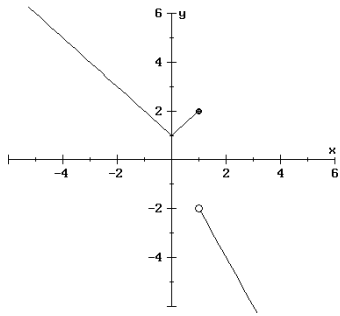


**Answers for Test Review Problems** (pg. 177-210 in Math 112 Workbook)

1. i) yes; each  $x$  has exactly one  $y$ -value  
ii) no; when  $x = 2$ ,  $y = 5$  or  $2$   
iii) no; when  $x = 1$ ,  $y = 0$  or  $-2$   
iv) yes; each  $x$  has exactly one  $y$ -value
2. C
3. i) yes; each  $x$  has exactly one  $y$ -value  
ii) yes, each  $x$  has exactly one  $y$ -value
4. i)  $\frac{\sqrt{3}}{3}$   
ii) 1  
iii)  $\frac{1}{\sqrt{3x+1}}$   
iv)  $\frac{1}{\sqrt{x+h+1}}$
5. i) 2  
ii) 0  
iii)  $2x^2$   
iv) 0
6. C
7. i) 33  
ii)  $2t^2 + 3$   
iii)  $2x^2 + 4x$   
iv)  $18r^2 - 12r + 3$   
v)  $6a^2 - 12a + 9$
8. i) Domain:  $x \geq -4$   
Range:  $y \geq -2.25$   
ii) Domain: All real numbers  
Range:  $y \leq 3$   
iii)  $f(0) = -2$   
 $g(2) = 3$
9. D
10. Domain: C  
Range: E
11. i) Domain:  $\{x \mid x \geq -2\}$   
ii) Domain:  $\{x \mid x \neq -3, x \neq 2\}$
12. i) Domain: all real numbers;  $f(x) = 0$  when  $x = \frac{3}{2}$   
ii) Domain: all real numbers except  $\sqrt{30}$  and  $-\sqrt{30}$ ;  $f(x) = 0$  when  $x = 0$   
iii) Domain: all real numbers;  $f(x)$  never equals 0  
iv) Domain:  $x \leq \frac{1}{5}$ ;  $f(x) = 0$  when  $x = \frac{-1}{5}$
13. C

14. The graph is:



A

15. E (graphs 1, 3 and 4 represent functions)

16. i) C

ii)  $T(20) = 325^\circ\text{F}$ . After 20 min. the temperature in the oven is about  $325^\circ\text{F}$ .

iii) At about 10 min.

iv)  $375^\circ\text{F}$

17. i) 2,200,000

ii) 455

iii) 1,001,000,000

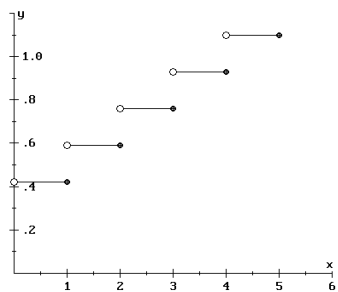
iv) decreased

18. i) 

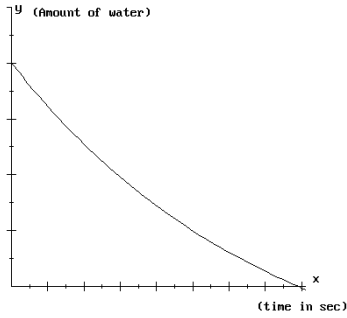
Weight W in ounces	Cost C in \$
0.5	0.44
1.0	0.44
1.2	0.61
2.0	0.61
2.4	0.78
3.1	0.95
4.99	1.12

Weight W in ounces	Cost C in \$
0.5	0.44
1.0	0.44
1.2	0.61
2.0	0.61
2.4	0.78
3.1	0.95
4.99	1.12

ii)



19. One possible graph is:



y-intercept is the amount of water in the tub before the plug was pulled

x-intercept is the amount of time it takes the tub to empty

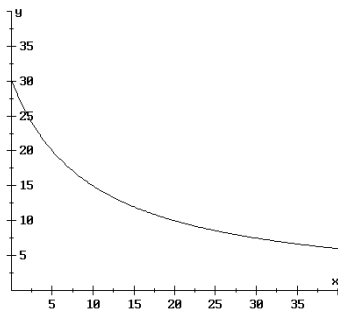
20. i)  $x = -4$  and  $x = 2$   
 ii) negative on  $(-4, 2)$   
       positive on  $(2, \infty)$   
 iii) increasing on  $(-\infty, 1)$   
       decreasing on  $(4, \infty)$   
       constant on  $(1, 4)$

21. i) neither  
 ii) even  
 iii) odd  
 iv) neither  
 v) neither

22. A

23. B

24. i) Graph, using the window  $[0, 40] \times [0, 40]$ :



ii) The y-intercept  $(0, 30)$  is the average cost when producing no plywood

iii) As  $x$  increases, the average cost decreases since variable costs generally decrease for large units produced.

25.  $A(x) = 12x - x^2$

26. i) The area of a circle is a function of the square of the radius.  
 ii) The volume of a sphere is a function of the cube of the radius.  
 iii) The area of a square is a function of the square of the side.

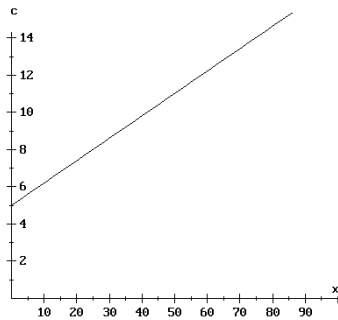
27. D

28. i)  $I(S) = 500 + 0.05(S)$

ii) \$14,000

29. i)  $C(x) = 5.00 + 0.12x$

ii)



iii)  $x \geq 0$

iv) The y-intercept is (0,5.00). This is the basic monthly fee for having the service.

30. B

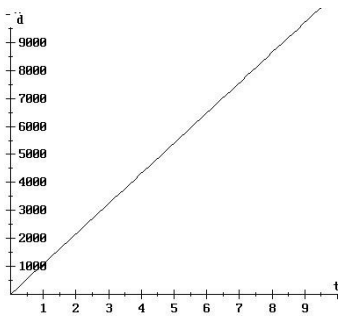
31. i)  $d = kt$

$$5400 = 5k$$

$$k = 1080$$

$$d = 1080t$$

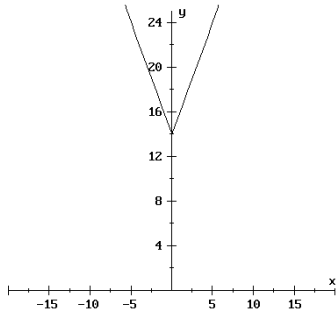
ii) The constant of proportionality is also the slope of the linear function  $d = kt$ . In this problem, it represents the speed of sound.



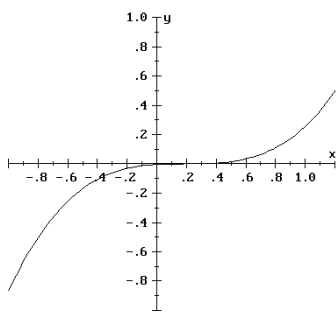
iii)  $d = (1080)(8) = 8640$  ft

32. 7 meters by 24 meters

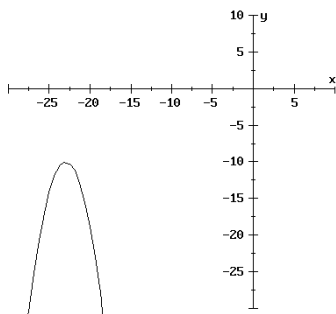
33. i) The graph of  $f(x) = |x|$  is vertically expanded by 2 and shifted 14 units up.



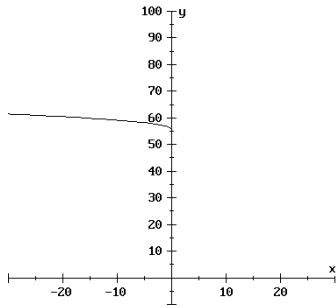
- ii) The graph of  $g(x) = x^3$  is shifted .2 units to the right and vertically compressed by a factor of  $\frac{1}{2}$



- iii) The graph of  $m(x) = x^2$  is shifted 23 units to the left, reflected across the  $x$ -axis, and shifted down 10 units.



- iv) The graph of  $h(x) = \sqrt{x}$  is reflected across the  $y$ -axis and shifted 56 units up.



34. i)  $f(x) = \sqrt{-x+1}$

ii)  $f(x) = -|x| + 2$

iii)  $f(x) = x^3 + 1$

35. i)  $g(x) = (x-3)^3$

ii)  $g(x) = -x^3$

iii)  $g(x) = x^3 - 2$

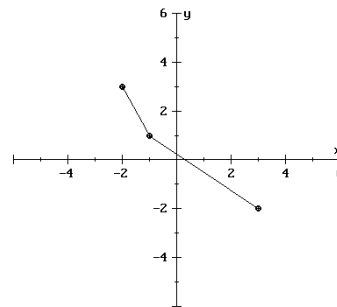
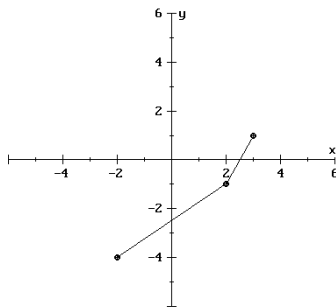
iv)  $g(x) = -x^3 - 2$

v)  $g(x) = -(x^3 - 2)$

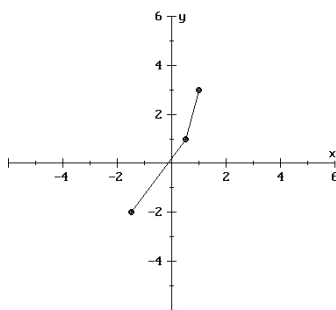
36. E

37. i)

ii)



iii)



38. i)  $g(x) = f(x+5)$

ii)  $h(x) = f(\frac{1}{2}x)$

39. i)  $\frac{1}{x^2(x^2+1)}$

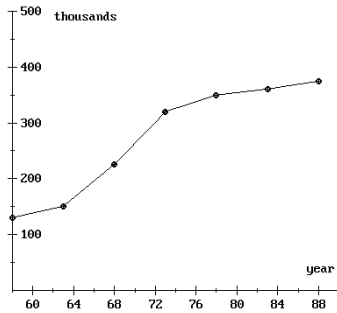
ii) -1

iii)  $x^2(x^2 + 1)$

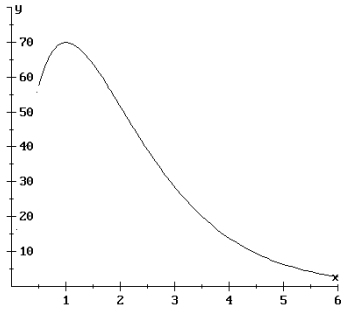
iv)  $\frac{1}{(x^2 + 1)^2}$

v)  $\frac{17}{16}$

40. i) 350 There were 350,000 students majoring in science and engineering in 1978.  
 ii) -50 There were 50,000 fewer women than men majoring in science and engineering in 1978.  
 iii)



41. i) -3  
 ii) No. They appear to be unrelated.  
 iii)  $(f \circ g)(x) = \frac{6 - 4x}{x - 1}$        $(g \circ f)(x) = \frac{1}{2x - 5}$
42. i)  $V(r(t)) = 0.02\pi t^2$  This gives the volume of the oil slick as a function of time.  
 ii) about 60 minutes  
 iii) It would take about 40 minutes.
43. C
44. i) 3  
 ii) 1  
 iii) 1
45.  $f(x) : (-\infty, 0) \text{ or } (0, \infty)$        $g(x) : (-\infty, \infty)$   
 $\left(\frac{f}{g}\right) : (-\infty, -3) \text{ or } (-3, 0) \text{ or } (0, 2) \text{ or } (2, \infty)$        $f(g(x)) : (-\infty, -3) \text{ or } (-3, 2) \text{ or } (2, \infty)$
46. i) 65 million  
 ii) between 1990 and 2013 except at 2000  
 iii) 2000 and 2013  
 iv) between 1990 and 2013 except at 2000
47. i) Yes, because there is a constant rate of change between each pair of ordered pairs  
 ii) No, because the rate of change between pairs of ordered pairs is not constant
48. i) Range:  $[0, 70]$



- ii) after 1 hour, the BAC is 69.92  
 iii) between 0.39 and 2.05 hours
- 49.** Slope =  $-50$ ; when the price of the product increases by \$1, 50 fewer items are sold.
- 50.**  $x$ -intercept  $(\frac{1}{3}, 0)$   
 $y$ -intercept  $(0, \frac{1}{7})$
- 51.** i) 2  
 ii) 4  
 iii) 3  
 iv) 1
- 52.** i)  $\frac{3}{4}$   
 ii) undefined  
 iii) 0
- 53.** C
- 54.** i)  $y = -\frac{1}{2}x + 1$   
 ii)  $y = -1$   
 iii)  $x = 2$   
 iv)  $y = 4x - 5$
- 55.** No. The change in  $y$  from  $x = 4$  to  $x = 5$  is 2.2. The change in  $y$  is 2.1 in the other intervals, though the change in  $x$  is still 1. Therefore there is no constant slope and the ordered pairs do not lie on a line.
- 56.** i)  $f(s) = 4s - 250$ , for  $s > 65$   
 ii) The slope of the line is 4. The fine increases by \$4 for every additional mile per hour over the speed limit.  
 iii) 90 mph
- 57.** i) neither  
 ii) perpendicular  
 iii) neither  
 iv) neither
- 58.** i) D  
 ii) E
- 59.** A
- 60.**  $y = x + 5$

61. B

62. First account \$180

Second \$820

63. B

64. i) Electric  $C = 1100t + 5000$

Solar  $C = 150t + 30,000$  Domain:  $t \geq 0$

ii) Installation: y-intercept

operation costs / year: slope

iii) 26.3 years

65. The last line is wrong. The  $\frac{9}{4}$  you are subtracting is multiplied by the 2 in front of the parentheses so you are really subtracting  $\frac{9}{2}$  (2 times  $\frac{9}{4}$ ).

66. D

67. i)  $P(100) = -\$39,750$

ii)  $P(300) = \$250$  is the profit resulting from producing 300 units

iii) It looks like  $x = 100$  units is too low a production level to make a profit (you lose money).

Producing 300 units helps you recoup the costs.

68.  $H(t) = \frac{1}{20}(t - 20)^2 + 2$

69. i)  $y = -\frac{3}{50}(x - 10)^2 + \frac{23}{2}$

ii) 15 feet

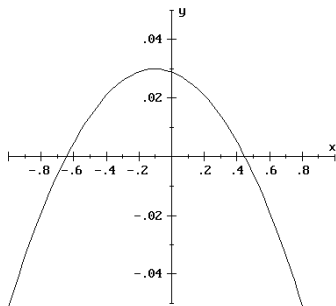
70. i)  $f(x) = -\frac{1}{10}\left(x + \frac{1}{10}\right)^2 + \frac{3}{100}$

ii) Vertex:  $\left(-\frac{1}{10}, \frac{3}{100}\right)$

x-intercepts:  $\left(\frac{-1+\sqrt{30}}{10}, 0\right), \left(\frac{-1-\sqrt{30}}{10}, 0\right)$

y-intercept:  $\left(0, \frac{29}{1000}\right)$

iii)



71. B

72. 55 ft by 110 ft (the area is 6050 sq. ft.)

73.  $y = \frac{4}{5}(x - 5)^2 - 23$

74.  $y = 4(x - 2)^2 - 1$

75. 70 trees per acre; 98,000 apples

76. C

77. 44.25 ft, 708 ft

78. 58

79. i)86

ii)28

80.  $3x + 3x^2 + 3x^3 + 3x^4 + 3x^5$

81. i) no, because  $y \rightarrow 0$  as  $x \rightarrow +\infty$  and  $y \rightarrow 0$  as  $x \rightarrow -\infty$

ii) no, because there is a corner or cusp on the graph

iii) yes, because the graph is continuous, there are no corners or cusps, and  $y \rightarrow +\infty$  as  $x \rightarrow +\infty$  and  $y \rightarrow +\infty$  as  $x \rightarrow -\infty$ .

82. D

83. i) 5; There are 4 turning points

ii) positive;  $y \rightarrow +\infty$  as  $x \rightarrow +\infty$  and  $y \rightarrow -\infty$  as  $x \rightarrow -\infty$

iii) negative

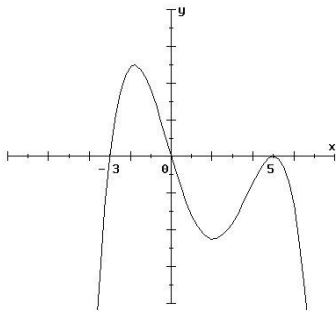
84. C

85.  $\frac{-3-\sqrt{29}}{2}$ ,  $0$ ,  $\frac{-3+\sqrt{29}}{2}$

86. B

87.  $f(x) = -\frac{1}{2}(x-2)(x-5)(x-6)$

88. The graph is:



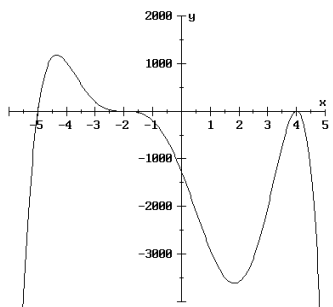
89.  $y = -2(x+2)(x+1)(x-1)^2$

90. i) D

ii) D

iii)  $-2$  is a zero of multiplicity 3;  $4$  is a zero of multiplicity 2;  $-5$  is a zero of multiplicity one

iv)The graph is:



91. i) 2

ii) 3

iii) 4

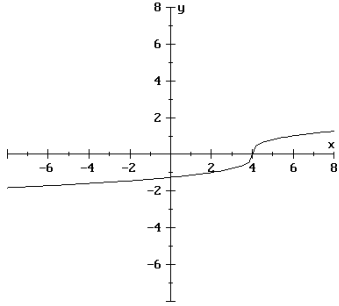
92. B
93. C
94. D
95. 157
96. i)  $-3, 4$   
 ii)  $-\frac{3}{2}, \frac{3}{2}$
97. 3.7 : A polynomial function is continuous, so in order for it to change from a negative value to a positive value, the function must go through zero. This happens when the value of  $x$  is between 3 and 4. Because  $f(4)$  is closer to zero than  $f(3)$  the zero is probably closer to 4 than to 3, thus the guess of a zero at 3.7.
98. D
99. Real zeros:  $2, -15$
100. Real solutions:  $-1, 2, \pm\sqrt{3}$
101. i) They are the same.  
 ii) They are the same.  
 iii) The  $y$ -intercept of  $g$  equals 6 times the the  $y$ -intercept of  $f$ .  
 iv) The graph of  $g$  is a vertical expansion of the graph of  $f$ .
102. Real zeroes:  $\pm\sqrt{5}, \pm\sqrt{2}$
103. A
104. Real solutions:  $-2, -1 \pm\sqrt{6}$
105.  $f(x) = 2x^3 - 5x^2 + 2x$
106. D
107.  $k = 25,000, b = 0.986$
108. 5%
109. \$5.06
110. i)  $P(0) = 10,000$   
 ii)  $P(-5) \approx 8,311$   
 iii) At the end of 2008
111. 56,250 lemmings
112. 9.33 years
113. Approximately 2.7364 hours
114. i) 64 ppm  
 ii) year 2023
115. i) 65%  
 ii) about 669 years
116. B
117. pH is 2.292; No, the lake is acidic!
118. i)  $k \approx -.00011995$   
 ii) 49.3%
119. i) \$123,114  
 ii) year 2001
120. \$2048.92

121. i)  $f(x)$  is one-to-one.

ii) 

$x$	$f^{-1}(x)$
2	0
3	1
1	2

122. Yes.  $f^{-1}(x) = \sqrt[3]{\frac{x-4}{2}}$

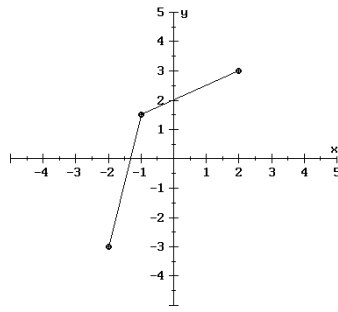
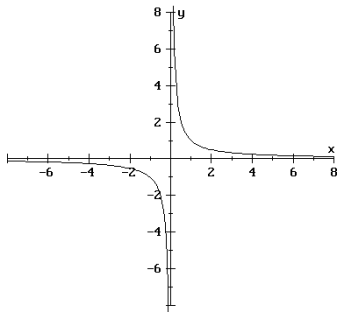


123. No. The function does not pass the horizontal line test

124. (7, 2)

125. D

126. (2) (3)



127. i) shutting down your computer and standing up

ii) multiply  $x$  by 3, then add 5

128. i)  $\{1, 3, 5, -9\}$

ii)  $\{-2, 7, 13, 20\}$

iii)  $\{-2, 7, 13, 20\}$

iv)  $\{1, 3, 5, -9\}$

129. i)  $f^{-1}(2) = 1$

ii)  $g^{-1}(f(3)) = g^{-1}(5) = 4$

130. i)  $g^{-1}(0.386) =$  Kristie Fox; the player with batting average 0.386 is Kristie Fox

ii)  $g(f(15)) = 0.270$ ; player #15 had batting average 0.270

iii)  $f^{-1}(g^{-1}(0.408)) = 0$ ; the player with batting average 0.408 was player #0

131.  $(f \circ g)(x) = 3 - 4\left(\frac{3-x}{4}\right) = 3 - (3-x) = x$

$(g \circ f)(x) = \frac{3-(3-4x)}{4} = \frac{4x}{4} = x$

132.  $T^{-1}(x) = \frac{C}{x} + 4$

133. B

134. i)  $\log_{243} 3 = \frac{1}{5}$

ii)  $\ln y = -\frac{1}{2}$

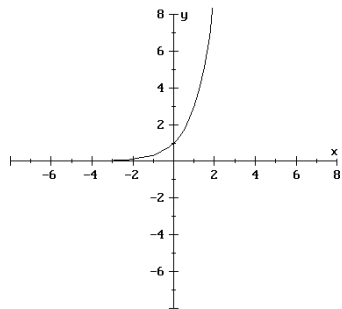
135.  $a = 2, b = 0.5$

136. B

137.  $\frac{y}{2}$

138.  $g^{-1}(t) = 2 + \log_7(t)$

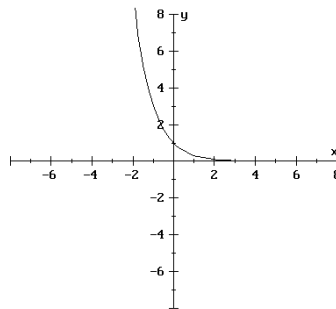
139. i)



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

Range:  $(0, \infty)$

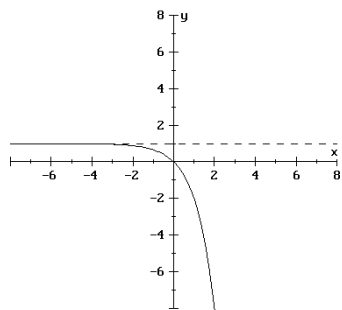
ii)



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

Range:  $(0, \infty)$

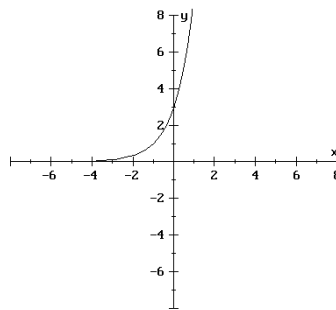
iii)



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

Range:  $(-\infty, 1)$

iv)



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

Range:  $(0, \infty)$

140.  $y = 2^x - 1$

141.  $y = -2 \cdot 3^x$

142. i)  $y = 5$

ii)  $x = \log_7(429) \approx 3.115$

iii)  $n = 2^{1/4} \approx 1.189$

143. C

144. i)  $x = -\ln 4$

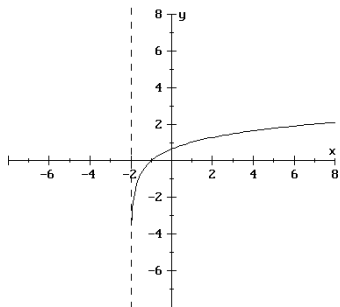
ii)  $x = \frac{\ln(\frac{13}{3})}{\ln 4}$

145. i)  $f(x) = 30,000(1.1)^x$   
 ii) approximately 9 years

146.  $x = 2$

147. i)  $-9$   
 ii)  $9$   
 iii)  $\sqrt{3}$   
 iv)  $-\frac{3}{2}$

148. i)



vertical asymptote:  $x = -2$

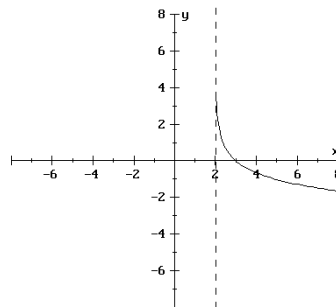
y-intercept:  $(0, \log_3 2)$

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

Domain:  $(-2, \infty)$

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

ii)



vertical asymptote:  $x = 2$

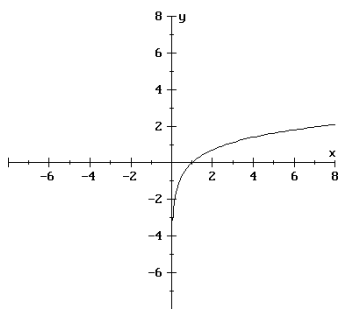
y-intercept: none

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

Domain:  $(2, \infty)$

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

149. i)



ii)  $y = \ln(-x)$

150.  $\{x \mid x > -\frac{11}{3}\}$

y-intercept:  $(0, \log_4 11)$

x-intercept:  $(-\frac{10}{3}, 0)$

151. D

152. i) translated 3 units to the left, 2 units up

ii)  $y = \ln(-x) - 4$

iii)  $y = -\ln(x - 2)$

153.  $\log_b \left( \frac{x+1}{2y^3z} \right)$

154. C
155.  $\log_5 10 - \log_5 a - 2 \log_5 b = 1 + \log_5 2 - \log_5 a - 2 \log_5 b$
156. i)  $\frac{\ln(2e)}{\ln(e)} = \frac{\ln 2 + \ln e}{1} = 1 + \ln 2$   
ii) correct  
iii) correct
157. A
158. i) 2.629  
ii) 2.569  
iii) 66.686  
iv) 2.153
159. D
160.  $x = -1$
161. C
162.  $x \approx 21.972$
163.  $t \approx 12.838$
164.  $y = 2$
165. i) average score of 76  
ii) average score of 58  
iii) 55 months after the initial exam
166.  $x = \frac{1}{2}$
167. A
168. B
169.  $f^{-1}(x) = \frac{2^x - 1}{3}$
170.  $T = \frac{\ln(\frac{kA}{P} + 1)}{k}$
171. i) 220 ladybugs  
ii) The population levels off at 400 ladybugs  
iii) 34.7 weeks
172. C