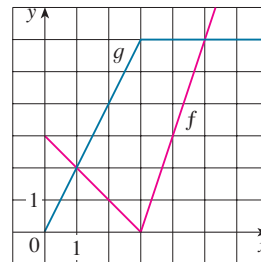


EXERCISES

1–30 ■ Calculate  $y'$ .

1.  $y = (x^4 - 3x^2 + 5)^3$
  2.  $y = \cos(\tan x)$
  3.  $y = \sqrt{x} + \frac{1}{\sqrt[3]{x^4}}$
  4.  $y = \frac{3x - 2}{\sqrt{2x + 1}}$
  5.  $y = 2x\sqrt{x^2 + 1}$
  6.  $y = \frac{e^x}{1 + x^2}$
  7.  $y = e^{\sin 2\theta}$
  8.  $y = e^{-t^2 - 2t + 2}$
  9.  $y = \frac{t}{1 - t^2}$
  10.  $y = \sin^{-1}(e^x)$
  11.  $y = xe^{-1/x}$
  12.  $y = x^r e^{sx}$
  13.  $xy^4 + x^2y = x + 3y$
  14.  $y = \ln(\csc 5x)$
  15.  $y = \frac{\sec 2\theta}{1 + \tan 2\theta}$
  16.  $x^2 \cos y + \sin 2y = xy$
  17.  $y = e^{cx}(c \sin x - \cos x)$
  18.  $y = \ln(x^2 e^x)$
  19.  $y = \log_5(1 + 2x)$
  20.  $y = (\ln x)^{\cos x}$
  21.  $y = \ln \sin x - \frac{1}{2} \sin^2 x$
  22.  $y = \frac{(x^2 + 1)^4}{(2x + 1)^3(3x - 1)^5}$
  23.  $y = x \tan^{-1}(4x)$
  24.  $y = e^{\cos x} + \cos(e^x)$
  25.  $y = \ln |\sec 5x + \tan 5x|$
  26.  $y = 10^{\tan \pi \theta}$
  27.  $y = \cot(3x^2 + 5)$
  28.  $y = \ln \left| \frac{x^2 - 4}{2x + 5} \right|$
  29.  $y = \sin(\tan \sqrt{1 + x^3})$
  30.  $y = \arctan(\arcsin \sqrt{x})$
31. If  $f(x) = 1/(2x - 1)^5$ , find  $f''(0)$ .
32. Find  $y''$  if  $x^6 + y^6 = 1$ .
33. If  $f(x) = 2^x$ , find  $f^{(n)}(x)$ .
34. Find an equation of the tangent to the curve  $\sqrt{x} + \sqrt{y} = 3$  at the point  $(4, 1)$ .
35. (a) If  $f(x) = x\sqrt{5 - x}$ , find  $f'(x)$ .  
 (b) Find equations of the tangent lines to the curve  $y = x\sqrt{5 - x}$  at the points  $(1, 2)$  and  $(4, 4)$ .
36. (a) If  $f(x) = 4x - \tan x$ ,  $-\pi/2 < x < \pi/2$ , find  $f'$  and  $f''$ .  
 (b) Check to see that your answers to part (a) are reasonable by comparing the graphs of  $f$ ,  $f'$ , and  $f''$ .
37. If  $f(x) = xe^{\sin x}$ , find  $f'(x)$ . Graph  $f$  and  $f'$  on the same screen and comment.

38. (a) Graph the function  $f(x) = x - 2 \sin x$  in the viewing rectangle  $[0, 8]$  by  $[-2, 8]$ .  
 (b) On which interval is the average rate of change larger:  $[1, 2]$  or  $[2, 3]$ ?  
 (c) At which value of  $x$  is the instantaneous rate of change larger:  $x = 2$  or  $x = 5$ ?  
 (d) Check your visual estimates in part (c) by computing  $f'(x)$  and comparing the numerical values of  $f'(2)$  and  $f'(5)$ .
39. Suppose that  $h(x) = f(x)g(x)$  and  $F(x) = f(g(x))$ , where  $f(2) = 3$ ,  $g(2) = 5$ ,  $g'(2) = 4$ ,  $f'(2) = -2$ , and  $f'(5) = 11$ . Find (a)  $h'(2)$  and (b)  $F'(2)$ .
40. If  $f$  and  $g$  are the functions whose graphs are shown, let  $P(x) = f(x)g(x)$ ,  $Q(x) = f(x)/g(x)$ , and  $C(x) = f(g(x))$ . Find (a)  $P'(2)$ , (b)  $Q'(2)$ , and (c)  $C'(2)$ .



41–48 ■ Find  $f'$  in terms of  $g'$ .

41.  $f(x) = x^2g(x)$
42.  $f(x) = g(x^2)$
43.  $f(x) = [g(x)]^2$
44.  $f(x) = g(g(x))$
45.  $f(x) = g(e^x)$
46.  $f(x) = e^{g(x)}$
47.  $f(x) = \ln |g(x)|$
48.  $f(x) = g(\ln x)$

49–50 ■ Find  $h'$  in terms of  $f'$  and  $g'$ .

49.  $h(x) = \frac{f(x)g(x)}{f(x) + g(x)}$
50.  $h(x) = f(g(\sin 4x))$

51. At what point on the curve  $y = [\ln(x + 4)]^2$  is the tangent horizontal?
52. (a) Find an equation of the tangent to the curve  $y = e^x$  that is parallel to the line  $x - 4y = 1$ .  
 (b) Find an equation of the tangent to the curve  $y = e^x$  that passes through the origin.
53. Find the points on the ellipse  $x^2 + 2y^2 = 1$  where the tangent line has slope 1.
54. (a) On what interval is the function  $f(x) = (\ln x)/x$  increasing?  
 (b) On what interval is  $f$  concave upward?