FOCUS ON PRACTICE

Find derivatives for the functions in Problems 1–63. Assume a, b, c, and k are constants.

1. $f(t) = t^2 + t^4$
2. $g(x) = 5x^4$
3. $y = 5x^3 + 7x^2 - 3x + 1$
4. $s(t) = 6t^{-2} + 3t^3 - 4t^{1/2}$
5. $f(x) = \dfrac{1}{x^2} + 5\sqrt{x} - 7$
6. $P(t) = 100e^{0.05t}$
7. $f(x) = 5e^{2x} - 2 \cdot 3^x$
8. $P(t) = 1{,}000(1.07)^t$
9. $D(p) = e^{p^2} + 5p^2$
10. $y = t^2 e^{5t}$
11. $y = x^2\sqrt{x^2+1}$
12. $f(x) = \ln\left(x^2+1\right)$
13. $s(t) = 8\ln(2t+1)$
14. $g(w) = w^2 \ln(w)$
15. $f(x) = 2^x + x^2 + 1$
16. $P(t) = \sqrt{t^2+4}$
17. $C(q) = (2q+1)^3$
18. $g(x) = 5x(x+3)^2$
19. $P(t) = be^{kt}$
20. $f(x) = ax^2 + bx + c$
21. $y = x^2 \ln(2x+1)$
22. $f(t) = \left(e^t + 4\right)^3$
23. $f(x) = 5\sin(2x)$
24. $W(r) = r^2 \cos r$
25. $g(t) = 3\sin(5t) + 4$
26. $y = e^{3t}\sin(2t)$
27. $y = 2e^x + 3\sin x + 5$
28. $f(t) = 3t^2 - 4t + 1$
29. $y = 17x + 24x^{1/2}$
30. $g(x) = -\frac{1}{2}(x^5 + 2x - 9)$
31. $f(x) = 5x^4 + \dfrac{1}{x^2}$
32. $y = \dfrac{e^{2x}}{x^2+1}$
33. $f(x) = \dfrac{x^2+3x+2}{x+1}$
34. $y = \left(\dfrac{x^2+2}{3}\right)^2$
35. $g(x) = \sin(2-3x)$
36. $f(z) = \dfrac{z^2+1}{3z}$
37. $q(r) = \dfrac{3r}{5r+2}$
38. $y = x\ln x - x + 2$
39. $j(x) = \ln(e^{ax} + b)$
40. $g(t) = \dfrac{t-4}{t+4}$
41. $h(w) = (w^4 - 2w)^5$
42. $h(w) = w^3 \ln(10w)$
43. $f(x) = \ln(\sin x + \cos x)$
44. $w(r) = \sqrt{r^4+1}$
45. $h(w) = -2w^{-3} + 3\sqrt{w}$
46. $h(x) = \sqrt{\dfrac{x^2+9}{x+3}}$
47. $v(t) = t^2 e^{-ct}$
48. $f(x) = \dfrac{x}{1+\ln x}$
49. $g(\theta) = e^{\sin\theta}$
50. $p(t) = e^{4t+2}$
51. $j(x) = \dfrac{x^3}{a} + \dfrac{a}{b}x^2 - cx$
52. $f(z) = \dfrac{z^2+1}{\sqrt{z}}$
53. $h(r) = \dfrac{r^2}{2r+1}$
54. $g(x) = 2x - \dfrac{1}{\sqrt[3]{x}} + 3^x - e$
55. $f(t) = 2te^t - \dfrac{1}{\sqrt{t}}$
56. $w = \dfrac{5-3z}{5+3z}$
57. $f(x) = \dfrac{x^3}{9}(3\ln x - 1)$
58. $g(x) = \dfrac{x^2+\sqrt{x}+1}{x^{3/2}}$
59. $y = \left(x^2+5\right)^3\left(3x^3-2\right)^2$
60. $f(x) = \dfrac{a^2-x^2}{a^2+x^2}$
61. $w(r) = \dfrac{ar^2}{b+r^3}$
62. $H(t) = (at^2+b)e^{-ct}$
63. $g(w) = \dfrac{5}{(a^2-w^2)^2}$

FOCUS ON PRACTICE

For Problems 1–48, evaluate the integrals. Assume a, b, A, B, P_0, h, and k are constants.

1. $\int (q^2 + 5q + 2)dq$
2. $\int (u^4 + 5)\,du$
3. $\int (x^2 + 1)\,dx$
4. $\int e^{-3t}\,dt$
5. $\int (6\sqrt{x})dx$
6. $\int (ax^2 + b)\,dx$
7. $\int (x^3 + 4x + 8)\,dx$
8. $\int 100e^{-0.5t}\,dt$
9. $\int (w^4 - 12w^3 + 6w^2 - 10)\,dw$
10. $\int \left(\frac{4}{x} + \frac{5}{x^2}\right)\,dx$
11. $\int \frac{dq}{\sqrt{q}}$
12. $\int 3\sin\theta\,d\theta$
13. $\int (p^2 + \frac{5}{p})\,dp$
14. $\int P_0 e^{kt}\,dt$
15. $\int (q^3 + 8q + 15)\,dq$
16. $\int 1000e^{0.075t}\,dt$
17. $\int (5\sin x + 3\cos x)\,dx$
18. $\int (10 + 5\sin x)\,dx$
19. $\int \frac{5}{w}\,dw$
20. $\int \pi r^2 h\,dr$
21. $\int \left(q + \frac{1}{q^3}\right)\,dq$
22. $\int 15p^2q^4\,dp$
23. $\int 15p^2q^4\,dq$
24. $\int (3x^2 + 6e^{2x})\,dx$
25. $\int 5e^{2q}\,dq$
26. $\int \left(p^3 + \frac{1}{p}\right)\,dp$
27. $\int (Ax^3 + Bx)\,dx$
28. $\int (6\sqrt{x} + 15)\,dx$
29. $\int (x^2 + 8 + e^x)\,dx$
30. $\int 30e^{-0.2t}dt$
31. $\int (t^2 - 6t + 5)\,dt$
32. $\int \left(\frac{a}{x} + \frac{b}{x^2}\right)\,dx$
33. $\int (Aq + B)dq$
34. $\int \left(\frac{6}{\sqrt{x}} + 8\sqrt{x}\right)\,dx$
35. $\int (e^{2t} + 5)dt$
36. $\int \sin(3x)dx$
37. $\int 12\cos(4x)dx$
38. $\int \frac{1}{y+2}dy$
39. $\int y(y^2 + 5)^8\,dy$
40. $\int \cos(4x)dx$
41. $\int A\sin(Bt)dt$
42. $\int \sqrt{3x+1}dx$
43. $\int \frac{e^x}{2 + e^x}\,dx$
44. $\int \sin^6(5\theta)\cos(5\theta)\,d\theta$
45. $\int \frac{\cos x}{\sqrt{1 + \sin x}}\,dx$
46. $\int x\ln x\,dx$ SKIP
47. $\int xe^x\,dx$ SKIP
48. $\int_0^{10} ze^{-z}\,dz$ SKIP

Calculus - Focus on Practice

(3) $y = 5x^3 + 7x^2 - 3x + 1$

$y' = 15x^2 + 14x - 3$

(6) $P(t) = 100e^{.05t}$

$P'(t) = 100e^{.05t}(.05)$

$P'(t) = 5e^{.05t}$

(9) $D(p) = e^{p^2} + 5p^2$

$D'(p) = e^{p^2}(2p) + 10p$

(12) $f(x) = \ln(x^2+1)$

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

(15) $f(x) = 2^x + x^2 + 1$

$f'(x) = 2^x \cdot \ln 2 + 2x$

(18) $g(x) = 5x(x+3)^2$

$g'(x) = 5(x+3)^2 + 5x \cdot 2(x+3)'$

(21) $y = x^2 \ln(2x+1)$

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

(24) $W(r) = r^2 \cos r$

$W'(r) = 2r\cos r + -r^2 \sin r$

(27) $y = 2e^x + 3\sin x + 5$

$y' = 2e^x + 3\cos x$

(30) $g(x) = -\frac{1}{2}x^5 + x + 4.5$

$g'(x) = -\frac{5}{2}x^4 - 1$

(33) $f(x) = \frac{x^2+3x+2}{x+1}$

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

(36) $f(z) = \frac{z^2+1}{3z} = \frac{1}{3}z + \frac{1}{3}z^{-1}$

$f'(z) = \frac{1}{3} - \frac{1}{3}z^{-2}$

$\frac{1}{3} - \frac{1}{3z^2}$

(39) $j(x) = \ln(e^{ax} + b)$

$j'(x) = \frac{ae^{ax} + 0}{e^{ax} + b}$

(42) $h(w) = w^3 \ln(10w)$

$h(w) = 3w^2 \ln(10w) + w^3 \frac{10}{10w}$

$+ w^2$

(45) $h(w) = -2w^{-3} + 3\sqrt{w}$

$h'(w) = 6w^{-4} + \frac{3}{2}w^{-1/2}$

(48) $f(x) = \frac{x}{1+\ln x}$ ↙ 1

$f'(x) = \frac{(1+\ln x)(1) - x\left(\frac{1}{x}\right)}{(1+\ln x)}$

$= \frac{\ln x}{1+\ln x}$

(51) $j(x) = \frac{1}{a}x^3 + \frac{a}{b}x^2 - cx$

$j'(x) = \frac{3}{a}x^2 + \frac{2a}{b}x - c$

(54) $g(x) = 2x - x^{-1/3} + 3^x - e$

$g'(x) = 2 + \frac{1}{3}x^{-4/3} + 3^x \ln 3 + 0$

(57) $f(x) = \frac{1}{9}x^3(3\ln x - 1)$

$f'(x) = \frac{1}{3}x^2(3\ln x - 1) + \frac{1}{9}x^3\left(3\cdot\frac{1}{x}\right)$

$+ \frac{1}{3}x^2$

(60) $f(x) = \frac{a^2 - x^2}{a^2 + x^2}$

$f'(x) = \frac{(a^2+x^2)(-2x) - (a^2-x^2)(2x)}{(a^2+x^2)^2}$

$-2xa^2 - 2x^3 - 2xa^2 + 2x^3$

$\frac{-4ax^2}{(a^2+x^2)^2}$

(63) $g(w) = \frac{5}{(a^2-w^2)^2}$

$g'(w) = \frac{(a^2-w^2)^2(0) - 5(2(a^2-w^2)^1(-2w))}{(a^2-w^2)^4} = \frac{20w(a^2-w^2)}{(a^2-w^2)^4}$

$= \frac{20w}{(a^2-w^2)^3}$

Integrals

(3) $\int (x^2+1)\,dx$

$\frac{1}{3}x^3+x+C$

(6) $\int (ax^2+b)\,dx$

$\frac{1}{3}ax^3+bx+C$

(9) $\int (w^4-12w^3+6w^2-10)\,dw$

$\frac{1}{5}w^5-3w^4+2w^3-10w+C$

(12) $3\int \sin\theta\,d\theta$

$-3\cos\theta+C$

(15) $\int (q^3+8q+15)\,dq$

$\frac{1}{4}q^4+4q^2+15q+C$

(18) $\int (10+5\sin x)\,dx$

$10x-5\cos x+C$

(21) $\int (q+q^{-3})\,dq$

$\frac{1}{2}q^2-\frac{1}{4}q^{-4}+C$

(24) $\int (3x^2+6e^{2x})\,dx$

$x^3+3e^{2x}+C$

scratch
$y=3e^{2x}$
$y'=3e^{2x}\cdot 2$
needs 3

(27) $\int (Ax^3+Bx)\,dx$

$\frac{A}{4}x^4+\frac{B}{2}x^2+C$

(30) $30\int e^{-.2t}\,dt$

$30(-5e^{-.2t})+C$

$-150e^{-.2t}+C$

if $y=e^{-.2t}$
$y'=e^{-.2t}(-.2)$
need -5
if $y=-5e^{-.2t}$
$y'=e^{-.2t}$

(33) $\int (Aq+B)\,dq$

$\frac{A}{2}q^2+Bq+C$

(36) $\int \sin(3x)\,dx$

$-\frac{1}{3}\cos(3x)+C$

(39) $\int y(y^2+5)^8\,dy$

$u=y^2+5$
$du=2y\,dy$
$\frac{1}{2}du=y\,dy$

$\frac{1}{2}\int u^8\,du$

$\frac{1}{18}u^9+C$

$\frac{1}{18}(y^2+5)^9+C$

(42) $\int (3x+1)^{1/2}\,dx$

$u=3x+1$
$du=3dx$
$\frac{1}{3}du=dx$

$\frac{1}{3}\int u^{1/2}\,du$

$\frac{1}{3}\cdot\frac{2}{3}u^{3/2}+C$

$\frac{2}{9}(3x+1)^{3/2}+C$

(45) $\int \frac{\cos x\,dx}{\sqrt{1+\sin x}}$

$u=1+\sin x$
$du=\cos x\,dx$

$\int u^{-1/2}\,du$

$2u^{1/2}+C$

$2(1+\sin x)^{1/2}+C$

$2\sqrt{1+\sin x}+C$

(48) $\int_0^{10} ze^{-z}\,dz$

$u=e^{-z}$
$\ln u=-z$
$-\ln u=z$
$du=-e^{-z}dz$
$-du=e^{-z}dz$

$+1\int \ln u\,du$

Skip. This is Integration By Parts: Calc. 2

Integration

Assorted Tough Probs.

(11) $\int q^{-1/2}\,dq$

$2q^{1/2}+C$

(14) $P_0\int e^{Kt}\,dt$

$P_0\left(\frac{1}{K}e^{Kt}\right)$

$\frac{P_0}{K}e^{Kt}$ ← this is C

(20) $\pi h\int r^2\,dr$

$\pi h\,\frac{1}{3}r^3+C$

(22) $15q^4\int p^2\,dp$

$\frac{15q^4p^3}{3}+C = 5q^4p^3+C$

(43) $\int \frac{e^x}{2+e^x}\,dx$ $\quad u=2+e^x$, $du=e^x dx$

~~$\int \frac{1}{u}\,du$~~

$\int \frac{1}{u}\,du$

$\ln|u|+C$

$\ln|2+e^x|+C$

(44) $\int \sin^6(5\theta)\cos(5\theta)\,d\theta$ $\quad u=\sin(5\theta)$, $du=\cos(5\theta)5\,d\theta$, $\frac{1}{5}du=\cos(5\theta)d\theta$

$\frac{1}{5}\int u^6\,du$

$\frac{1}{5}\left(\frac{1}{7}u^7\right)+C$

$\frac{1}{35}\sin^7(5\theta)+C$

*Skip 46-48