

# Finding Derivatives Expanded

## Question Bank

1. For the following functions, find their derivatives by first rearranging to a suitable form then by applying the power rule.

a)  $f(x) = 3x^2(2x^3 + x^2)$

f)  $f(x) = 5\sqrt{x}$

b)  $f(x) = 4x^3\left(x^2 - 2x + \frac{3}{2}\right)$

g)  $f(x) = 4\sqrt{x^3}$

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

h)  $f(x) = \frac{8}{3}x\sqrt{x}$

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

i)  $f(x) = \frac{2}{\sqrt{x}}$

e)  $f(x) = x^{-\frac{1}{2}}$

j)  $f(x) = \frac{5}{\sqrt[3]{x^2}}$

2. For each of the following functions find their derivatives.

a)  $f(x) = (4x^3 - 4x)^4$

d)  $f(x) = -5\left(\frac{x^4 - 5x^3}{4}\right)^6$

b)  $f(x) = 2(6x^2 - 3x + 5)^3$

e)  $f(x) = -\frac{2}{3x^2 - 5}$

c)  $f(x) = \left(\frac{x^3}{3} + 4x^2\right)^4$

f)  $f(x) = \frac{1}{2(3x^4 + 2x^2)^2}$

3. For each of the following functions find their derivatives.

a)  $f(x) = (e^x)^3$

e)  $f(x) = 2(-e^x)^3$

b)  $f(x) = (e^x + 4)^4$

f)  $f(x) = \sqrt{e^x}$

c)  $f(x) = \frac{2}{(e^x)^2}$

g)  $f(x) = 5\sqrt[3]{e^x}$

d)  $f(x) = -\frac{2}{e^x}$

h)  $f(x) = \frac{4}{\sqrt{(e^x)^3}}$

4. For each of the following functions find their derivatives.

a)  $f(x) = e^{(x^2)}$

e)  $f(x) = e^{\left(-\frac{1}{x^2}\right)}$

b)  $f(x) = e^{(x^3)}$

f)  $f(x) = e^{(x^3-3x^2)}$

c)  $f(x) = 2^{(3x^2)}$

g)  $f(x) = 10^{\sqrt{x}}$

d)  $f(x) = 3^{\left(\frac{1}{x}\right)}$

h)  $f(x) = 2^{\sqrt{x^3}}$

5. For each of the following functions find their derivatives.

a)  $f(x) = (x^2 + 3)e^x$

d)  $f(x) = (e^{(3x^2)} + 4x)(x^2 - 2x)$

b)  $f(x) = (2x^3 + 4x^2)e^x$

e)  $f(x) = (x^2 + 2)^3 e^x$

c)  $f(x) = 10x^2(1 - e^{-3x})$

f)  $f(x) = (9x^3 + 2x)^4 e^{3x}$

6. For each of the following functions find their derivatives.

a)  $f(x) = \ln(3x^2)$

e)  $f(x) = 3(\ln(x))^3$

b)  $f(x) = \ln(x^3 + 4x^2)$

f)  $f(x) = -17(\ln(x))^7$

c)  $f(x) = \ln\left(4x^3 + \frac{2}{x}\right)$

g)  $f(x) = (\ln(2x^3 + 3))^8$

d)  $f(x) = \ln\left(\frac{3}{4x^4 + 2x^2}\right)$

h)  $f(x) = 4(\ln(4x^2 - 8))^4$

7. For each of the following functions find their derivatives.

a)  $f(x) = (4x^9 + 8x^5 + 2)\ln(x)$

d)  $f(x) = (x^2 + 3x - 28)\ln(x - 4)$

b)  $f(x) = (7x^4 + 2x^2)\ln(2x)$

e)  $f(x) = (3x + 5)^4 \ln(3x + 5)$

c)  $f(x) = (x + 4)^4 \ln(4x)$

f)  $f(x) = (5x^4 + 3x)^3 \ln(5x^4 + 3x)$

## Answers

1.
  - a)  $f'(x) = 30x^4 + 12x^3$  or  $6x^3(5x+2)$
  - b)  $f'(x) = 20x^4 - 8x^3 + 18x^2$  or  $2x^2(10x^2 - 4x + 9)$
  - c)  $f'(x) = \frac{1}{2}x^{-\frac{1}{2}}$  or  $\frac{1}{2\sqrt{x}}$
  - d)  $f'(x) = \frac{1}{2}x^{-\frac{1}{3}}$  or  $\frac{1}{2\sqrt[3]{x}}$
  - e)  $f'(x) = -\frac{1}{2}x^{-\frac{3}{2}}$  or  $-\frac{1}{2\sqrt{x^3}}$
  - f)  $f'(x) = \frac{5}{2\sqrt{x}}$
  - g)  $f'(x) = 6\sqrt{x}$
  - h)  $f'(x) = 4\sqrt{x}$
  - i)  $f'(x) = -\frac{1}{\sqrt{x^3}}$
  - j)  $f'(x) = -\frac{10}{3\sqrt[3]{x^5}}$
2.
  - a)  $f'(x) = 16(3x^2 - 1)(4x^3 - 4x)^3$
  - b)  $f'(x) = 18(4x - 1)(6x^2 - 3x + 5)^2$
  - c)  $f'(x) = 4(x^2 + 8x)\left(\frac{x^3}{3} + 4x^2\right)^3$
  - d)  $f'(x) = -\frac{15}{2}(4x^3 - 15x^2)\left(\frac{x^4 - 5x^3}{4}\right)^5$
  - e)  $f'(x) = \frac{12x}{(3x^2 - 5)^2}$
  - f)  $f'(x) = -\frac{4x(3x^2 + 1)}{(3x^4 + 2x^2)^3}$
3.
  - a)  $f'(x) = 3e^{3x}$
  - b)  $f'(x) = 4e^x(e^x + 4)^3$
  - c)  $f'(x) = -\frac{4}{e^{2x}}$  or  $-4e^{-2x}$
  - d)  $f'(x) = 2e^{-x}$
  - e)  $f'(x) = 6(-e^x)^3$
  - f)  $f'(x) = \frac{1}{2}e^{\frac{x}{2}}$
  - g)  $f'(x) = \frac{5}{3}e^{\frac{x}{3}}$
  - h)  $f'(x) = 6e^{\frac{3x}{2}}$
4.
  - a)  $f'(x) = 2xe^{(x^2)}$
  - b)  $f'(x) = 3x^2e^{(x^3)}$
  - c)  $f'(x) = 3\ln(2)x2^{(3x^2)}$
  - d)  $f'(x) = -\frac{\ln(3)}{x^2}3^{\left(\frac{1}{x}\right)}$

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

$$\text{g) } f'(x) = \frac{\ln(10)}{2\sqrt{x}} 10^{\sqrt{x}}$$

$$\text{f) } f'(x) = (3x^2 - 6x)e^{(x^3-3x^2)}$$

$$\text{h) } f'(x) = \frac{3\ln(2)\sqrt{x}}{2} 2^{\sqrt{x^3}}$$

$$5. \quad \text{a) } f'(x) = (x^2 + 2x + 3)e^x$$

$$\text{b) } f'(x) = 2(x^3 + 5x^2 + 4x)e^x$$

$$\text{c) } f'(x) = 10x(2 + (3x - 2)e^{-3x})$$

$$\text{d) } f'(x) = x(13x - 24)e^{(3x^2)} + 4(x^3 - 2x^2 + 2x - 2)$$

$$\text{e) } f'(x) = (x^2 + 2)^2(x^2 + x + 2)e^x$$

$$\text{f) } f'(x) = (9x^3 + 2x)^3(27x^3 + 108x^2 + 6x + 8)e^{3x}$$

$$6. \quad \text{a) } f'(x) = \frac{6}{3x}$$

$$\text{e) } f'(x) = \frac{12}{x}(\ln(x))^3$$

$$\text{b) } f'(x) = \frac{3x + 8}{x^2 + 4x}$$

$$\text{f) } f'(x) = -\frac{119}{x}(\ln(x))^6$$

$$\text{c) } f'(x) = \frac{6x^4 + 1}{4x^5 + 2x}$$

$$\text{g) } f'(x) = \frac{48x^2}{2x^3 + 3}(\ln(2x^3 + 3))^7$$

$$\text{d) } f'(x) = -\frac{16x^2 + 4}{4x^3 + 2x}$$

$$\text{h) } f'(x) = \frac{32x}{x^2 - 2}(\ln(4x^2 - 8))^3$$

$$7. \quad \text{a) } f'(x) = 4(9x^8 + 10x^4)\ln(x) + \frac{2(2x^9 + 4x^5 + 1)}{x}$$

$$\text{b) } f'(x) = 4(7x^3 + x)\ln(2x) + x(7x^2 + 2)$$

$$\text{c) } f'(x) = (x + 4)^3 \left( 4\ln(4x) + 1 + \frac{4}{x} \right)$$

$$\text{d) } f'(x) = (2x + 3)\ln(x - 4) + x + 7$$

$$\text{e) } f'(x) = 3(3x + 5)^3(4\ln(3x + 5) + 1)$$

$$\text{f) } f'(x) = (20x^3 + 3)(5x^4 + 3x)^2(3\ln(5x^4 + 3x) + 1)$$