

Topic 12: Chain Rule

Find the derivative of each function.

1. $f(x) = \sqrt{x^2 + 4}$

2. $f(x) = (x^3 + x - 1)^5$

3. $f(x) = \sin(2x^2 + 3)$

4. $f(x) = \sin^4 x$

5. $f(x) = \tan^2 x$

6. $f(x) = e^{1/3x}$

7. $f(x) = \ln(x^3 + 3x)$

8. $f(x) = x^2 \sin 4x$

9. $f(x) = \frac{\sin x^2}{x^2}$

10. $f(x) = \sin(\ln(\cos x^3))$

11. $f(x) = \sqrt{\sin x^2}$

12. $f(x) = [\ln(x^2 + 1)]^8$

13. $f(x) = \cos\left(\frac{4x}{x^2 + 1}\right)$

Answers

$$1) f'(x) = x(x^2 + 4)^{-1/2}$$

$$2) f'(x) = 5(3x^2 + 1)(x^3 + x - 1)^4$$

$$3) f'(x) = 4x \cos(2x^2 + 3)$$

$$4) f'(x) = 4 \sin^3 x \cos x$$

$$5) f'(x) = 2 \tan x \sec^2 x$$

$$6) f'(x) = \frac{-1}{3x^2} e^{1/3x}$$

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

$$8) f'(x) = 4x^2 \cos 4x + 2x \sin 4x$$

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

$$10) f'(x) = -3x^2 \tan x^3 \cos(\ln(\cos x^3))$$

$$11) f'(x) = (\sin x^2)^{-1/2} (x \cos x^2)$$

$$12) f'(x) = \frac{16x [\ln(x^2 + 1)]^7}{x^2 + 1}$$

$$13) f'(x) = \frac{4x^2 - 4}{(x^2 + 1)^2} \sin\left(\frac{4x}{x^2 + 1}\right)$$