) $\dfrac{x + 5}{5x} = \dfrac{x^2 + 6x + 5}{5x} - 6$

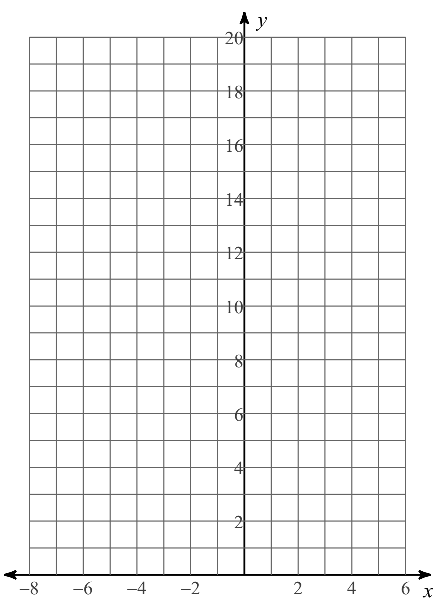
EXPONENTIAL FUNCTIONS

To graph exponential functions, identify any transformations, graph horizontal asymptote, mark your starting position, plot three points (x = -1, x=0, and x=1 from your starting position). Then sketch the graph.

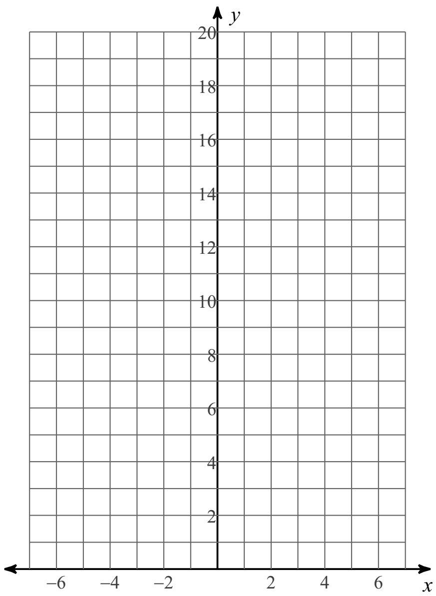
36) $y = 3^{x-1} + 2$



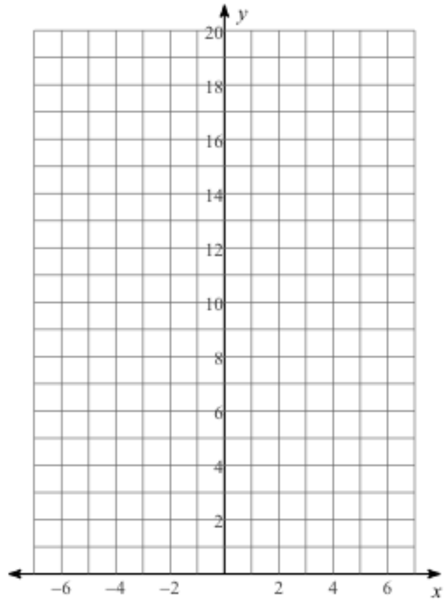
37) $y = \left(\frac{1}{2}\right)^{x+1} + 2$



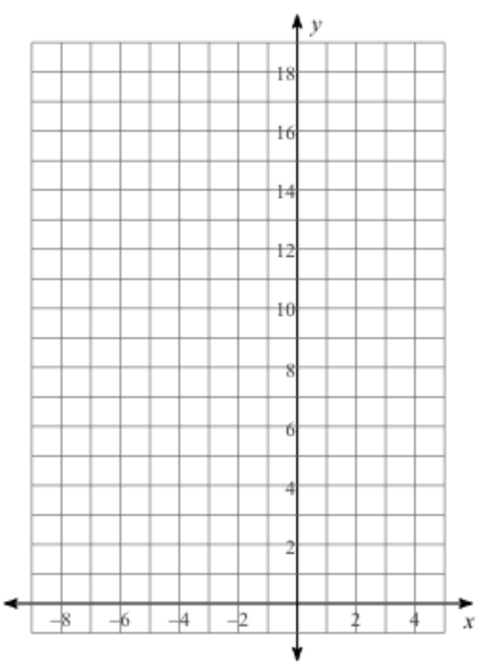
38) $y = e^{x}$



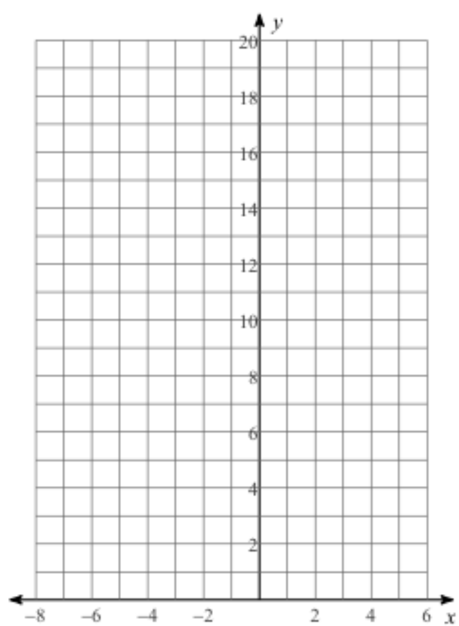
39) $y = \left(\frac{1}{e}\right)^{x}$



40) $y = e^{x + 2} - 1$



41) $y = \left(\frac{1}{e}\right)^{x + 1} + 2$



Solve each exponential equation.

Reminder: To solve an exponential equation you must first isolate the exponential term on one side of the equation. If both sides of the equation can be converted to a term with the same base, then the equation can be solved by simply equating the exponents once the terms have the same base. If this is not possible, then you must solve by using logarithms.

42) $6^{2n} = \frac{1}{36}$

43) $64^{3x+2} = 16^{2-2x}$

44) $e^{x+10} = 67$

45) $10^{x+6} - 9 = 4$

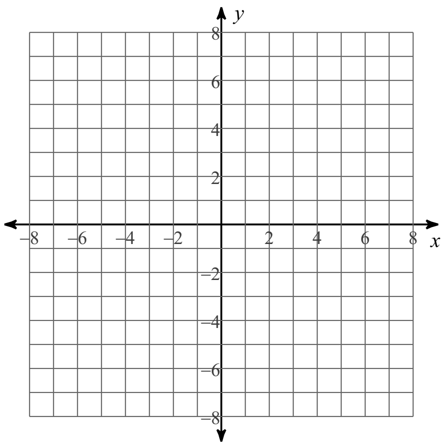
46) $5^{x+2} = 90$

47) $8^{n+3} = 79$

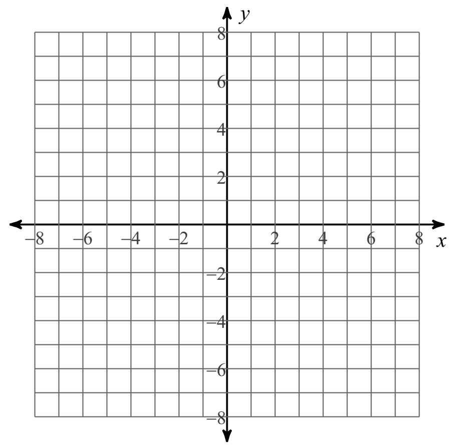
LOGARITHMIC FUNCTIONS

Reminder: To graph logarithmic functions, isolate the log, change the equation to exponential if this helps you, identify transformations, mark starting position, at least two points, the vertical asymptote and sketch the graph.

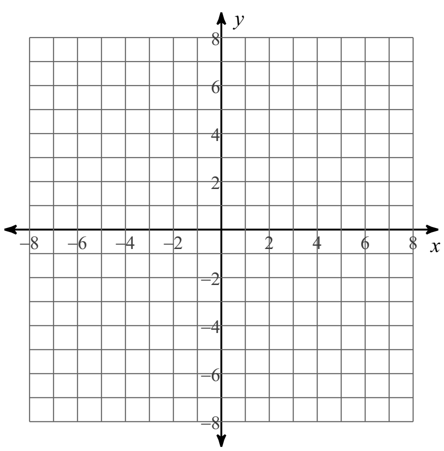
48) $y = \log_4 (x - 1) + 4$



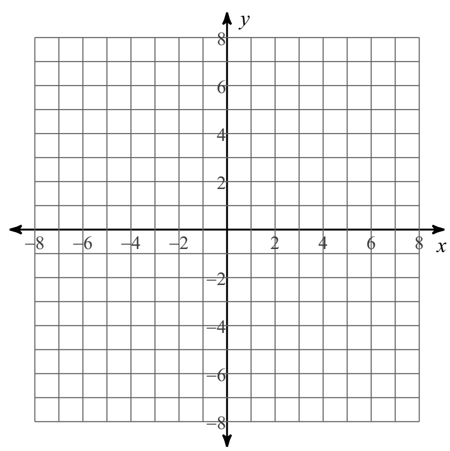
49) $y = \log_{\frac{1}{4}} (x - 2) + 5$



50) $y = \log (x - 1) - 4$



51) $y = \ln (x - 1) - 5$



Evaluate each expression without the use of a calculator.

52) $\log_7 \frac{1}{49}$

53) $\log_4 64$

54) $\log_{36} 6$

55) $\log_2 \frac{1}{32}$

56) $\log_{81} 3$

57) $\log_7 1$

Expand each logarithm.

58) $\log_6 \sqrt[3]{x \cdot y \cdot z}$

59) $\log_9 \left(x^2 y^3\right)$

Condense each expression to a single logarithm.

60) $2\log_5 u - 6\log_5 v$

61) $\log_3 x + \log_3 y + 2\log_3 z$

Use the properties of logarithms and the values below to find the logarithm indicated. Do not use a calculator to evaluate the logs.

62) $\log_7 6 \approx 0.9$
$\log_7 5 \approx 0.8$
$\log_7 4 \approx 0.7$
Find $\log_7 28$

63) $\log_4 9 \approx 1.6$
$\log_4 6 \approx 1.3$
$\log_4 10 \approx 1.7$
Find $\log_4 \frac{1}{6}$

64) $\log_4 10 \approx 1.7$
$\log_4 6 \approx 1.3$
$\log_4 9 \approx 1.6$
Find $\log_4 \frac{2}{3}$

65) $\log_4 7 \approx 1.4$
$\log_4 10 \approx 1.7$
$\log_4 6 \approx 1.3$
Find $\log_4 \frac{7}{4}$

66) $\log_5 6 \approx 1.1$
$\log_5 4 \approx 0.9$
$\log_5 9 \approx 1.4$
Find $\log_5 \frac{1}{36}$

Solve each logarithmic equation. Give exact solution.

Reminder: If both sides of an equation contain one logarithmic term with the same base then the equation can be solved by setting the terms inside of the parenthesis equal to each other. If this is not the case, then use the properties of logarithms to condense the logarithms on one side of the equation. Convert the equation to exponential form and solve.

67) $\log 3b = \log (2b + 6)$

68) $\log_9 (x - 5) - \log_9 x = \log_9 38$

69) $\log_9 4 - \log_9 (x + 1) = 2$

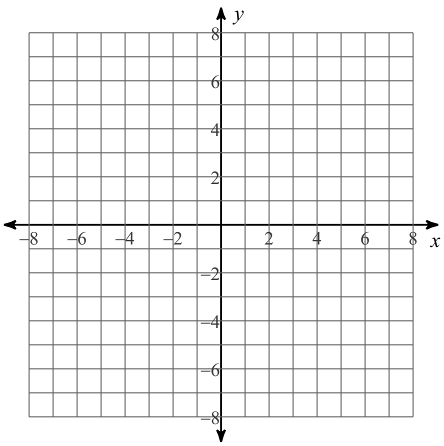
70) $\log (x^2 - 2) + \log 4 = \log 8$

71) $\ln 9 - \ln 3x = 1$

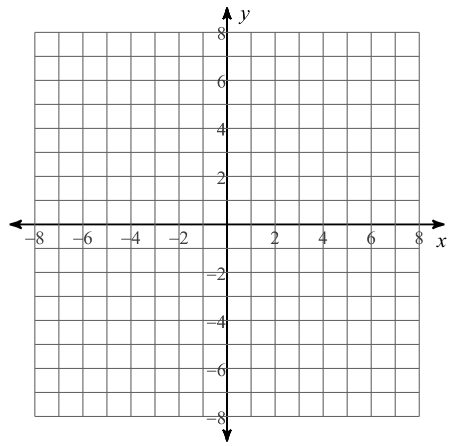
72) $\ln 4 + \ln 4x^2 = 4$

Sketch the graph of each function.

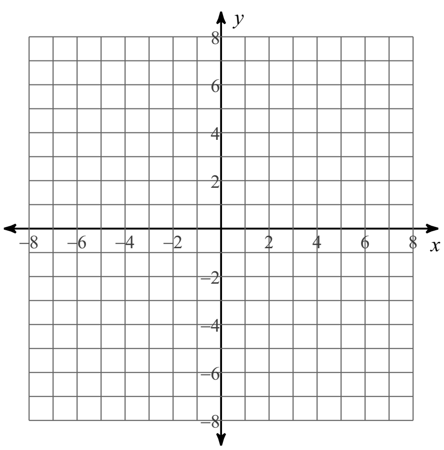
73) $f(x) = \begin{cases} \sqrt{-2x}, & x \le -4 \\ -6, & -4 < x \le 2 \\ -2x + 4, & x > 2 \end{cases}$



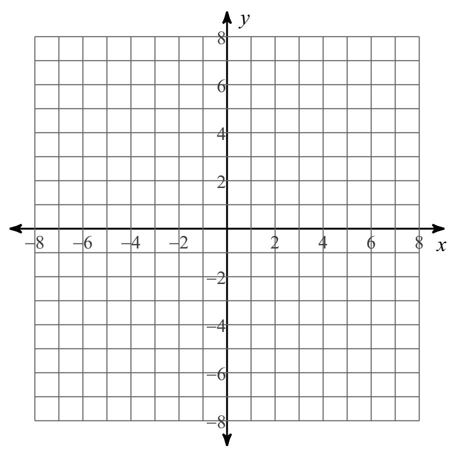
74) $g(x) = \begin{cases} 4 - x^2, & x < 1 \\ (x - 1)^2, & x \ge 1 \end{cases}$



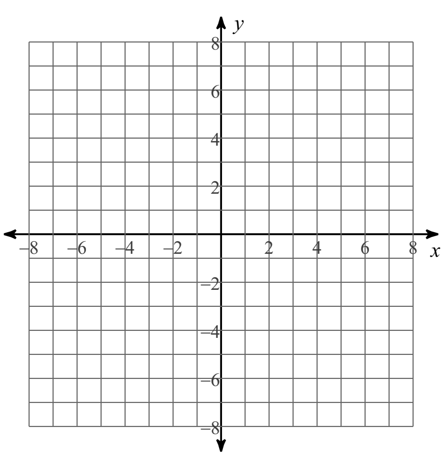
75) $f(x) = \begin{cases} -2^x, & x \ne 0 \\ 4 - x^2, & x = 0 \end{cases}$



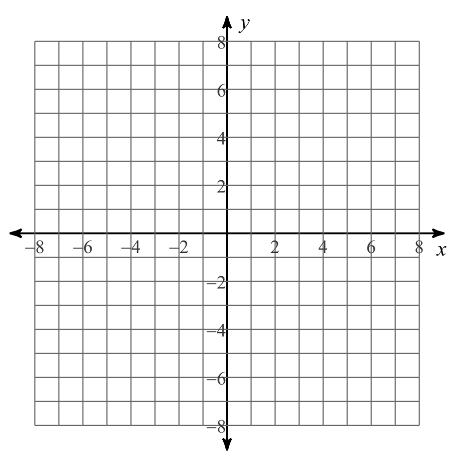
76) $w(x) = \begin{cases} 5, & x \ne -4 \\ \dfrac{1}{x} - 4, & x = -4 \end{cases}$



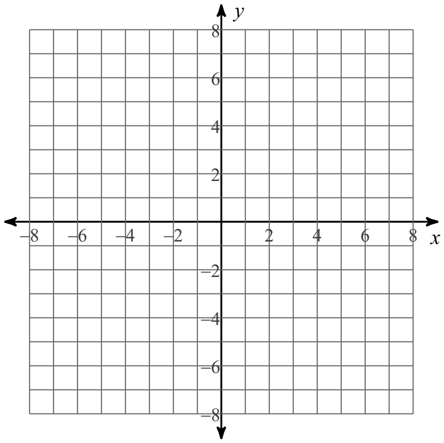
77) $f(x) = \begin{cases} (x + 5)^2, & x < -4 \\ -|x|, & -4 \le x \le 3 \\ 5, & x > 3 \end{cases}$



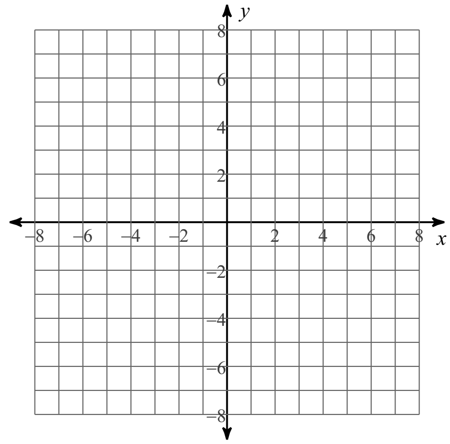
78) $w(x) = \begin{cases} 6, & x < -3 \\ -3, & x = -1 \\ -x + 3, & x > 1 \end{cases}$



79) $f(x) = \begin{cases} |x| - 2, & x \leq -1 \\ \sqrt{3x}, & x > -1 \end{cases}$

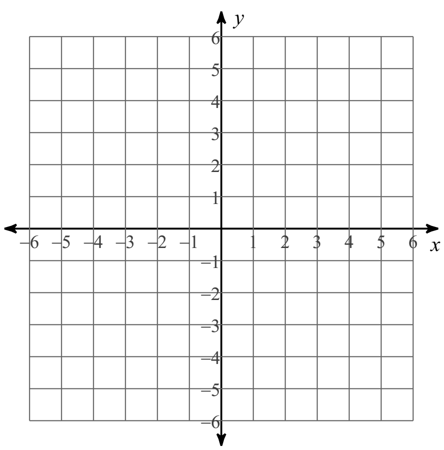


80) $g(x) = \begin{cases} |x|, & x < 1 \\ |x + 3|, & x > 1 \end{cases}$

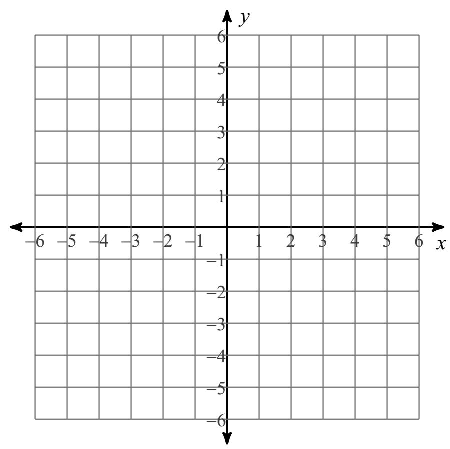


Find the inverse of each function. Then graph the function and its inverse.

81) $f(x) = \sqrt[3]{x} - 2$



82) $g(x) = x - 2$



Find the inverse of each function.

83) $g(x) = -\frac{3}{x + 1} - 1$

84) $f(x) = \sqrt[5]{x + 1} - 2$

Perform the indicated operation.

85) $g(x) = 2x + 1$
$f(x) = x^3 + 5x^2$
Find $g(x) \cdot f(x)$

86) $f(n) = 2n + 4$
$g(n) = n^2 + 4n$
Find $(f - g)(n)$

87) $g(a) = -3a^3 - 2a^2$
$f(a) = -a + 2$
Find $(g \circ f)(-1)$

88) $h(n) = -n + 1$
Find $(h \circ h)(n)$

89) $g(t) = 4t - 4$
$h(t) = -4t - 2$
Find $(g \circ h)(t)$

90) $f(t) = 3t - 1$
$g(t) = 2t + 4$
Find $(f \circ g)(t)$

Find f and g so that $h(x) = (f \circ g)(x)$. Neither function may be the identity function $f(x) = x$.

91) $h(x) = \left(\sqrt{x} + 3\right)^3$

92) $h(x) = \dfrac{2}{2x + 5} - 2$

Expand completely using the Binomial Theorem and/or Pascal's Triangle.

93) $(3y - 1)^4$

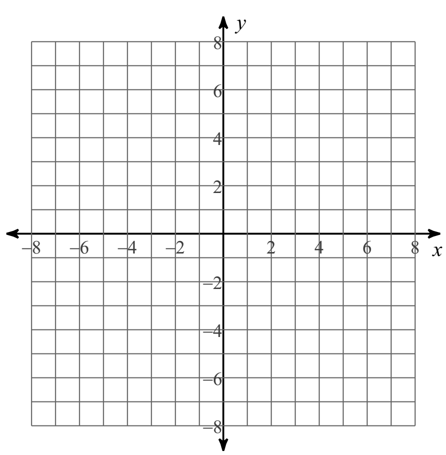
Divide one problem using long division and the other with synthetic division. Write your answer in fraction form.

94) $(6x^4 + 29x^3 - 9x^2 - 22x - 5) \div (x + 5)$

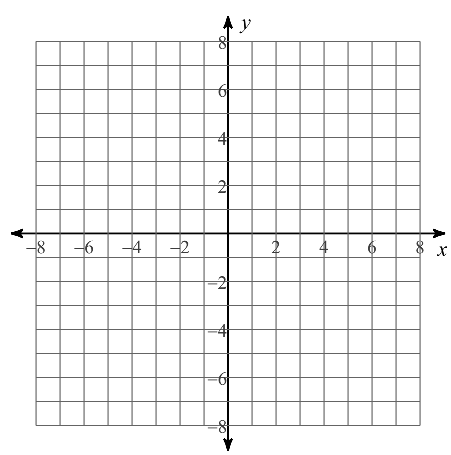
95) $(9x^4 + 21x^3 - 10x^2 + 21x) \div (x + 3)$

Identify the center and radius of each. Then sketch the graph.

96) $x^2 + (y - 4)^2 = 4$



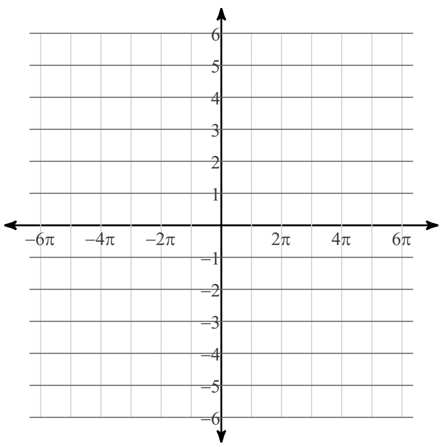
97) $(x - 2)^2 + (y + 4)^2 = 6$



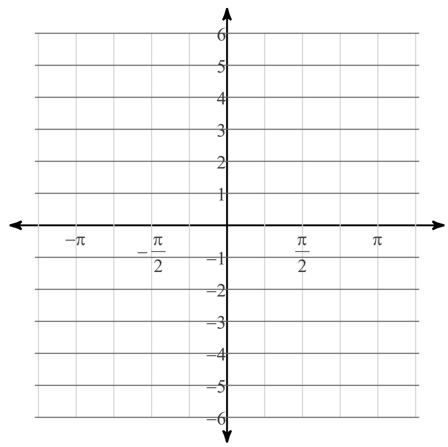
TRIGONOMETRIC FUNCTIONS

Find the amplitude, the period in radians, the phase shift in radians, the vertical shift, and the minimum and maximum values. Then sketch the graph using radians. Graph two cycles. Show all work.

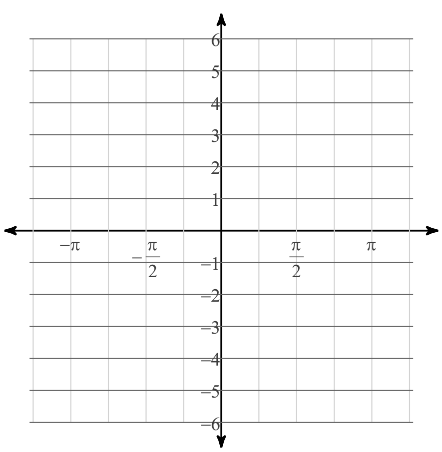
98) $y = 4\sin\dfrac{\theta}{4}$



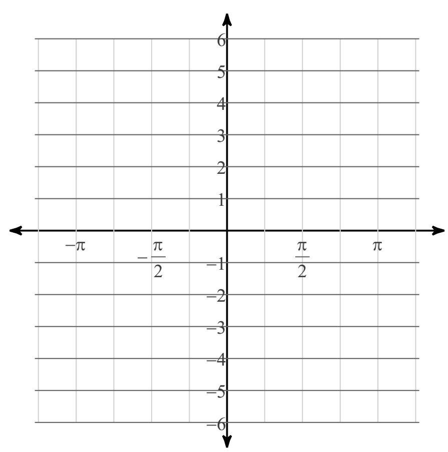
99) $y = 3\cos\left(2\theta + \dfrac{3\pi}{4}\right) - 2$



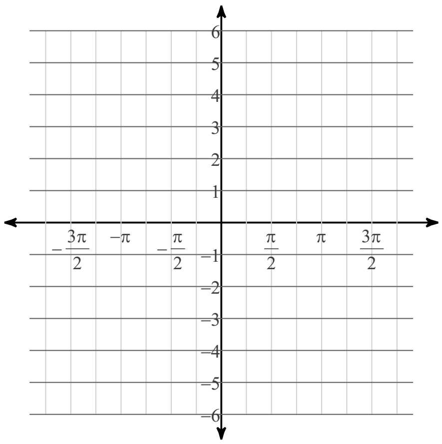
100) $y = \cot\theta$



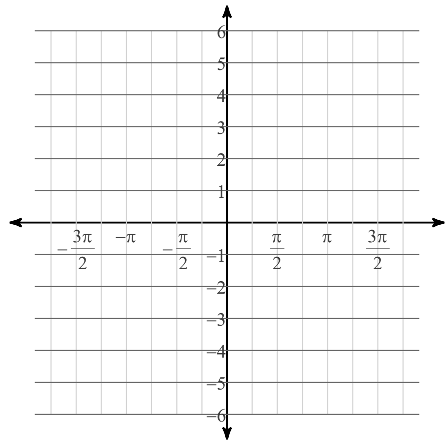
101) $y = \tan\theta$



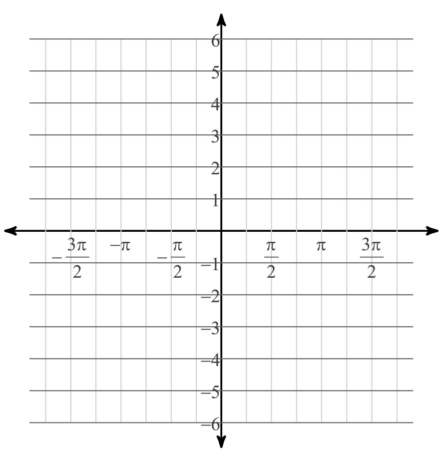
102) $y = \cot\left(\frac{\theta}{2} + \frac{3\pi}{4}\right)$



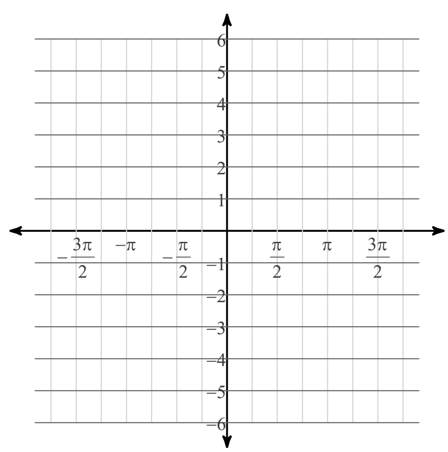
103) $y = \tan\left(\frac{\theta}{2} + \frac{\pi}{6}\right)$



104) $y = \csc\,\theta - 1$



105) $y = \sec\,\theta + 2$



Find the exact value of each trigonometric function without a calculator.

106) $\cos \frac{23\pi}{4}$

107) $\sin -\frac{21\pi}{4}$

108) $\csc \frac{23\pi}{6}$

109) $\cot -\pi$

110) $\tan -2\pi$

111) $\sec \frac{7\pi}{6}$

112) $\csc -\frac{7\pi}{3}$

113) $\cos 0$

114) $\cot \frac{2\pi}{3}$

115) $\sec -\frac{5\pi}{4}$

116) $\sin \frac{17\pi}{6}$

117) $\sec \frac{3\pi}{2}$

Find the exact value of each expression. Review restricted domain for inverse sine, tangent and cosine.

118) $\cos^{-1}\left(\frac{\sqrt{2}}{2}\right)$

119) $\sin^{-1}\left(\frac{1}{2}\right)$

120) $\tan^{-1}\left(\sqrt{3}\right)$

121) $\tan^{-1}(1)$

122) $\sin^{-1}(-1)$

123) $\cos^{-1}\left(-\frac{1}{2}\right)$

124) $\sin^{-1}\left(\csc -\frac{\pi}{2}\right)$

125) $\cos^{-1}\left(\cot \frac{3\pi}{4}\right)$

126) $\sin^{-1}\left(\cos \frac{3\pi}{4}\right)$

127) $\tan^{-1}(\cos \pi)$

Solve each equation for $0 \le \theta < 2\pi$.

128) $\cot \theta = \frac{\sqrt{3}}{3}$

129) $\cos \theta = -\frac{\sqrt{3}}{2}$

130) $12\csc \theta = -8\sqrt{3}$

131) $4 = 3 + \tan \theta$

132) $\tan \theta \sin \theta - \sin \theta = -\tan \theta - \sin \theta$

133) $\sqrt{3}\cot \theta - \cot^2 \theta = 0$

134) $\cos^2 \theta + 1 = 3\cos \theta - \cos^2 \theta$

135) $-3\sin \theta - 1 = 2\sin^2 \theta$

136) $\tan^2\theta - 1 + 2\tan\theta = -2$

137) $3\cos^2\theta + 1 = 2\cos\theta + 2\cos^2\theta$

Solve each equation for $0 \le \theta < 2\pi$. Hint: Use a Pythagorean Identity to solve.

138) $\sin^2\theta - 2 + 3\cos\theta = \cos^2\theta$

139) $\sec^2\theta = -2\tan\theta$

Solve each equation for $0 \le \theta < 2\pi$. Hint: Use Double Angle Identities.

140) $6\sin^2\theta = -\cos 2\theta + 3$

141) $-\sqrt{2}\sin\theta + \sin 2\theta = 0$

Use the Sum and Difference Identities to find the exact value of each.

142) $\sin \frac{7\pi}{12}$

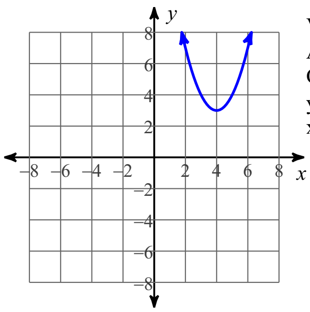
143) $\cos \frac{\pi}{12}$

144) $\cos \frac{13\pi}{9} \cos \frac{4\pi}{9} + \sin \frac{13\pi}{9} \sin \frac{4\pi}{9}$

145) $\dfrac{\tan \frac{\pi}{18} + \tan \frac{5\pi}{18}}{1 - \tan \frac{\pi}{18} \tan \frac{5\pi}{18}}$

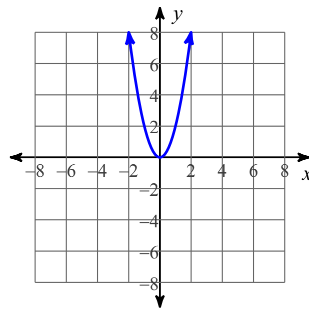
Answers to Summer Math Packet (ID: 1)

1)



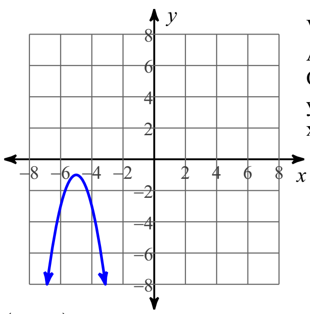
Vertex: $(4, 3)$
Axis of Sym.: $x = 4$
Opens: Up
y-int: 19
x-int: None

2)



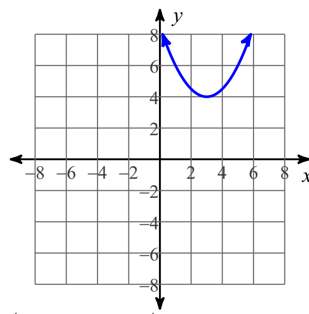
Vertex: $(0, 0)$
Axis of Sym.: $x = 0$
Opens: Up
y-int: 0
x-int: 0

3)



Vertex: $(-5, -1)$
Axis of Sym.: $x = -5$
Opens: Down
y-int: -51
x-int: None

4)



Vertex: $(3, 4)$
Axis of Sym.: $x = 3$
Opens: Up
y-int: $\frac{17}{2}$
x-int: None

5) $\{3, 1\}$

6) $\{4, 3\}$

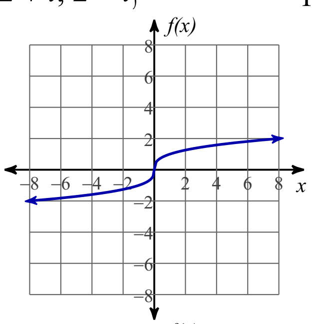
7) $\{-1 \text{ mult. } 2\}$

8) $\{3, 2\}$

9) $\{2 + i, 2 - i\}$

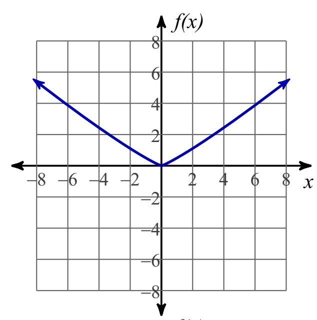
10) $\{-4 + \sqrt{47}, -4 - \sqrt{47}\}$

11)



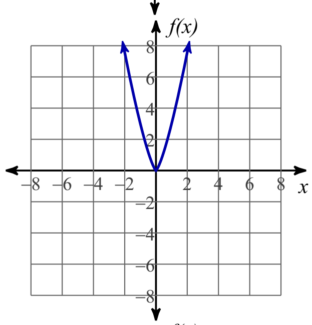
Power: $\frac{1}{3}$ Constant: 1
Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$
x-intercept: 0 y-intercept: 0
$\lim_{x\to-\infty} f(x) = -\infty$ $\lim_{x\to\infty} f(x) = \infty$
Continuous on $(-\infty, \infty)$
Increasing: $(-\infty, \infty)$

12)



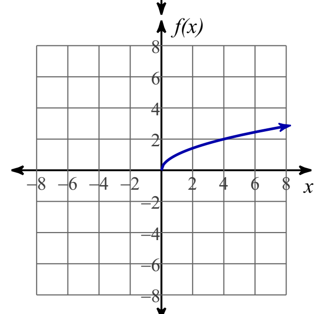
Power: $\frac{8}{7}$ Constant: $\frac{1}{2}$
Domain: $(-\infty, \infty)$
Range: $[0, \infty)$
x-intercept: 0 y-intercept: 0
$\lim_{x\to-\infty} f(x) = \infty$ $\lim_{x\to\infty} f(x) = \infty$
Continuous on $(-\infty, \infty)$
Increasing: $(0, \infty)$
Decreasing: $(-\infty, 0)$

13)



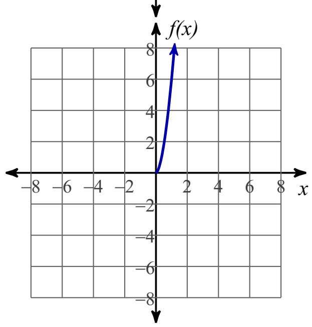
Power: $\frac{4}{3}$ Constant: 3
Domain: $(-\infty, \infty)$
Range: $[0, \infty)$
x-intercept: 0 y-intercept: 0
$\lim_{x\to-\infty} f(x) = \infty$ $\lim_{x\to\infty} f(x) = \infty$
Continuous on $(-\infty, \infty)$
Increasing: $(0, \infty)$
Decreasing: $(-\infty, 0)$

14)



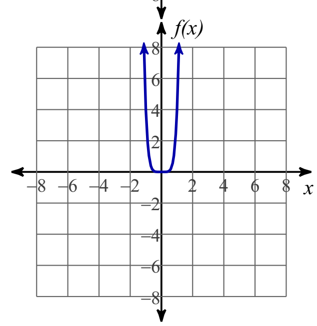
Power: $\frac{1}{2}$ Constant: 1
Domain: $[0, \infty)$
Range: $[0, \infty)$
x-intercept: 0 y-intercept: 0
$\lim_{x\to\infty} f(x) = \infty$
Continuous on $[0, \infty)$
Increasing: $(0, \infty)$

15)



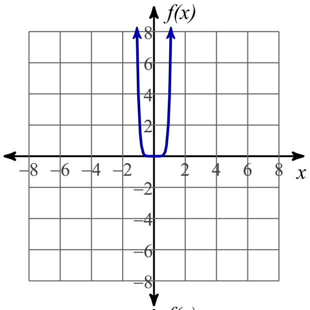
Power: $\frac{7}{4}$ Constant: 6
Domain: $[0, \infty)$
Range: $[0, \infty)$
x-intercept: 0 y-intercept: 0
$\lim_{x\to\infty} f(x) = \infty$
Continuous on $[0, \infty)$
Increasing: $(0, \infty)$

16)



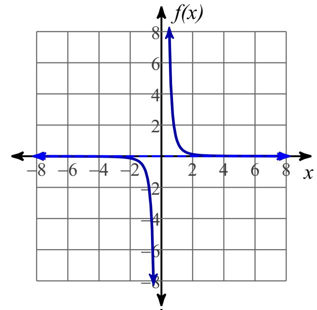
Power: 6 Constant: 4
Domain: $(-\infty, \infty)$
Range: $[0, \infty)$
x-intercept: 0 y-intercept: 0
$\lim_{x\to-\infty} f(x) = \infty$ $\lim_{x\to\infty} f(x) = \infty$
Continuous on $(-\infty, \infty)$
Increasing: $(0, \infty)$
Decreasing: $(-\infty, 0)$

17)



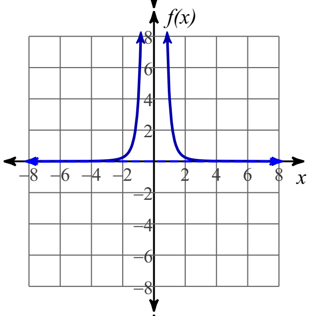
Power: 8 Constant: 4
Domain: $(-\infty, \infty)$
Range: $[0, \infty)$
x-intercept: 0 y-intercept: 0
$\lim_{x\to-\infty} f(x) = \infty$ $\lim_{x\to\infty} f(x) = \infty$
Continuous on $(-\infty, \infty)$
Increasing: $(0, \infty)$
Decreasing: $(-\infty, 0)$

18)



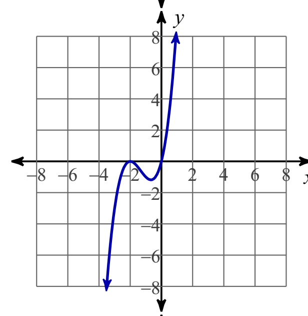
Power: -3 Constant: 1
Domain: $(-\infty, 0) \cup (0, \infty)$
Range: $(-\infty, 0) \cup (0, \infty)$
No intercepts
$\lim_{x\to-\infty} f(x) = 0$ $\lim_{x\to\infty} f(x) = 0$
Infinite discontinuity at $x = 0$
Decreasing: $(-\infty, 0)$, $(0, \infty)$

19)



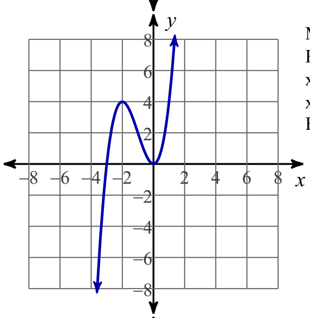
Power: -4 Constant: 4
Domain: $(-\infty, 0) \cup (0, \infty)$
Range: $(0, \infty)$
No intercepts
$\lim_{x\to-\infty} f(x) = 0$ $\lim_{x\to\infty} f(x) = 0$
Infinite discontinuity at $x = 0$
Increasing: $(-\infty, 0)$
Decreasing: $(0, \infty)$

20)



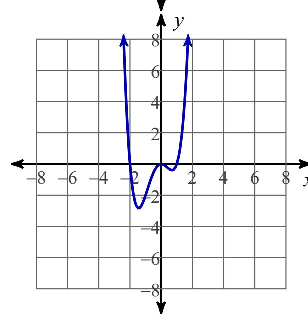
Max # turns: 2
Real zeros: $\{0, -2 \text{ mult. } 2\}$
x-int, crosses: 0
x-int, doesn't cross: -2
End behavior:
$\lim_{x\to-\infty} f(x) = -\infty$
$\lim_{x\to\infty} f(x) = \infty$

21)



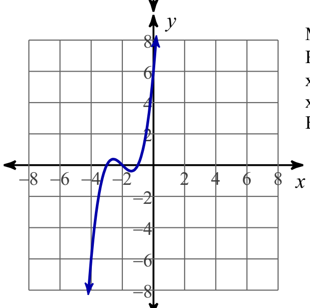
Max # turns: 2
Real zeros: $\{0 \text{ mult. } 2, -3\}$
x-int, crosses: -3
x-int, doesn't cross: 0
End behavior:
$\lim_{x\to-\infty} f(x) = -\infty$
$\lim_{x\to\infty} f(x) = \infty$

22)



Max # turns: 3
Real zeros: $\{0 \text{ mult. } 2, 1, -2\}$
x-int, crosses: 1, -2
x-int, doesn't cross: 0
End behavior:
$\lim_{x\to-\infty} f(x) = \infty$
$\lim_{x\to\infty} f(x) = \infty$

23)



Max # turns: 2
Real zeros: $\{-3, -2, -1\}$
x-int, crosses: $-3, -2, -1$
x-int, doesn't cross: None
End behavior:
$\lim_{x\to-\infty} f(x) = -\infty$
$\lim_{x\to\infty} f(x) = \infty$

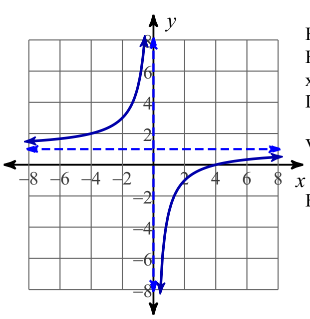
24) $\{2, -1 + i\sqrt{3}, -1 - i\sqrt{3}, -2, 1 + i\sqrt{3}, 1 - i\sqrt{3}\}$

25) $\{\sqrt{5}, -\sqrt{5}, i\sqrt{3}, -i\sqrt{3}\}$

26) $\{\sqrt{2}, -\sqrt{2}, 2, -2, 2i, -2i\}$

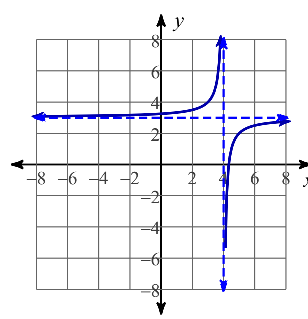
27) $\{5, 1 \text{ mult. } 2\}$

28)



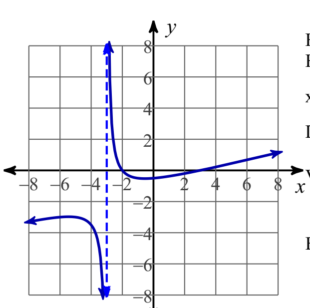
Holes: None
Horz. Asym.: $y = 1$
x-intercepts: 4, y-intercept: None
Domain:
All reals except 0
Vert. Asym. behavior:
$\lim_{x\to0^-} f(x) = \infty$, $\lim_{x\to0^+} f(x) = -\infty$
End behavior asym.: $y = 1$

29)



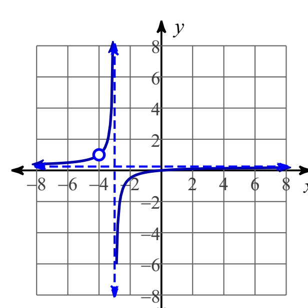
Holes: None
Horz. Asym.: $y = 3$
x-intercepts: $\frac{13}{3}$, y-intercept: $\frac{13}{4}$
Domain:
All reals except 4
Vert. Asym. behavior:
$\lim_{x\to4^-} f(x) = \infty$, $\lim_{x\to4^+} f(x) = -\infty$
End behavior asym.: $y = 3$

30)



Holes: None
Horz. Asym.: None
x-intercepts: 3, -2, y-intercept: $-\frac{1}{2}$
Domain:
All reals except -3
Vert. Asym. behavior:
$\lim_{x\to-3^-} f(x) = -\infty$, $\lim_{x\to-3^+} f(x) = \infty$
End behavior asym.: $y = -1 + \frac{x}{4}$

31)



Holes: $x = -4$
Horz. Asym.: $y = \frac{1}{4}$
x-intercepts: 0, y-intercept: 0
Domain:
All reals except $-4, -3$
Vert. Asym. behavior:
$\lim_{x\to-3^-} f(x) = \infty$, $\lim_{x\to-3^+} f(x) = -\infty$
End behavior asym.: $y = \frac{1}{4}$

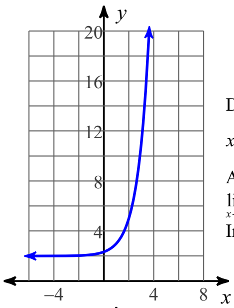
32) $\{4\}$

33) $\{8\}$

34) $\left\{\frac{4}{3}, -3\right\}$

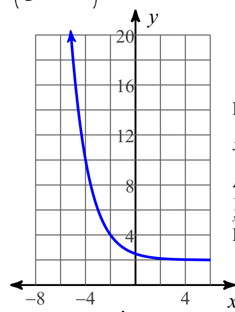
35) $\{25\}$

36)



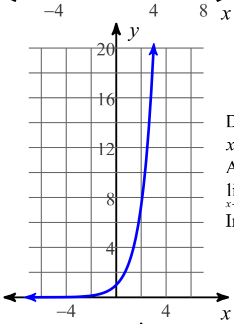
Domain: $(-\infty, \infty)$ Range: $(2, \infty)$
x-intercept: none y-intercept: $\frac{7}{3}$
Asymptote: $y = 2$
$\lim_{x \to \infty} y = \infty$ $\lim_{x \to -\infty} y = 2$
Increasing on: $(-\infty, \infty)$

37)



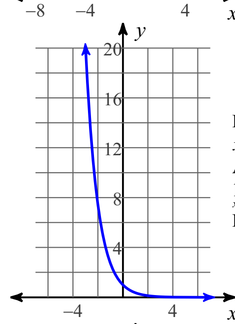
Domain: $(-\infty, \infty)$ Range: $(2, \infty)$
x-intercept: none y-intercept: $\frac{5}{2}$
Asymptote: $y = 2$
$\lim_{x \to \infty} y = 2$ $\lim_{x \to -\infty} y = \infty$
Decreasing on: $(-\infty, \infty)$

38)



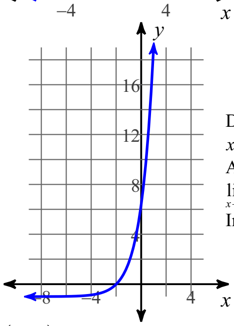
Domain: $(-\infty, \infty)$ Range: $(0, \infty)$
x-intercept: none y-intercept: 1
Asymptote: $y = 0$
$\lim_{x \to \infty} y = \infty$ $\lim_{x \to -\infty} y = 0$
Increasing on: $(-\infty, \infty)$

39)



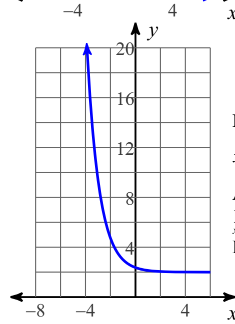
Domain: $(-\infty, \infty)$ Range: $(0, \infty)$
x-intercept: none y-intercept: 1
Asymptote: $y = 0$
$\lim_{x \to \infty} y = 0$ $\lim_{x \to -\infty} y = \infty$
Decreasing on: $(-\infty, \infty)$

40)



Domain: $(-\infty, \infty)$ Range: $(-1, \infty)$
x-intercept: -2 y-intercept: $e^2 - 1$
Asymptote: $y = -1$
$\lim_{x \to \infty} y = \infty$ $\lim_{x \to -\infty} y = -1$
Increasing on: $(-\infty, \infty)$

41)



Domain: $(-\infty, \infty)$ Range: $(2, \infty)$
x-intercept: none y-intercept: $2 + \frac{1}{e}$
Asymptote: $y = 2$
$\lim_{x \to \infty} y = 2$ $\lim_{x \to -\infty} y = \infty$
Decreasing on: $(-\infty, \infty)$

42) $\{-1\}$

43) $\left\{-\frac{2}{13}\right\}$

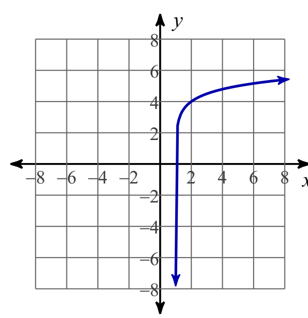
44) $\ln 67 - 10$

45) $\log 13 - 6$

46) $\log_5 90 - 2$

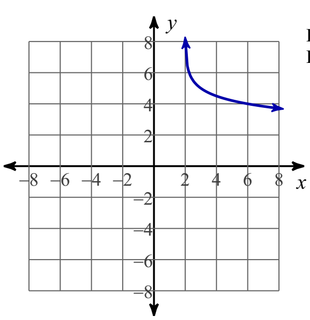
47) $\log_8 79 - 3$

48)



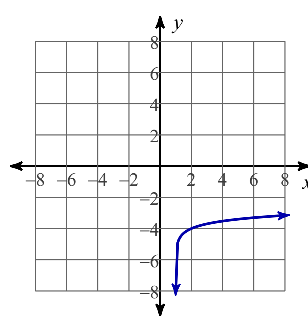
Domain: $x > 1$
Range: All reals

49)



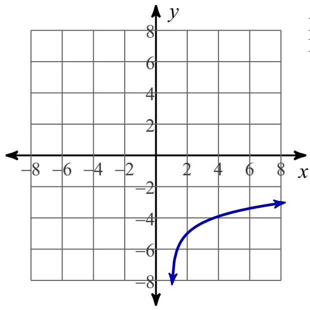
Domain: $x > 2$
Range: All reals

50)



Domain: $x > 1$
Range: All reals

51)



Domain: $x > 1$
Range: All reals

52) -2

53) 3

54) $\frac{1}{2}$

55) -5

56) $\frac{1}{4}$

57) 0

58) $\frac{\log_6 x}{3} + \frac{\log_6 y}{3} + \frac{\log_6 z}{3}$

59) $2\log_9 x + 3\log_9 y$

60) $\log_5 \frac{u^2}{v^6}$

61) $\log_3 \left(yxz^2\right)$

62) 1.7

63) -1.3

64) -0.3

65) 0.4

66) -2.2

67) $\{6\}$

68) No solution.

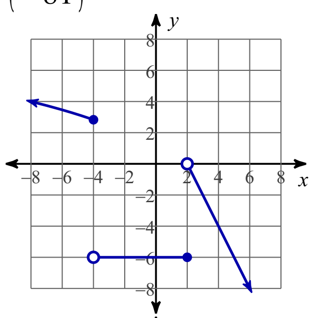
69) $\left\{-\frac{77}{81}\right\}$

70) $\{2, -2\}$

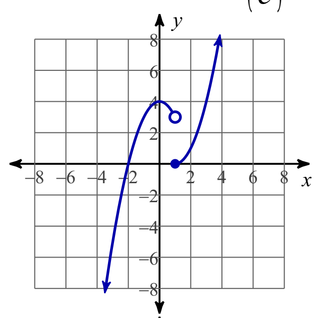
71) $\left\{\frac{3}{e}\right\}$

72) $\left\{\frac{e^2}{4}, -\frac{e^2}{4}\right\}$

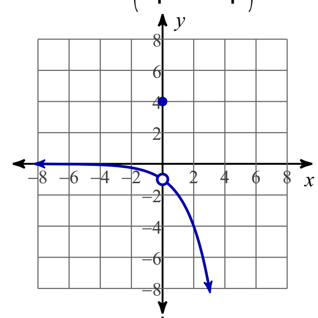
73)



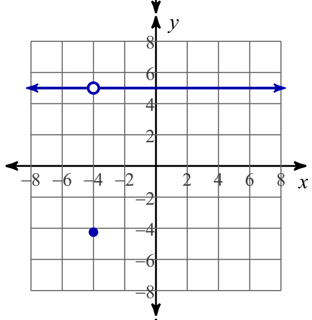
74)



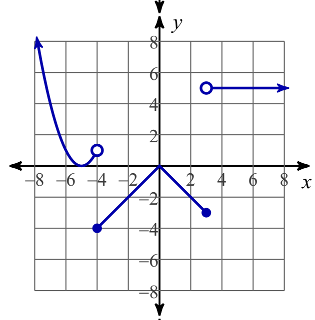
75)



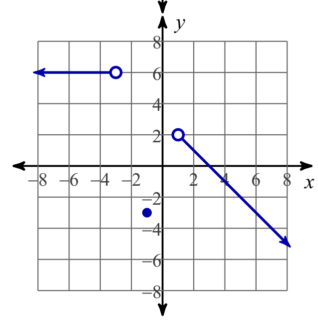
76)



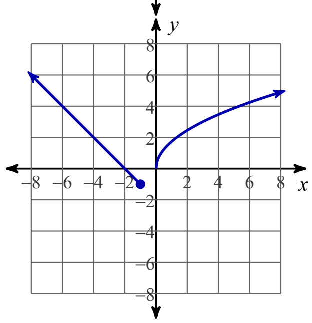
77)



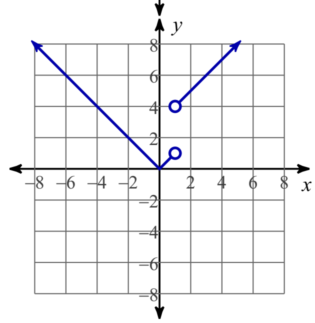
78)



79)

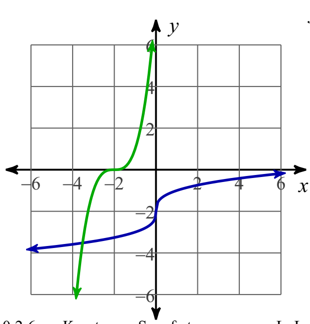


80)



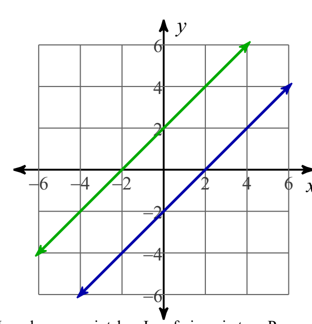
81)

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



82)

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



83) $g^{-1}(x) = \frac{3}{-x-1} - 1$

84) $f^{-1}(x) = (x+2)^5 - 1$

85) $2x^4 + 11x^3 + 5x^2$

86) $-n^2 - 2n + 4$

87) -99

88) n

89) $-16t - 12$

90) $6t + 11$

91) $f(x) = x^3$
$g(x) = \sqrt{x} + 3$

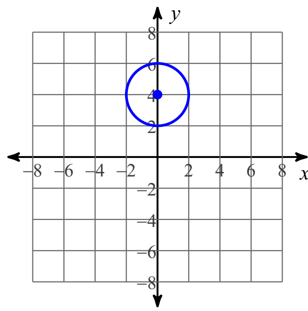
92) $f(x) = \frac{2}{x} - 2$
$g(x) = 2x + 5$

93) $81y^4 - 108y^3 + 54y^2 - 12y + 1$

94) $6x^3 - x^2 - 4x - 2 + \frac{5}{x+5}$

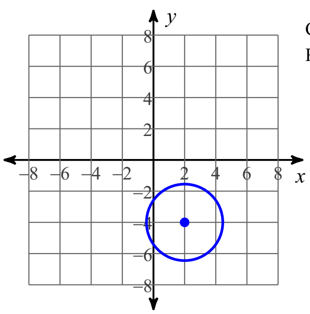
95) $9x^3 - 6x^2 + 8x - 3 + \frac{9}{x+3}$

96)



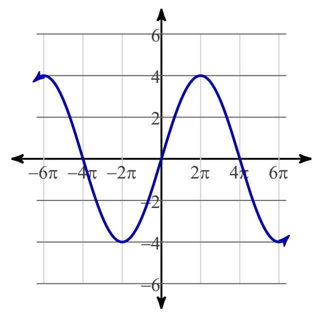
Center: $(0, 4)$
Radius: 2

97)



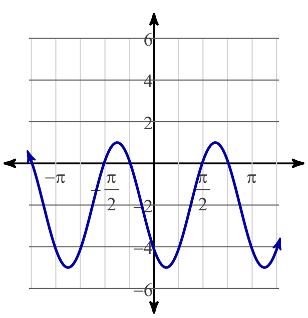
Center: $(2, -4)$
Radius: $\sqrt{6}$

98)



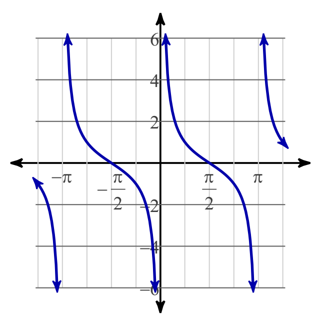
Amplitude: 4
Period: 8π
Phase shift: None
Vert. shift: None
Min: -4
Max: 4

99)



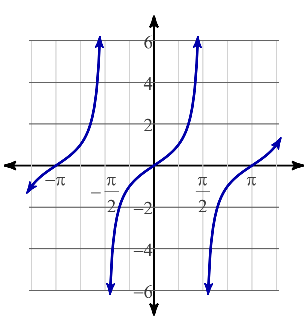
Amplitude: 3
Period: π
Phase shift: Left $\frac{3\pi}{8}$
Vert. shift: Down 2
Min: -5
Max: 1

100)



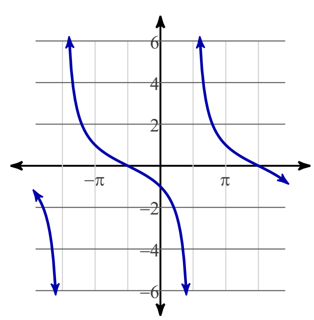
Amplitude: None
Period: π
Phase shift: None
Vert. shift: None
Min: None
Max: None

101)



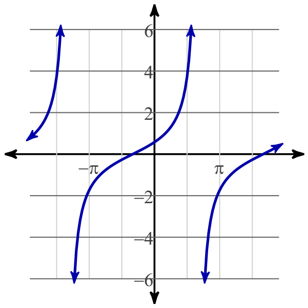
Amplitude: None
Period: π
Phase shift: None
Vert. shift: None
Min: None
Max: None

102)



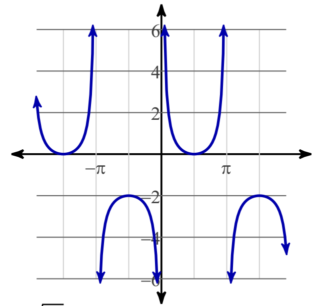
Amplitude: None
Period: 2π
Phase shift: Left $\frac{3\pi}{2}$
Vert. shift: None
Min: None
Max: None

103)



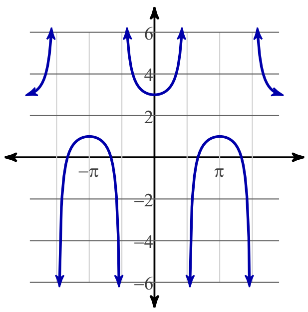
Amplitude: None
Period: 2π
Phase shift: Left $\frac{\pi}{3}$
Vert. shift: None
Min: None
Max: None

104)



Amplitude: None
Period: 2π
Phase shift: None
Vert. shift: Down 1
Min: None
Max: None

105)



Amplitude: None
Period: 2π
Phase shift: None
Vert. shift: Up 2
Min: None
Max: None

106) $\frac{\sqrt{2}}{2}$

107) $\frac{\sqrt{2}}{2}$

108) -2

109) Undefined

110) 0

111) $-\frac{2\sqrt{3}}{3}$

112) $-\frac{2\sqrt{3}}{3}$

113) 1

114) $-\frac{\sqrt{3}}{3}$

115) $-\sqrt{2}$

116) $\frac{1}{2}$

117) Undefined

118) $\frac{\pi}{4}$

119) $\frac{\pi}{6}$

120) $\frac{\pi}{3}$

121) $\frac{\pi}{4}$

122) $-\frac{\pi}{2}$

123) $\frac{2\pi}{3}$

124) $-\frac{\pi}{2}$

125) π

126) $-\frac{\pi}{4}$

127) $-\frac{\pi}{4}$

128) $\left\{\frac{\pi}{3}, \frac{4\pi}{3}\right\}$

129) $\left\{\frac{5\pi}{6}, \frac{7\pi}{6}\right\}$

130) $\left\{\frac{4\pi}{3}, \frac{5\pi}{3}\right\}$

131) $\left\{\frac{\pi}{4}, \frac{5\pi}{4}\right\}$

132) $\{0, \pi\}$

133) $\left\{\frac{\pi}{6}, \frac{\pi}{2}, \frac{7\pi}{6}, \frac{3\pi}{2}\right\}$

134) $\left\{0, \frac{\pi}{3}, \frac{5\pi}{3}\right\}$

135) $\left\{\frac{7\pi}{6}, \frac{3\pi}{2}, \frac{11\pi}{6}\right\}$

136) $\left\{\frac{3\pi}{4}, \frac{7\pi}{4}\right\}$

137) $\{0\}$

138) $\left\{0, \frac{\pi}{3}, \frac{5\pi}{3}\right\}$

139) $\left\{\frac{3\pi}{4}, \frac{7\pi}{4}\right\}$

140) $\left\{\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}\right\}$

141) $\left\{0, \frac{\pi}{4}, \pi, \frac{7\pi}{4}\right\}$

142) $\frac{\sqrt{6} + \sqrt{2}}{4}$

143) $\frac{\sqrt{6} + \sqrt{2}}{4}$

144) -1

145) $\sqrt{3}$