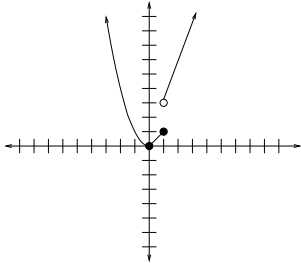


## Solutions to 142 Student Review Problems

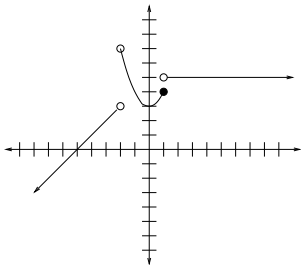
1. 21

2.  $8x + 4h$ 3.  $[0, 1) \cup (3, \infty)$ 

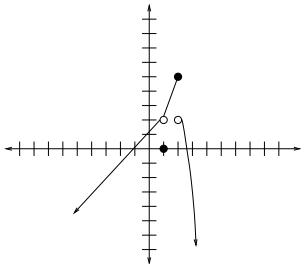
4. (a)



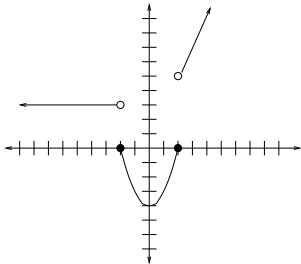
(b)



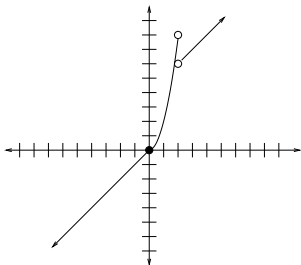
(c)



(d)



(e)

5. (a)  $3x + 4y = 150$ (b) Slope =  $-3/4$ ; Meaning: To produce 3 more bookcases, 4 less desks must be made.

6. \$123,333.33

7. Approx 9.434 years

8. (a)  $p = -0.01x + 95$ 

(b) \$50

9.  $p = -0.005x + 22.5$ 10. (a)  $p = -0.01 + 400$ (b)  $R(x) = -0.01x^2 + 400x$ 11. (a)  $p = -0.0075x + 150$ (b)  $R(x) = -0.0075x^2 + 150x$ 12. (a)  $p = \frac{-1}{60}x + \frac{475}{3}$ (b)  $R(x) = \frac{-1}{60}x^2 + \frac{475}{3}x$ 

13. \$21,000

14. (a)  $C(x) = 0.50x + 250$ (b)  $R(x) = 0.75x$ (c)  $P(x) = 0.25x - 250$ 15.  $C(x) = 164x + 6500$ ,  $R(x) = 1200x$ ,  
 $P(x) = 1036x - 6500$ 16.  $C(x) = 50x + 500$ ,  $R(x) = 100x - 0.5x^2$ 17. (a)  $C(x) = 0.75x + 300$ (b)  $R(x) = 5x$ 

(c) Mathematical answer: (70.58, 352.94); Actual answer: None - you can't make 70.58 candles.

18. (a)  $C(x) = 0.37x + 450$ ,  $R(x) = 40x - 0.031x^2$ 

(b) 639 pizzas

(c) \$20.19

19. (a)  $C(x) = 2x + 800$ ,  $R(x) = \frac{-1}{50}x^2 + 11x$ ,  
 $P(x) = \frac{-1}{50}x^2 + 9x - 800$ 

(b) 225 gadgets

(c) \$212.50

(d) \$6.50

20. Approx. 24

21. (4 units, \$65)

22. 400 bats

23. (a) \$37,055.48  
 (b) \$36,041.88  
 (c) \$35,968.43  
 (d) \$35,946.32
24. (a) \$14,769.80  
 (b) \$14,741.93  
 (c) \$14,767.64
25. (a) \$281,024.36  
 (b) \$317,205.82  
 (c) \$326,386.50  
 (d) \$330,043.35  
 (e) \$330,995.81  
 (f) \$331,154.51
26. (a) 11.5678 years  
 (b) 8.2432%
27. Approx. 32 years
28. 11.5813 years
29. 6.9603 years
30. (a) \$55,115.88  
 (b) 12.75%
31.  $x = 1$
32. 124.58 days
33. Will never totally evaporate (exp. func. never reach zero)
34. (a)  $(f + g)(x) = \sqrt{x+1} + x - 2$ ; D:  $[-1, \infty)$   
 (b)  $(f - g)(x) = \sqrt{x+1} - x + 2$ ; D:  $[-1, \infty)$   
 (c)  $(f * g)(x) = (\sqrt{x+1})(x - 2)$ ; D:  $[-1, \infty)$   
 (d)  $(f/g)(x) = \frac{\sqrt{x+1}}{x-2}$ ; D:  $[-1, 2) \cup (2, \infty)$
35. (a)  $(f \circ g)(x) = 2(x^2 + 1)^2 + (x^2 + 1) - 1$   
 $(g \circ f)(x) = (2x^2 + x - 1)^2 + 1$   
 $(f \circ f)(x) = 2(2x^2 + x - 1)^2 + (2x^2 + x - 1) - 1$   
 $(g \circ g)(x) = (x^2 + 1)^2 + 1$   
 (b)  $(f \circ g)(x) = \sqrt{3x^6 + 2x^2 + 1}$   
 $(g \circ f)(x) = 3x^3 + 2x + 1$   
 $(f \circ f)(x) = \frac{\sqrt{3(\sqrt{3x^3 + 2x + 1})^3 + 2(\sqrt{3x^3 + 2x + 1})} + 1}{\sqrt{3(\sqrt{3x^3 + 2x + 1})^3 + 2(\sqrt{3x^3 + 2x + 1})} + 1}$   
 $(g \circ g)(x) = x^4$
- (c)  $(f \circ g)(x) = 4x^3 + 4$   
 $(g \circ f)(x) = 4(x + 4)^3$   
 $(f \circ f)(x) = x + 8$   
 $(g \circ g)(x) = 4(4x^3)^3$
36. (a)  $(f \circ g)(x) = 6x^2 + 9$ , D: All reals  
 (b)  $(g \circ f)(x) = (6x + 9)^2$ , D: All reals
37.  $\frac{1997}{9}$
38. (a)  $\log x + \log y$   
 (b)  $\log y - \log x$
39.  $\log\left(\frac{y^{1/4}z\sqrt{3}}{x^2}\right)$
40. (a)  $5 \log x - 3 \log y - \log z$   
 (b)  $2 \log x + 3 \log y - 1/2 \log z$   
 (c)  $4 \log x - 5 \log y - 2 \log z$
41. (a)  $x = \frac{1}{3} \log 2.5$   
 (b)  $x = \frac{1}{4} \log(2/3)$   
 (c)  $x = \frac{\ln(12/9)}{\ln 2}$   
 (d)  $x = \frac{1}{7} \left( \left( \frac{\ln 12}{\ln 5} \right) - 9 \right)$   
 (e)  $x = \frac{\log(1/130)}{\log 40}$
42. (a) 244,140,652  
 (b)  $x = \sqrt{\frac{32}{3}}$
43. (a) 0 (if  $x, b > 0$  and  $x, b \neq 1$ )  
 (b) 32
44. (a)  $y = 4.2x + 11.6667$ ;  $r = 0.9902$   
 (b)  $y = 5.7x - 1.7$ ;  $r = 0.9816$
45. (a) Quadratic:  $y = -0.1121x^2 + 5.0437x - 45.3982$   
 $R^2 = 0.76$  - Fits as good as quartic and much simpler.  
 (b) Quadratic:  $y = -0.0641x^2 + 3.5997x - 37.3184$   
 $R^2 = 0.901$  - Fits data trend (inc. then dec.) and simpler than quartic.
46. Exponential:  $y = 4.3264(1.3646)^x$   
 $R^2 = 0.93$  - Population growth usually exponential.  
 Pop. = 4000 on Day 22

47. (a)  $0$  ( $m < n$ )  
 (b)  $\frac{-5}{6}$  ( $m=n$ )  
 (c)  $\infty$   
 (d)  $\frac{3}{2}$  ( $m=n$ )  
 (e)  $6$   
 (f)  $-1$   
 (g)  $\frac{17}{72}$   
 (h)  $2$   
 (i)  $-1$   
 (j)  $1$   
 (k)  $-\infty$   
 (l)  $0$   
 (m)  $\infty$
48. (a)  $3$   
 (b)  $3$   
 (c)  $3$   
 (d) No
49. VA:  $x = 3$ ; HA:  $y = 5$   
 (Hole at  $x = 2$ , not a VA)
50. (a)  $a = e^2 - 6$   
 (b)  $a = \frac{46}{3}$   
 (c)  $a = -6$   
 (d) No such values  
 (e)  $a = \frac{3}{2}$   
 (f)  $a = -1$   
 (g)  $a = \frac{-5}{12}$   
 (h)  $a = 1$   
 (i)  $a = \frac{7}{5}$
51. (a) Not continuous at  $x = 1$   
 (b)  $(-\infty, -8)$
52. (a) Approx 1.9340  
 (b)  $\frac{30}{19}$   
 (c)  $\frac{49}{86}$
53. (a)  $y = 16x - 8$   
 (b)  $y = 5x - 6$   
 (c)  $y = 400x - 1053$
54. (a)  $f'(x) = \frac{-9x^2}{(x^3-4)^2}$   
 (b)  $f'(x) = -6x + 2$   
 (c)  $f'(x) = 6x - 4$
- (d)  $f'(x) = \frac{1}{2}x^{-1/2}$
55. Corners, Vertical Tangents, and Discontinuities
56.  $-6, -4, -3, -1, 1, 2, 5$
57. (a)  $f'(x) = 3(2x)^2(2) + e^{\sqrt{x}+3}(\frac{1}{2}x^{-1/2})$   
 (b)  $f'(x) = \frac{(1-3x)(-2e^x)-(4-2e^x)(-3)}{(1-3x)^2}$   
 (c)  $f'(x) = \frac{(7e^{3x+1}-7x^3+1)^2(24x^2-6x)}{(7e^{3x+1}-7x^3+1)^4} - \frac{(8x^3-3x^2+7)(2)(7e^{3x+1}-7x^3+1)(7e^{3x+1}(3)-21x^2)}{(7e^{3x+1}-7x^3+1)^4}$   
 (d)  $f'(x) = \frac{3(4x+3+x^{-2})}{(2x^2+3x-x^{-1})}$   
 (e)  $f'(x) = \frac{(7)13(5x^4-3x^3+x-23)}{(7x)(13)(5x^4-3x^3+x-23)} + \frac{(20x^3-9x^2+1)(\ln 13)}{(7x)(13)(5x^4-3x^3+x-23)}$   
 (f)  $f'(x) = \frac{(x^3+x)(2e^{2x+1}+24x-9x^{-4})}{(x^3+x)^2} - \frac{(e^{2x+1}+12x^2+3x^{-3})(3x^2+1)}{(x^3+x)^2}$   
 (g)  $f'(x) = \frac{1}{x(x+1)}$   
 (h)  $f'(x) = (-6xe^{-3x^2-2})(\ln |800x^{-4}|) + e^{-3x^2-2}(\frac{-3200x^{-5}}{800x^{-4}})$   
 (i)  $f'(x) = 4(4x^4 + 56x^2 + 5)^3(16x^3 + 112x)(x^3 + 2x) + (4x^4 + 56x^2 + 5)^4(3x^2 + 2)$   
 (j)  $f'(x) = \frac{1}{2} \left[ \left( \frac{1}{x+1} \right) - \left( \frac{1}{x+2} \right) \right]$   
 (k)  $f'(x) = \frac{1}{2}(36x)^{-1/2}(36) - 6(6x)^{-3/2} + \frac{1}{3}(8x^2)^{-2/3}(16x)$   
 (l)  $f'(x) = 4(6x^3 + 3x^2 - x)^3(18x^2 + 6x - 1)(e^{2x+7} - e^x)^{1/2} + (6x^3 + 3x^2 - x)^4(1/2)(e^{2x+7} - e^x)^{-1/2}(2e^{2x+7} - e^x)$   
 (m)  $f'(x) = 10xe^{5x^2+3}(10x)^2 + 200xe^{5x^2+3}$   
 (n)  $f'(x) = 2x + 6 + 4(x + 1)^3 + \frac{6x}{3x^2(\ln 10)}$   
 (o)  $f'(x) = \frac{x^4[6e^{x^2}+6xe^{x^2}(2x)+6x]-(6xe^{x^2}+3x^2)(4x^3)}{x^8}$   
 (p)  $f'(x) = -6x + 1$   
 (q)  $f'(x) = (8x + 2)e^{4x^2+2x+7}(x^{-3} + 2x^2 - x)^{1/2} + e^{4x^2+2x+7}(1/2)(x^{-3} + 2x^2 - x)^{-1/2}(-3x^{-4} + 4x - 1)$   
 (r)  $f'(x) = \frac{\ln(x^4+x^2+3)(\frac{2}{x})-\ln(x^2)\left(\frac{4x^3+2x}{x^4+x^2+3}\right)}{[\ln(x^4+x^2+3)]^2}$   
 (s)  $f'(x) = (1/2)[\ln(x^2 + x + 1)]^{-1/2} \left( \frac{2x+1}{x^2+x+1} \right)$   
 (t)  $f'(x) = \frac{e^x(20x^3+8x)-(5x^4+4x^2)e^x}{e^{2x}}$   
 (u)  $f'(x) = (20x + 9x^2)e^{10x^2+3x^3}$   
 (v)  $f'(x) = (3x^2 + 3)2^{x^3+3x+5}(\ln 2)$
58.  $C'(t) = -(200 + 10t)^{-2}(10)$
59.  $C'(x) = \frac{1}{2}(x - 4)^{-1/2} + 10x + 10$   
 $C'(9)$  estimates the cost of the 10th item

$$60. R'(x) = \frac{(x^2+4x+3)(4x^3-6x^2)-(x^4-2x^3)(2x+4)}{(x^2+4x+3)^2}$$

$$61. R'(x) = -8x + 60$$

$$R'(2) = \$44 - \text{rev. from 3rd item is approx. } \$44$$

$$R'(15) = \$60 - \text{rev. from 16th item is approx. } \$60$$

$$62. (a) P'(x) = -19x$$

$$(b) \$165$$

$$63. (a) \text{Inc: } (-\infty, 0.6573); \text{Dec: } (0.6573, \infty)$$

$$(b) \text{Rel min at } x = 0.6573$$

$$(c) \text{Concave up: } (-\infty, -1/3) \cup (0, \infty);$$

$$\text{Concave down: } (-1/3, 0)$$

$$(d) \text{Inf Pt at } x = -1/3 \text{ and } x = 0$$

$$64. \text{Inc: } (-\infty, -0.6180) \cup (1.6180, \infty)$$

$$\text{Dec: } (-0.6180, 1.6180)$$

$$\text{Concave Up: } (0.5, \infty)$$

$$\text{Concave Down: } (-\infty, 0.5)$$

$$65. (a) \text{Domain: All reals}$$

$$\text{VA/HA: None}$$

$$\text{Inc: } (-\infty, -0.5736) \cup (0.1291, \infty)$$

$$\text{Dec: } (-0.5736, 0.1291)$$

$$\text{Rel max: At } x = -0.5736$$

$$\text{Rel min: At } x = 0.1291$$

$$\text{Concave Up: } (-2/9, \infty)$$

$$\text{Concave Down: } (-\infty, -2/9)$$

$$\text{Inf Pts: At } x = -2/9$$

$$(b) \text{Domain: All reals}$$

$$\text{VA/HA: None}$$

$$\text{Inc: } (-\infty, -2.8685) \cup (-0.4648, \infty)$$

$$\text{Dec: } (-2.8685, -0.4648)$$

$$\text{Rel max: At } x = -2.8685$$

$$\text{Rel min: At } x = -0.4648$$

$$\text{Concave Up: } (-5/3, \infty)$$

$$\text{Concave Down: } (-\infty, -5/3)$$

$$\text{Inf Pts: At } x = -5/3$$

$$(c) \text{Domain: All reals}$$

$$\text{VA/HA: None}$$

$$\text{Inc: } (-\infty, 2) \cup (4, \infty)$$

$$\text{Dec: } (2, 4)$$

$$\text{Rel max: At } x = 2$$

$$\text{Rel min: At } x = 4$$

$$\text{Concave Up: } (3, \infty)$$

$$\text{Concave Down: } (-\infty, 3)$$

$$\text{Inf Pts: At } x = 3$$

$$(d) \text{Domain: } (-\infty, -5) \cup (-5, \infty)$$

$$\text{VA: } x = -5; \text{No HA}$$

$$\text{Inc: } (-\infty, -8) \cup (-2, \infty)$$

$$\text{Dec: } (-8, -5) \cup (-5, -2)$$

$$\text{Rel max: At } x = -8$$

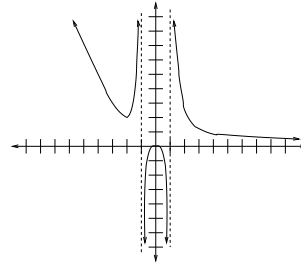
$$\text{Rel min: At } x = -2$$

$$\text{Concave Up: } (-5, \infty)$$

$$\text{Concave Down: } (-\infty, -5)$$

$$\text{Inf Pts: None}$$

66.



$$67. (a) \text{MAX: } (16, 12857); \text{MIN: } (-16, -11815)$$

$$(b) \text{MAX: None; MIN: None}$$

$$(c) \text{MAX: } (13, 4688); \text{MIN: } (-13, -13148)$$

$$(d) \text{MAX: } (2, 29); \text{MIN: } (-5, -55)$$

$$(e) \text{MAX: } (2, 31); \text{MIN: } (-1, 4)$$

$$(f) \text{MAX: } (1, 0.25); \text{MIN: } (-1, -0.25)$$

$$68. x = 0, y = 40$$

$$69. x = 420, y = 0 \text{ or } x = 0, y = 420$$

$$70. 8 \text{ cars}$$

$$71. \$625$$

$$72. \$0.59$$

$$73. \$103$$

$$74. \text{Poster is } 16.33 \text{ in. by } 24.49 \text{ in.}$$

$$75. (a) x \approx 2.1132 \text{ in.}$$

$$(b) x \approx 1.4266 \text{ in.}$$

$$76. 3.6215 \text{ in. by } 12.757 \text{ in. by } 16.757 \text{ in.}$$

$$77. 8 \text{ yds. by } 4 \text{ yds.}$$

$$78. 20 \text{ ft. by } 10 \text{ ft.}$$

$$79. 18.68 \text{ ft. by } 26.76 \text{ ft.}$$

$$80. 116.62 \text{ ft. by } 13.72 \text{ ft.}$$

$$81. 125 \text{ ft. by } 125 \text{ ft.}$$

$$82. 20 \text{ ft. by } 40 \text{ ft.}$$

83. 24.15 ft. by 20.7 ft.
84. 16.73 ft. by 20.92 ft.
85. 22.36 ft. by 44.72 ft.
86. 64.41 ft. by 64.41 ft. by 48.31 ft.
87. (a)  $5e^x - 6x^{-1/2} + (2/5)x^{5/2} + (2/3)x^3 + C$   
 (b)  $4x + C$   
 (c)  $(4/3)x^{9/4} + C$   
 (d)  $(16/3)t^{3/2} - 14t^{1/2} + C$   
 (e)  $(8/3)x^{3/2} + 4x^{1/2} + C$   
 (f)  $(1/6)x^6 + 3x^4 + (35/2)x^2 + C$   
 (g)  $(1/2)\ln|\ln x^2| + C$   
 (h)  $(1/3)(2x + 2)^6 + C$   
 (i)  $-e^{-x+4} + C$   
 (j)  $(50/3)e^{0.15x^2} + C$   
 (k)  $e^2y + 2y^{1/2} + 8(2y^3 - 3y^2 + 5y)^{1/4} - (1/6)e^{3y^2} + C$   
 (l)  $(5/16)(2x^2 + 5)^{4/5} + C$
88. (a)  $f'(x) = x^4 + (5/3)x^3 - (1/4)x^2 + e^{2x} - 12x - 3$   
 (b)  $f(x) = (1/5)x^5 + (5/12)x^4 - (1/12)x^3 + (1/2)e^{2x} - 6x^2 - 3x + 2.5$
89.  $f(x) = x^5 - 5x^2 + 6x - 7$
90.  $p = \frac{4}{(4x^2+1)} + 7.2$
91. Lower: (LHS) 54 ft.  
Upper: (RHS) 118 ft.
92. (a) -0.1683  
 (b) 129.1674  
 (c)  $\frac{200}{3}$   
 (d)  $\frac{505}{6}$   
 (e)  $6.0143x10^{24}$   
 (f) 0.3413
93. False: Need absolute value bars - (b/a) could be negative
94.  $\frac{1}{3}(b^3 - a^3) + 50(b - a)$
95. -18
96. 109
97. 70
98.  $\approx 1$  item
99.  $\approx 30,661$  tickets
100. 220.20 grams
101. 8,117,084 birds
102. 0.06 - His blood alcohol is less than the legal limit (0.08), so he technically wouldn't go to jail, but he shouldn't be driving.
103. \$18,003.86
104. \$110,000,000
105. (a) 29.8142  
 (b) 32  
 (c) 21.0740
106. 152.8
107.  $\frac{500}{3}$
108.  $2\pi$
109. (a) EP: (4,\$30)  
CS: \$40  
PS: \$40  
 (b) EP: (10,\$27)  
CS: \$120  
PS: \$155  
 (c) EP: (2,\$12)  
CS: \$8  
PS: \$12