

**Exercises of Derivatives**


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1) Find out the derivative of the following functions:

a)  $y = (3x^4 - 2) \cdot (x^3 + 8)$

b)  $y = 5\sqrt{x}$

c)  $y = 6\sqrt[4]{x}$

d)  $y = -11x^6 \sin x$

e)  $y = 4x \cos x$

f)  $y = 5\sqrt[7]{x}$

g)  $y = 5x^8 e^x$

h)  $y = \frac{\sqrt[3]{x}}{\sqrt[4]{x}}$

2) Find out the derivative of the following functions:

a)  $y = \frac{\cos x}{9x^3}$

b)  $y = \frac{\sin x}{4x}$

c)  $y = 3 \arctan x$

d)  $y = -3 e^x \sqrt{x}$

e)  $y = 8 \arccos x$

f)  $y = \frac{-3x - 2}{\sqrt{x}}$

g)  $y = \frac{\ln x}{3x^3}$

h)  $y = \frac{4x - 8}{\sqrt{x}}$

3) Find out the derivative of the following functions:

a)  $y = \sqrt[5]{6x^3 - 24}$

b)  $y = e^{3x^2 + 8x}$

c)  $y = \frac{1}{(3x + 3)^3}$

d)  $y = \frac{2}{(6x + 8)^5}$

e)  $y = 13x^8 e^{5x}$

f)  $y = \sin(6x^2 - 24)$

g)  $y = \ln(x^4 - 2x^2)$

h)  $y = \arctan(4x^4 + 23)$

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4) Find out the derivative of the following functions:

a)  $y = \sin^5(8x^7 + 14)$

b)  $y = \arctan\left(\frac{5x + 10}{2x + 6}\right)$

c)  $y = \cos^5(10x^6 + 2)$

d)  $y = \ln\sqrt{\frac{9x - 3}{5x + 1}}$

e)  $y = \sqrt{\frac{5x - 2}{x - 5}}$

f)  $y = \frac{4x + 2}{(3x + 2)^4}$

g)  $y = \arctan\left(\frac{9x - 1}{5x + 2}\right)$

h)  $y = \ln\left(\frac{8x + 11}{6x - 1}\right)$

5) Find the derivative of the following functions:

a)  $y = \sqrt{15x}^{11x}$

b)  $y = \sqrt{11x}^{\sin 11x}$

c)  $y = \sqrt{5x}^{\sin 7x}$

d)  $y = (3x)^{4x}$

e)  $y = (5x)^{\sin 8x}$

f)  $y = (\sin 12x)^{6x}$

g)  $y = \sqrt{8x}^{7x}$

6) For each of the following equations, find  $y'$  by implicit differentiation:

a)  $x^6 y + \ln(x + y^3) = 1$

b)  $x^5 y + \sqrt{x + y^8} = -11$

c)  $x^7 y + \frac{7}{1 + 6xy} = -10$

d)  $13x^8 y^7 + 3x^5 y^5 = 4$

e)  $x^2 y^7 + \sin(4xy) = -6$

f)  $x^3 y + \cos(8xy) = 8$

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**Answers:**

1) a)  $y' = 21x^6 + 96x^3 - 6x^2$

b)  $y' = \frac{5}{2\sqrt{x}}$

c)  $y' = \frac{3}{2\sqrt[4]{x^3}}$

d)  $y' = -66x^5 \sin x - 11x^6 \cos x$

e)  $y' = 4(\cos x - x \sin x)$

f)  $y' = \frac{5}{7\sqrt[7]{x^6}}$

g)  $y' = 5x^7 e^x (8 + x)$

h)  $y' = \frac{1}{12\sqrt[12]{x^{11}}}$

2) a)  $y' = \frac{-x \sin x - 3 \cos x}{9x^4}$

b)  $y' = \frac{x \cos x - \sin x}{4x^2}$

c)  $y' = \frac{3}{1 + x^2}$

d)  $y' = -3 e^x \left( \frac{2x + 1}{2\sqrt{x}} \right)$

e)  $y' = \frac{-8}{\sqrt{1 - x^2}}$

f)  $y' = \frac{-3x + 2}{2\sqrt{x^3}}$

g)  $y' = \frac{1 - 3 \ln x}{3x^4}$

h)  $y' = \frac{2x + 4}{\sqrt{x^3}}$

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- 3)
- a)  $y' = \frac{18x^2}{5\sqrt[5]{(6x^3 - 24)^4}}$
- b)  $y' = (6x + 8)e^{3x^2 + 8x}$
- c)  $y' = \frac{-9}{(3x + 3)^4}$
- d)  $y' = \frac{-60}{(6x + 8)^6}$
- e)  $y' = e^{5x}(65x^8 + 104x^7)$
- f)  $y' = 12x \cos(6x^2 - 24)$
- g)  $y' = \frac{4x^2 - 4}{x^3 - 2x}$
- h)  $y' = \frac{16x^3}{1 + (4x^4 + 23)^2}$
- 4)
- a)  $y' = 280x^6 \sin^4(8x^7 + 14) \cos(8x^7 + 14)$
- b)  $y' = \frac{10}{29x^2 + 124x + 136}$
- c)  $y' = -300x^5 \cos^4(10x^6 + 2) \sin(10x^6 + 2)$
- d)  $y' = \frac{4}{15x^2 - 2x - 1}$
- e)  $y' = \frac{-23}{(2x - 10)\sqrt{5x^2 - 27x + 10}}$
- f)  $y' = \frac{-36x - 16}{(3x + 2)^5}$
- g)  $y' = \frac{23}{106x^2 + 2x + 5}$
- h)  $y' = \frac{-74}{48x^2 + 58x - 11}$
- 5)
- a)  $y' = \frac{11}{2} \sqrt{15x}^{11x} (1 + \ln 15x)$
- b)  $y' = \sqrt{11x}^{\sin 11x} \left( \frac{11 \cos 11x \cdot \ln 11x}{2} + \frac{\sin 11x}{2x} \right)$
- c)  $y' = \sqrt{5x}^{\sin 7x} \left( \frac{7 \cos 7x \cdot \ln 5x}{2} + \frac{\sin 7x}{2x} \right)$
- d)  $y' = 4(3x)^{4x} (1 + \ln 3x)$
- e)  $y' = (5x)^{\sin 8x} \left( 8 \cos 8x \cdot \ln 5x + \frac{\sin 8x}{x} \right)$
- f)  $y' = (\sin 12x)^{6x} (6 \ln \sin 12x + 72x \cot 12x)$

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$$6) \quad \text{a) } y' = \frac{-1 - 6x^6 y - 6x^5 y^4}{x^7 + x^6 y^3 + 3y^2}$$

$$\text{c) } y' = \frac{42y - 7x^6 y (1 + 6xy)^2}{(1 + 6xy)^2 x^7 - 42x}$$

$$\text{e) } y' = \frac{-2xy^7 - 4y \cos(4xy)}{7x^2 y^6 + 4x \cos(4xy)}$$

$$\text{b) } y' = \frac{-1 - 10x^4 y \sqrt{x + y^8}}{8y^7 + 2x^5 \sqrt{x + y^8}}$$

$$\text{d) } y' = \frac{-104x^3 y^3 - 15y}{91x^4 y^2 + 15x}$$

$$\text{f) } y' = \frac{-3x^2 y + 8y \sin(8xy)}{x^3 - 8x \sin(8xy)}$$