

Derivative exercises

Note: This is a supplement material and is NOT a replacement for class notes.

1. Solve the following derivatives using the power rule:

(a) $5x$

(b) x^2

(c) $5x^5$

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

(e) $\sqrt{x}$

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

2. Solve the following derivatives using the sum rule:

(a) $y = 3x + 5$

(b) $y = 5x + 2$

(c) $y = 7x^2 + 13$

(d) $y = 9x^2 + 4x$

(e) $y = 11x^2 + 13x + 17$

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

(g) $y = 5x^5 + 4x^4 + 3x^3 + 2x^2 + x + 1$

(h) $y = 12\sqrt{x} + \frac{5}{x} + 10x^{\frac{5}{7}} + x + 1$

3. Solve the following derivatives using the chain rule:

(a) $y = (4x + 3)^5$

(b) $y = x^2 + 4x + 4$

(c) $y = (x^2 + 2x + 2)^4$

(d) $y = (27x^3 + 27x^2 + 9x + 1)^2$

(e) $y = \sqrt{x^2 + 4}$

(f) $y = \frac{1}{x^3 + 8}$

(g) $y = \sqrt{1 - \sqrt{x + 1}}$

(h) $y = \frac{1}{1 - \frac{1}{x+1}}$

4. Solve the following derivatives using the product rule:

(a) $y = x(x + 1)$

(b) $y = x^2 + 3x + 2$ (factor first)

(c) $y = (2x + 1)(5x + 3)$

(d) $y = (x^2 + 2x + 2)(x + 2)$

(e) $y = (x^2 + 3x + 3)(2x^2 + 2x + 1)$

(f) $y = x^2(3x + 4)(4x + 5)$

(g) $y = (x^2 + 1)(4x^2 + 4x + 1)(3x^2 + 6x + 10)$

(h) $y = (\sqrt{x} + 1)\left(\frac{1}{x^3} - 1\right)$

5. Solve the following derivatives using quotient rule:

(a) $y = \frac{x}{x + 1}$

(b) $y = \frac{2x + 1}{2x + 3}$

(c) $y = \frac{x^2 - 1}{x^2 + 2x + 1}$

(d) $y = \frac{x^2 + 2x + 2}{x + 1}$

(e) $y = \frac{x}{x^2 + 1}$

(f) $y = \frac{x + 2\sqrt{x} + 1}{\sqrt{x} + 1}$



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(g) $y = \frac{1 + \frac{2}{x} + \frac{1}{x^2}}{\frac{1}{x^2} + 1}$ (There's a trick to make it "easier")

(h) $y = \frac{x^{\frac{3}{5}}}{3 + \frac{1}{\sqrt[3]{x}}}$



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Answers

1. (a) $y' = 5$
 (b) $y' = 2x$
 (c) $y' = 25x^4$
 (d) $y' = \frac{3}{2}x^{\frac{1}{2}}$ or $y' = \frac{3}{2}\sqrt{x}$
2. (a) $y' = 3$
 (b) $y' = 5$
 (c) $y' = 14x$
 (d) $y' = 18x + 4$
 (e) $y' = 22x + 13$
3. (a) $y' = 20(4x + 3)^4$
 (b) $y' = 2(x + 2)$
 (c) $y' = 4(x^2 + 2x + 2)^3(2x + 2)$ or $8(x^2 + 2x + 2)^3(x + 1)$
 (d) $y' = 2(27x^3 + 27x^2 + 9x + 1)(81x^2 + 54x + 9)$ or $18(27x^3 + 27x^2 + 9x + 1)(9x^2 + 6x + 1)$
 (e) $y' = \frac{x}{\sqrt{x^2 + 4}}$
4. (a) $y' = 2x + 1$
 (b) $y' = 2x + 3$
 (c) $y' = 2(5x + 3) + 5(2x + 1)$ or $20x + 11$
 (d) $y' = (2x + 2)(x + 2) + x^2 + 2x + 2$ or $3x^2 + 8x + 6$
 (e) $y' = (2x + 3)(2x^2 + 2x + 1) + (x^2 + 3x + 3)(4x + 2)$
 (f) $y' = 2x(3x + 4)(4x + 5) + 3x^2(4x + 5) +$
5. (a) $y' = \frac{1}{(x + 1)^2}$
 (b) $y' = \frac{4}{(2x + 3)^2}$
 (c) $y' = \frac{2}{(x + 1)^2}$
- (e) $y' = \frac{1}{2}x^{-\frac{1}{2}}$ or $y' = \frac{1}{2\sqrt{x}}$
 (f) $y' = -2x^{-3}$ or $\frac{-2}{x^3}$
 (f) $y' = 2x + 3$
 (g) $y' = 25x^4 + 16x^3 + 9x^2 + 4x + 1$
 (h) $y' = 6x^{-\frac{1}{2}} - 5x^{-2} + \frac{50}{7}x^{-\frac{2}{7}} + 1$ or $\frac{6}{\sqrt{x}} - \frac{5}{x^2} + \frac{50}{7\sqrt[7]{x^2}} + 1$
 (f) $y' = -\frac{3x^2}{(x^3 + 8)^2}$
 (g) $y' = -\frac{1}{4\sqrt{(1 - \sqrt{x + 1})(x + 1)}}$
 (h) $y' = -\frac{1}{(1 - \frac{1}{x+1})^2(x + 1)^2}$ or $-\frac{1}{x^2}$
 $4x^2(3x + 4)$
 (g) $y' = 2x(4x^2 + 4x + 1)(3x^2 + 6x + 10) + (x^2 + 1)(8x + 4)(3x^2 + 6x + 10) + (x^2 + 1)(4x^2 + 4x + 1)(6x + 6)$
 (h) $y' = \frac{1}{2}x^{-\frac{1}{2}}(\frac{1}{x^3} - 1) + (\sqrt{x} + 1)(-3x^{-4})$ or $y' = \frac{1}{2\sqrt{x}}(\frac{1}{x^3} - 1) + (\sqrt{x} + 1)(\frac{-3}{x^4})$
 (d) $y' = \frac{x(x + 2)}{(x + 1)^2}$
 (e) $y' = \frac{1 - x^2}{(1 + x^2)^2}$
 (f) $y' = \frac{(1 + \frac{1}{\sqrt{x}})(\sqrt{x} + 1) - \frac{1}{2\sqrt{x}}(x + 2\sqrt{x} + 1)}{(\sqrt{x} + 1)^2}$



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$$(g) \ y' = -\frac{2(x^2 - 1)}{(x^2 + 1)^2}$$

$$(h) \ y' = \frac{27\sqrt[3]{x} + 14}{15(3\sqrt[3]{x} + 1)^2 \sqrt[15]{x}}$$



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