Chapter 5

Section 5.1 (page 331)

1.

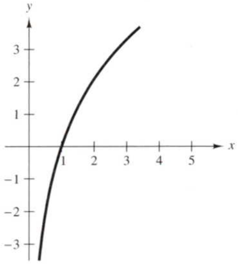
x	0.5	1.5	2	2.5	3	3.5	4
$\int_1^x (1/t)\,dt$	−0.6932	0.4055	0.6932	0.9163	1.0987	1.2529	1.3865

3. (a) 3.8067 (b) $\ln 45 = \int_1^{45} \frac{1}{t}\,dt \approx 3.8067$

5. (a) −0.2231 (b) $\ln 0.8 = \int_1^{0.8} \frac{1}{t}\,dt \approx -0.2231$

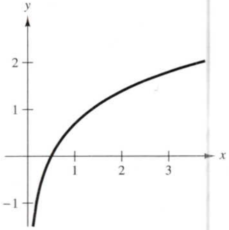
7. b **8.** d **9.** a **10.** c

11.



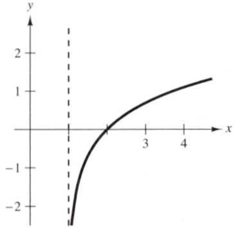
Domain: $x > 0$

13.



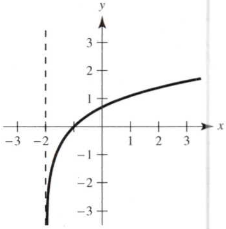
Domain: $x > 0$

15.



Domain: $x > 1$

17.



Domain: $x > -2$

19. (a) 1.7917 (b) −0.4055 (c) 4.3944 (d) 0.5493

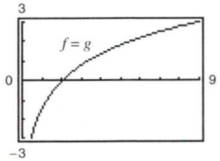
21. $\ln x - \ln 4$ **23.** $\ln x + \ln y - \ln z$

25. $\ln x + \frac{1}{2}\ln(x^2 + 5)$ **27.** $\frac{1}{2}[\ln(x - 1) - \ln x]$

29. $\ln z + 2\ln(z - 1)$

31. $\ln \frac{x - 2}{x + 2}$ **33.** $\ln \sqrt[3]{\frac{x(x + 3)^2}{x^2 - 1}}$ **35.** $\ln\left(9/\sqrt{x^2 + 1}\right)$

37. (a)



(b) $f(x) = \ln \frac{x^2}{4} = \ln x^2 - \ln 4$

$= 2\ln x - \ln 4$

$= g(x)$

39. $-\infty$ **41.** $\ln 4 \approx 1.3863$ **43.** $y = 3x - 3$

45. $y = 4x - 4$ **47.** $1/x$ **49.** $2/x$ **51.** $4(\ln x)^3/x$

53. $2/(t + 1)$ **55.** $\dfrac{2x^2 - 1}{x(x^2 - 1)}$ **57.** $\dfrac{1 - x^2}{x(x^2 + 1)}$

59. $\dfrac{1 - 2\ln t}{t^3}$ **61.** $\dfrac{2}{x\ln x^2} = \dfrac{1}{x\ln x}$ **63.** $\dfrac{1}{1 - x^2}$

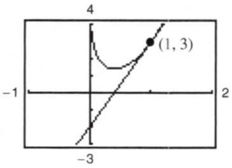
65. $\dfrac{-4}{x(x^2 + 4)}$ **67.** $\dfrac{\sqrt{x^2 + 1}}{x^2}$ **69.** $\cot x$

71. $-\tan x + \dfrac{\sin x}{\cos x - 1}$ **73.** $\dfrac{3\cos x}{(\sin x - 1)(\sin x + 2)}$

75. $[\ln(2x) + 1]/x$

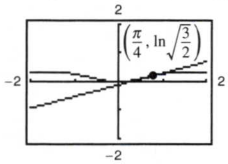
77. (a) $5x - y - 2 = 0$

(b)



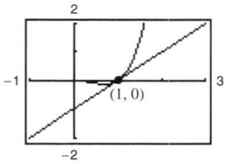
79. (a) $y = \frac{1}{3}x - \frac{1}{12}\pi + \frac{1}{2}\ln\left(\frac{3}{2}\right)$

(b)



81. (a) $y = x - 1$

(b)



83. $2xy/(3 - 2y^2)$

85. $\dfrac{y(1 - 6x^2)}{1 + y}$ **87.** $y = x - 1$

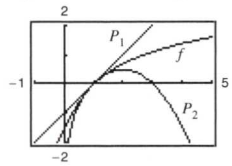
89. $xy'' + y' = x(-2/x^2) + (2/x) = 0$

91. Relative minimum: $\left(1, \frac{1}{2}\right)$

93. Relative minimum: $(e^{-1}, -e^{-1})$

95. Relative minimum: (e, e); Point of inflection: $(e^2, e^2/2)$

97. $P_1(x) = x - 1$; $P_2(x) = x - 1 - \frac{1}{2}(x - 1)^2$



The values of f, P_1, and P_2 and their first derivatives agree at $x = 1$.

99. $x \approx 0.567$ **101.** $(2x^2 + 1)/\sqrt{x^2 + 1}$

103. $\dfrac{3x^3 + 15x^2 - 8x}{2(x + 1)^3\sqrt{3x - 2}}$ **105.** $\dfrac{(2x^2 + 2x - 1)\sqrt{x - 1}}{(x + 1)^{3/2}}$

107. The domain of the natural logarithmic function is $(0, \infty)$ and the range is $(-\infty, \infty)$. The function is continuous, increasing, and one-to-one, and its graph is concave downward. In addition, if a and b are positive numbers and n is rational, then $\ln(1) = 0$, $\ln(a \cdot b) = \ln a + \ln b$, $\ln(a^n) = n\ln a$, and $\ln(a/b) = \ln a - \ln b$.

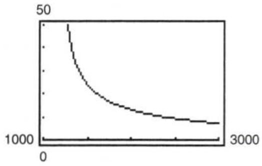
109. (a) Yes. If the graph of g is increasing , then $g'(x) > 0$. Since $f(x) > 0$, you know that $f'(x) = g'(x)f(x)$ and thus $f'(x) > 0$. Therefore, the graph of f is increasing.

(b) No. Let $f(x) = x^2 + 1$ (positive and concave up) and let $g(x) = \ln(x^2 + 1)$ (not concave up).

111. False; $\ln x + \ln 25 = \ln 25x$.

113. False; π is a constant, so $\dfrac{d}{dx}[\ln \pi] = 0$.

115. (a)



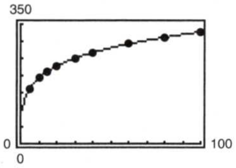
(b) 30 yr; \$503,434.80

(c) 20 yr; \$386,685.60

(d) When $x = 1398.43$, $dt/dx \approx -0.0805$.
When $x = 1611.19$, $dt/dx \approx -0.0287$.

(e) Two benefits of a higher monthly payment are a shorter term and the total amount paid is lower.

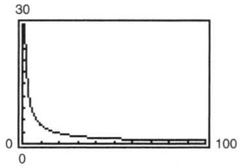
117. (a)



(b) $T'(10) \approx 4.75°/\text{lb/in.}^2$

$T'(70) \approx 0.97°/\text{lb/in.}^2$

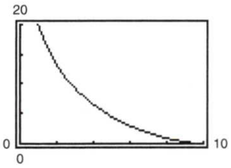
(c)



$\lim_{p\to\infty} T'(p) = 0$

Answers will vary.

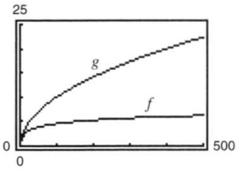
119. (a)



(b) When $x = 5$, $dy/dx = -\sqrt{3}$.
When $x = 9$, $dy/dx = -\sqrt{19}/9$.

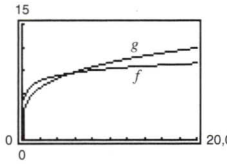
(c) $\lim_{x\to 10^-} \dfrac{dy}{dx} = 0$

121. (a)



For $x > 4$, $g'(x) > f'(x)$. g is increasing at a faster rate than f for large values of x.

(b)



For $x > 256$, $g'(x) > f'(x)$. g is increasing at a faster rate than f for large values of x.

$f(x) = \ln x$ increases very slowly for large values of x.