

Find the derivative of each of the following functions by using the product rule.

1. $\frac{1}{x} \cot(x)$
2. $x^{100} 10e^x$
3. $-\sin(x) \left(\frac{1}{x}\right)$
4. $\cos(x) (-\sin(x))$
5. $\cos(x) \tan(x)$
6. $\sin(x) \sec(x)$
7. $x^{2008} \sin(x)$
8. $\sqrt[3]{x} \sin(x)$
9. $x^{100} \sec(x)$
10. $x^{2008} \cot(x)$
11. $\cot(x) \csc(x)$
12. $x^{81} \cot(x)$
13. $e^x \sqrt[9]{x}$
14. $-\cos(x) 6e^x$
15. $-\sin(x) (16x + 1)$
16. $\tan(x) \sqrt[18]{x}$
17. $x^{2008} \cos(x)$
18. $x^{22} 6e^x$
19. $x^{2008} (-\cos(x))$
20. $\frac{1}{x} (-\sin(x))$
21. $\tan(x) \sqrt{x}$
22. $\cot(x) \sqrt[9]{x}$
23. $\frac{1}{x} \cos(x)$
24. $\sqrt[3]{x} \csc(x)$
25. $\sqrt[20]{x} (-\cos(x))$
26. $e^x \sec(x)$
27. $-\sin(x) (-\cos(x))$
28. $\sin(x) \left(\frac{1}{x}\right)$
29. $\cot(x) \left(\frac{1}{x}\right)$
30. $\frac{1}{x} \tan(x)$
31. $\sqrt[20]{x} (-\sin(x))$
32. $-\cos(x) (16x + 1)$
33. $\sqrt{x} \tan(x)$
34. $\frac{1}{x} 10e^x$
35. $\sqrt{x} \cot(x)$
36. $\sqrt[18]{x} \csc(x)$
37. $\sqrt[19]{x} \sqrt{x}$
38. $\sqrt[3]{x} (-\cos(x))$
39. $\cot(x) \sqrt{x}$
40. $e^x \sqrt{x}$
41. $\sqrt[18]{x} (-\cos(x))$
42. $\cos(x) \sqrt{x}$
43. $\frac{1}{x} \csc(x)$
44. $\tan(x) \sec(x)$
45. $\sin(x) (-5x^2 + 14x + 3)$
46. $-\cos(x) \sqrt{x}$
47. $\tan(x) (3x^3 + 4)$
48. $\sqrt{x} e^x$
49. $\cos(x) (3x^3 + 4)$
50. $x^{22} (-\cos(x))$
51. $\sqrt[19]{x} \tan(x)$
52. $\sqrt{x} \cos(x)$
53. $x^{81} \cos(x)$
54. $\sqrt[19]{x} \csc(x)$
55. $-\cos(x) \csc(x)$
56. $\sqrt{x} (-\cos(x))$
57. $x^{100} \csc(x)$
58. $\sqrt{x} \sec(x)$
59. $-\sin(x) \tan(x)$
60. $\frac{1}{x} \sin(x)$

Solutions:

1. $\left(\frac{-1}{x^2}\right) \cot(x) + \frac{1}{x}(-\csc^2(x))$
2. $100x^{99}10e^x + x^{100}10e^x$
3. $(-\cos(x))\left(\frac{1}{x}\right) + -\sin(x)\left(\frac{-1}{x^2}\right)$
4. $(-\sin(x))(-\sin(x)) + \cos(x)(-\cos(x))$
5. $(-\sin(x))\tan(x) + \cos(x)\sec^2(x)$
6. $\cos(x)\sec(x) + \sin(x)\sec(x)\tan(x)$
7. $2008x^{2007}\sin(x) + x^{2008}\cos(x)$
8. $\left(\frac{1}{3\sqrt[3]{x^2}}\right)\sin(x) + \sqrt[3]{x}\cos(x)$
9. $100x^{99}\sec(x) + x^{100}\sec(x)\tan(x)$
10. $2008x^{2007}\cot(x) + x^{2008}(-\csc^2(x))$
11. $(-\csc^2(x))\csc(x) + \cot(x)(-\csc(x)\cot(x))$
12. $81x^{80}\cot(x) + x^{81}(-\csc^2(x))$
13. $e^x\sqrt[9]{x} + e^x\left(\frac{1}{9\sqrt[9]{x^8}}\right)$
14. $\sin(x)6e^x + -\cos(x)6e^x$
15. $(-\cos(x))(16x+1) + -\sin(x)(16)$
16. $\sec^2(x)\sqrt[18]{x} + \tan(x)\left(\frac{1}{18\sqrt[18]{x^{17}}}\right)$
17. $2008x^{2007}\cos(x) + x^{2008}(-\sin(x))$
18. $22x^{21}6e^x + x^{22}6e^x$
19. $2008x^{2007}(-\cos(x)) + x^{2008}\sin(x)$
20. $\left(\frac{-1}{x^2}\right)(-\sin(x)) + \frac{1}{x}(-\cos(x))$
21. $\sec^2(x)\sqrt{x} + \tan(x)\frac{1}{2\sqrt{x}}$
22. $(-\csc^2(x))\sqrt[9]{x} + \cot(x)\left(\frac{1}{9\sqrt[9]{x^8}}\right)$
23. $\left(\frac{-1}{x^2}\right)\cos(x) + \frac{1}{x}(-\sin(x))$
24. $\left(\frac{1}{3\sqrt[3]{x^2}}\right)\csc(x) + \sqrt[3]{x}(-\csc(x)\cot(x))$
25. $\left(\frac{1}{20\sqrt[20]{x^{19}}}\right)(-\cos(x)) + \sqrt[20]{x}\sin(x)$
26. $e^x\sec(x) + e^x\sec(x)\tan(x)$
27. $(-\cos(x))(-\cos(x)) + -\sin(x)\sin(x)$
28. $\cos(x)\left(\frac{1}{x}\right) + \sin(x)\left(\frac{-1}{x^2}\right)$
29. $(-\csc^2(x))\left(\frac{1}{x}\right) + \cot(x)\left(\frac{-1}{x^2}\right)$
30. $\left(\frac{-1}{x^2}\right)\tan(x) + \frac{1}{x}\sec^2(x)$
31. $\left(\frac{1}{20\sqrt[20]{x^{19}}}\right)(-\sin(x)) + \sqrt[20]{x}(-\cos(x))$
32. $\sin(x)(16x+1) + -\cos(x)(16)$
33. $\left(\frac{1}{2\sqrt{x}}\right)\tan(x) + \sqrt{x}\sec^2(x)$
34. $\left(\frac{-1}{x^2}\right)10e^x + \frac{1}{x}10e^x$
35. $\left(\frac{1}{2\sqrt{x}}\right)\cot(x) + \sqrt{x}(-\csc^2(x))$
36. $\left(\frac{1}{18\sqrt[18]{x^{17}}}\right)\csc(x) + \sqrt[18]{x}(-\csc(x)\cot(x))$
37. $\left(\frac{1}{19\sqrt[19]{x^{18}}}\right)\sqrt{x} + \sqrt[19]{x}\frac{1}{2\sqrt{x}}$
38. $\left(\frac{1}{3\sqrt[3]{x^2}}\right)(-\cos(x)) + \sqrt[3]{x}\sin(x)$
39. $(-\csc^2(x))\sqrt{x} + \cot(x)\frac{1}{2\sqrt{x}}$
40. $e^x\sqrt{x} + e^x\frac{1}{2\sqrt{x}}$
41. $\left(\frac{1}{18\sqrt[18]{x^{17}}}\right)(-\cos(x)) + \sqrt[18]{x}\sin(x)$
42. $(-\sin(x))\sqrt{x} + \cos(x)\frac{1}{2\sqrt{x}}$
43. $\left(\frac{-1}{x^2}\right)\csc(x) + \frac{1}{x}(-\csc(x)\cot(x))$
44. $\sec^2(x)\sec(x) + \tan(x)\sec(x)\tan(x)$
45. $\cos(x)(-5x^2+14x+3) + \sin(x)(-10x+14)$
46. $\sin(x)\sqrt{x} + -\cos(x)\frac{1}{2\sqrt{x}}$
47. $\sec^2(x)(3x^3+4) + \tan(x)(9x^2)$
48. $\left(\frac{1}{2\sqrt{x}}\right)e^x + \sqrt{x}e^x$
49. $(-\sin(x))(3x^3+4) + \cos(x)(9x^2)$
50. $22x^{21}(-\cos(x)) + x^{22}\sin(x)$
51. $\left(\frac{1}{19\sqrt[19]{x^{18}}}\right)\tan(x) + \sqrt[19]{x}\sec^2(x)$
52. $\left(\frac{1}{2\sqrt{x}}\right)\cos(x) + \sqrt{x}(-\sin(x))$
53. $81x^{80}\cos(x) + x^{81}(-\sin(x))$
54. $\left(\frac{1}{19\sqrt[19]{x^{18}}}\right)\csc(x) + \sqrt[19]{x}(-\csc(x)\cot(x))$
55. $\sin(x)\csc(x) + -\cos(x)(-\csc(x)\cot(x))$
56. $\left(\frac{1}{2\sqrt{x}}\right)(-\cos(x)) + \sqrt{x}\sin(x)$
57. $100x^{99}\csc(x) + x^{100}(-\csc(x)\cot(x))$
58. $\left(\frac{1}{2\sqrt{x}}\right)\sec(x) + \sqrt{x}\sec(x)\tan(x)$
59. $(-\cos(x))\tan(x) + -\sin(x)\sec^2(x)$
60. $\left(\frac{-1}{x^2}\right)\sin(x) + \frac{1}{x}\cos(x)$