

Instructions: Use the product rule to find the derivative of each of the following functions with respect to  $x$ .

1.  $\frac{x-7}{2e^x}$

2.  $\frac{\frac{1}{\sqrt[18]{x}}}{4x^3 + x^2 + 2x - 1}$

3.  $\frac{2x^2 - 5x - 5}{\frac{1}{\sqrt{x}}}$

4.  $\frac{e^x}{2x}$

5.  $\frac{2x^2 - 5x - 5}{x^{2009} + 1}$

6.  $\frac{\sqrt[4]{x}}{e^x}$

7.  $\frac{\sqrt[24]{x^{23}}}{x^{2009} + 1}$

8.  $\frac{-5e^x}{-7x^2 - 7x - 10}$

9.  $\frac{2x^2 - 5x - 5}{-2x^2}$

10.  $\frac{\sqrt[4]{x}}{4x^3 + x^2 + 2x - 1}$

11.  $\frac{x^{2009} + 1}{-8x - 10}$

12.  $\frac{x-7}{2x}$

13.  $\frac{x^{2009} + 1}{2x}$

14.  $\frac{2x^2 - 5x - 5}{\sqrt[4]{x}}$

15.  $\frac{\sqrt[10]{x}}{x^{2009} + 1}$

16.  $\frac{\frac{1}{\sqrt{x}}}{e^x}$

17.  $\frac{2x^2 - 5x - 5}{\sqrt{x}}$

18.  $\frac{\sqrt[4]{x}}{-7x^2 - 7x - 10}$

19.  $\frac{x-7}{e^x}$

20.  $\frac{-5e^x}{\sqrt[32]{x^{31}}}$

21.  $\frac{-5e^x}{\frac{1}{\sqrt[4]{x}}}$

22.  $\frac{2x^2 - 5x - 5}{-8x - 10}$

23.  $\frac{x-7}{-7x^2 - 7x - 10}$

24.  $\frac{e^x}{-2x^2}$

25.  $\frac{x-7}{\frac{1}{\sqrt{x}}}$

26.  $\frac{-x^3 - 5x^2 - 5x - 6}{-2x^2}$

27.  $\frac{x-7}{\sqrt[32]{x^{31}}}$

28.  $\frac{-5e^x}{-2x^2}$

29.  $\frac{\sqrt[4]{x}}{x^{2009} + 1}$

30.  $\frac{e^x}{-8x - 10}$

31.  $\frac{x^{2009} + 1}{-7x^2 - 7x - 10}$

32.  $\frac{2x^2 - 5x - 5}{-7x^2 - 7x - 10}$

33.  $\frac{x-7}{4x^3 + x^2 + 2x - 1}$

34.  $\frac{e^x}{\frac{1}{\sqrt[4]{x}}}$

35.  $\frac{-5e^x}{\sqrt[32]{x}}$

36.  $\frac{-x^3 - 5x^2 - 5x - 6}{-8x - 10}$

37.  $\frac{x^{2009} + 1}{e^x}$

38.  $\frac{-5x}{\frac{1}{\sqrt[4]{x}}}$

39.  $\frac{\sqrt{x}}{2e^x}$

40.  $\frac{\frac{1}{\sqrt[18]{x}}}{e^x}$

41.  $\frac{-5x}{2e^x}$

42.  $\frac{9x^2}{2e^x}$

43.  $\frac{\frac{1}{\sqrt{x}}}{-8x - 10}$

44.  $\frac{e^x}{\sqrt{x}}$

45.  $\frac{2x^2 - 5x - 5}{2x}$

46.  $\frac{-5x}{-7x^2 - 7x - 10}$

47.  $\frac{e^x}{-7x^2 - 7x - 10}$

48.  $\frac{x - 7}{\frac{1}{\sqrt[4]{x}}}$

49.  $\frac{-5e^x}{\sqrt{x}}$

50.  $\frac{x - 7}{-2x^2}$

Solutions:

1.  $\frac{(2e^x)(1) - (x-7)(2e^x)}{(2e^x)^2}$
2.  $\frac{(4x^3 + x^2 + 2x - 1)\left(\frac{-1}{18}x^{-19/18}\right) - \left(\frac{1}{18\sqrt{x}}\right)(12x^2 + 2x + 2)}{(4x^3 + x^2 + 2x - 1)^2}$
3.  $\frac{\left(\frac{1}{\sqrt{x}}\right)(4x - 5) - (2x^2 - 5x - 5)\left(\frac{-1}{2}x^{-3/2}\right)}{\left(\frac{1}{\sqrt{x}}\right)^2}$
4.  $\frac{(2x)(e^x) - (e^x)(2)}{(2x)^2}$
5.  $\frac{(x^{2009} + 1)(4x - 5) - (2x^2 - 5x - 5)(2009x^{2008})}{(x^{2009} + 1)^2}$
6.  $\frac{(e^x)\left(\frac{1}{4}x^{-3/4}\right) - (\sqrt[4]{x})(e^x)}{(e^x)^2}$
7.  $\frac{(x^{2009} + 1)\left(\frac{23}{24}x^{-1/24}\right) - \left(\sqrt[24]{x^{23}}\right)(2009x^{2008})}{(x^{2009} + 1)^2}$
8.  $\frac{(-7x^2 - 7x - 10)(-5e^x) - (-5e^x)(-14x - 7)}{(-7x^2 - 7x - 10)^2}$
9.  $\frac{(-2x^2)(4x - 5) - (2x^2 - 5x - 5)(-4x)}{(-2x^2)^2}$
10.  $\frac{(4x^3 + x^2 + 2x - 1)\left(\frac{1}{4}x^{-3/4}\right) - (\sqrt[4]{x})(12x^2 + 2x + 2)}{(4x^3 + x^2 + 2x - 1)^2}$
11.  $\frac{(-8x - 10)(2009x^{2008}) - (x^{2009} + 1)(-8)}{(-8x - 10)^2}$
12.  $\frac{(2x)(1) - (x-7)(2)}{(2x)^2}$
13.  $\frac{(2x)(2009x^{2008}) - (x^{2009} + 1)(2)}{(2x)^2}$
14.  $\frac{(\sqrt[4]{x})(4x - 5) - (2x^2 - 5x - 5)\left(\frac{1}{4}x^{-3/4}\right)}{(\sqrt[4]{x})^2}$
15.  $\frac{(x^{2009} + 1)\left(\frac{1}{10}x^{-9/10}\right) - (\sqrt[10]{x})(2009x^{2008})}{(x^{2009} + 1)^2}$
16.  $\frac{(e^x)\left(\frac{-1}{2}x^{-3/2}\right) - \left(\frac{1}{\sqrt{x}}\right)(e^x)}{(e^x)^2}$
17.  $\frac{(\sqrt{x})(4x - 5) - (2x^2 - 5x - 5)\left(\frac{1}{2}x^{-1/2}\right)}{(\sqrt{x})^2}$
18.  $\frac{(-7x^2 - 7x - 10)\left(\frac{1}{4}x^{-3/4}\right) - (\sqrt[4]{x})(-14x - 7)}{(-7x^2 - 7x - 10)^2}$
19.  $\frac{(e^x)(1) - (x-7)(e^x)}{(e^x)^2}$
20.  $\frac{\left(\sqrt[32]{x^{31}}\right)(-5e^x) - (-5e^x)\left(\frac{31}{32}x^{-1/32}\right)}{\left(\sqrt[32]{x^{31}}\right)^2}$
21.  $\frac{\left(\frac{1}{\sqrt[4]{x}}\right)(-5e^x) - (-5e^x)\left(\frac{-1}{4}x^{-5/4}\right)}{\left(\frac{1}{\sqrt[4]{x}}\right)^2}$
22.  $\frac{(-8x - 10)(4x - 5) - (2x^2 - 5x - 5)(-8)}{(-8x - 10)^2}$
23.  $\frac{(-7x^2 - 7x - 10)(1) - (x-7)(-14x - 7)}{(-7x^2 - 7x - 10)^2}$
24.  $\frac{(-2x^2)(e^x) - (e^x)(-4x)}{(-2x^2)^2}$
25.  $\frac{\left(\frac{1}{\sqrt{x}}\right)(1) - (x-7)\left(\frac{-1}{2}x^{-3/2}\right)}{\left(\frac{1}{\sqrt{x}}\right)^2}$
26.  $\frac{(-2x^2)(-3x^2 - 10x - 5) - (-x^3 - 5x^2 - 5x - 6)(-4x)}{(-2x^2)^2}$
27.  $\frac{\left(\sqrt[32]{x^{31}}\right)(1) - (x-7)\left(\frac{31}{32}x^{-1/32}\right)}{\left(\sqrt[32]{x^{31}}\right)^2}$
28.  $\frac{(-2x^2)(-5e^x) - (-5e^x)(-4x)}{(-2x^2)^2}$
29.  $\frac{(x^{2009} + 1)\left(\frac{1}{4}x^{-3/4}\right) - (\sqrt[4]{x})(2009x^{2008})}{(x^{2009} + 1)^2}$
30.  $\frac{(-8x - 10)(e^x) - (e^x)(-8)}{(-8x - 10)^2}$
31.  $\frac{(-7x^2 - 7x - 10)(2009x^{2008}) - (x^{2009} + 1)(-14x - 7)}{(-7x^2 - 7x - 10)^2}$
32.  $\frac{(-7x^2 - 7x - 10)(4x - 5) - (2x^2 - 5x - 5)(-14x - 7)}{(-7x^2 - 7x - 10)^2}$
33.  $\frac{(4x^3 + x^2 + 2x - 1)(1) - (x-7)(12x^2 + 2x + 2)}{(4x^3 + x^2 + 2x - 1)^2}$
34.  $\frac{\left(\frac{1}{\sqrt[4]{x}}\right)(e^x) - (e^x)\left(\frac{-1}{4}x^{-5/4}\right)}{\left(\frac{1}{\sqrt[4]{x}}\right)^2}$
35.  $\frac{\left(\sqrt[32]{x}\right)(-5e^x) - (-5e^x)\left(\frac{1}{32}x^{-31/32}\right)}{\left(\sqrt[32]{x}\right)^2}$

$$36. \frac{(-8x - 10)(-3x^2 - 10x - 5) - (-x^3 - 5x^2 - 5x - 6)(-8)}{(-8x - 10)^2}$$

$$37. \frac{(e^x)(2009x^{2008}) - (x^{2009} + 1)(e^x)}{(e^x)^2}$$

$$38. \frac{\left(\frac{1}{\sqrt[4]{x}}\right)(-5) - (-5x)\left(\frac{-1}{4}x^{-5/4}\right)}{\left(\frac{1}{\sqrt[4]{x}}\right)^2}$$

$$39. \frac{(2e^x)\left(\frac{1}{2}x^{-1/2}\right) - (\sqrt{x})(2e^x)}{(2e^x)^2}$$

$$40. \frac{(e^x)\left(\frac{-1}{18}x^{-19/18}\right) - \left(\frac{1}{\sqrt[8]{x}}\right)(e^x)}{(e^x)^2}$$

$$41. \frac{(2e^x)(-5) - (-5x)(2e^x)}{(2e^x)^2}$$

$$42. \frac{(2e^x)(18x) - (9x^2)(2e^x)}{(2e^x)^2}$$

$$43. \frac{(-8x - 10)\left(\frac{-1}{2}x^{-3/2}\right) - \left(\frac{1}{\sqrt{x}}\right)(-8)}{(-8x - 10)^2}$$

$$44. \frac{(\sqrt{x})(e^x) - (e^x)\left(\frac{1}{2}x^{-1/2}\right)}{(\sqrt{x})^2}$$

$$45. \frac{(2x)(4x - 5) - (2x^2 - 5x - 5)(2)}{(2x)^2}$$

$$46. \frac{(-7x^2 - 7x - 10)(-5) - (-5x)(-14x - 7)}{(-7x^2 - 7x - 10)^2}$$

$$47. \frac{(-7x^2 - 7x - 10)(e^x) - (e^x)(-14x - 7)}{(-7x^2 - 7x - 10)^2}$$

$$48. \frac{\left(\frac{1}{\sqrt[4]{x}}\right)(1) - (x - 7)\left(\frac{-1}{4}x^{-5/4}\right)}{\left(\frac{1}{\sqrt[4]{x}}\right)^2}$$

$$49. \frac{(\sqrt{x})(-5e^x) - (-5e^x)\left(\frac{1}{2}x^{-1/2}\right)}{(\sqrt{x})^2}$$

$$50. \frac{(-2x^2)(1) - (x - 7)(-4x)}{(-2x^2)^2}$$