# The Chain Rule

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Write the function in the form y = f(u) and u = g(x). Then find dy/dx as a function of x.**

1) $y = (2x + 10)^3$ 1) _____

A) $y = u^3$; $u = 2x + 10$; $\frac{dy}{dx} = 2(2x + 10)^3$

B) $y = u^3$; $u = 2x + 10$; $\frac{dy}{dx} = 6(2x + 10)^2$

C) $y = 3u + 10$; $u = x^3$; $\frac{dy}{dx} = 6x^2$

D) $y = u^3$; $u = 2x + 10$; $\frac{dy}{dx} = 3(2x + 10)^2$

2) $y = \left(5x^2 - \frac{6}{x} - x\right)^8$ 2) _____

A) $y = u^8$; $u = 5x^2 - \frac{6}{x} - x$; $\frac{dy}{dx} = 8\left(5x^2 - \frac{6}{x} - x\right)^7$

B) $y = 5u^2 - \frac{6}{u} - u$; $u = x^8$; $\frac{dy}{dx} = 10x^{16} - \frac{6}{x^8} - x^8$

C) $y = u^8$; $u = 5x^2 - \frac{6}{x} - x$; $\frac{dy}{dx} = 8\left(10x + \frac{6}{x^2} - 1\right)^7$

D) $y = u^8$; $u = 5x^2 - \frac{6}{x} - x$; $\frac{dy}{dx} = 8\left(5x^2 - \frac{6}{x} - x\right)^7\left(10x + \frac{6}{x^2} - 1\right)$

3) $y = \cos^4 x$ 3) _____

A) $y = u^4$; $u = \cos x$; $\frac{dy}{dx} = 4\cos^3 x \sin x$

B) $y = \cos u$; $u = x^4$; $\frac{dy}{dx} = -4x^3 \sin(x^4)$

C) $y = u^4$; $u = \cos x$; $\frac{dy}{dx} = -4\cos^3 x \sin x$

D) $y = \cos u$; $u = x^4$; $\frac{dy}{dx} = -\sin(x^4)$

4) $y = \cot(3x - 8)$ 4) _____

A) $y = \cot u$; $u = 3x - 8$; $\frac{dy}{dx} = -3\cot(3x - 8)\csc(3x - 8)$

B) $y = \cot u$; $u = 3x - 8$; $\frac{dy}{dx} = -\csc^2(3x - 8)$

C) $y = \cot u$; $u = 3x - 8$; $\frac{dy}{dx} = -3\csc^2(3x - 8)$

D) $y = 3u - 8$; $u = \cot x$; $\frac{dy}{dx} = -3\cot x \csc^2 x$

5) $y = \csc(\cot x)$ 5) _____

A) $y = \csc u;\ u = \cot x;\ \frac{dy}{dx} = \csc^3 x \cot x$

B) $y = \cot u;\ u = \csc x;\ \frac{dy}{dx} = \csc^2(\csc x) \csc x \cot x$

C) $y = \csc u;\ u = \cot x;\ \frac{dy}{dx} = \csc(\cot x) \cot(\cot x) \csc^2 x$

D) $y = \csc u;\ u = \cot x;\ \frac{dy}{dx} = -\csc(\cot x) \cot(\cot x)$

**Find the derivative of the function.**

6) $s = \sin\left(\frac{5\pi t}{2}\right) - \cos\left(\frac{5\pi t}{2}\right)$ 6) _____

A) $\cos\left(\frac{5\pi t}{2}\right) + \sin\left(\frac{5\pi t}{2}\right)$

B) $-\frac{5\pi}{2}\cos\left(\frac{5\pi t}{2}\right) - \frac{5\pi}{2}\sin\left(\frac{5\pi t}{2}\right)$

C) $\frac{5\pi}{2}\cos\left(\frac{5\pi t}{2}\right) - \frac{5\pi}{2}\sin\left(\frac{5\pi t}{2}\right)$

D) $\frac{5\pi}{2}\cos\left(\frac{5\pi t}{2}\right) + \frac{5\pi}{2}\sin\left(\frac{5\pi t}{2}\right)$

7) $q = \sqrt{17r - r^5}$ 7) _____

A) $\frac{17 - 5r^4}{2\sqrt{17r - r^5}}$ B) $\frac{1}{2\sqrt{17 - 5r^4}}$ C) $\frac{-5r^4}{\sqrt{17r - r^5}}$ D) $\frac{1}{2\sqrt{17r - r^5}}$

8) $r = (\sec\theta + \tan\theta)^{-3}$ 8) _____

A) $-3(\sec\theta + \tan\theta)^{-4}(\tan^2\theta + \sec\theta\tan\theta)$

B) $-3(\sec\theta\tan\theta + \sec^2\theta)^{-4}$

C) $\frac{-3\sec\theta}{(\sec\theta + \tan\theta)^3}$

D) $-3(\sec\theta + \tan\theta)^{-4}$

**Find dy/dt.**

9) $y = 3t(5t + 2)^4$ 9) _____

A) $3(25t + 2)^3$

B) $3(5t + 2)^3$

C) $3(5t + 2)^3(25t + 2)$

D) $3(5t + 2)^4(9t + 2)$

10) $y = 4t(2t + 3)^5$ 10) _____

A) $4(2t + 3)^4(12t + 3)$

B) $4(2t + 3)^5(7t + 3)$

C) $4(12t + 3)^4$

D) $4(2t + 3)^4$

**Find $D_x y$.**

11) $y = 3x(4x + 3)^3$ 11) _____

A) $3(4x + 3)^2(16x + 3)$

B) $3(16x + 3)^2$

C) $3(4x + 3)^2$

D) $3(4x + 3)^3(7x + 3)$

**Find the derivative of the function.**

12) $h(x) = \left(\frac{\cos x}{1 + \sin x}\right)^4$ 12) _____

A) $-4\left(\frac{\sin x}{\cos x}\right)^3$

B) $\left(-\frac{4 \sin x}{\cos x}\right)\left(\frac{\cos x}{1 + \sin x}\right)^3$

C) $4\left(\frac{\cos x}{1 + \sin x}\right)^3$

D) $\frac{-4 \cos^3 x}{(1 + \sin x)^4}$

**Find dy/dt.**

13) $y = \cos^3(\pi t - 12)$ 13) _____

A) $3 \cos^2(\pi t - 12)$

B) $-3 \cos^2(\pi t - 12) \sin(\pi t - 12)$

C) $-3\pi \cos^2(\pi t - 12) \sin(\pi t - 12)$

D) $-3\pi \sin^2(\pi t - 12)$

14) $y = \cos^4(\pi t - 15)$ 14) _____

A) $-4 \cos^3(\pi t - 15) \sin(\pi t - 15)$

B) $-4\pi \cos^3(\pi t - 15) \sin(\pi t - 15)$

C) $4 \cos^3(\pi t - 15)$

D) $-4\pi \sin^3(\pi t - 15)$

15) $y = (1 + \sin 11t)^{-4}$ 15) _____

A) $-4(1 + \sin 11t)^{-5} \cos 11t$

B) $-44(1 + \sin 11t)^{-5} \cos 11t$

C) $-44(\cos 11t)^{-5}$

D) $-4(1 + \sin 11t)^{-5}$

16) $y = (1 + \sin 9t)^{-5}$ 16) _____

A) $-45(\cos 9t)^{-6}$

B) $-45(1 + \sin 9t)^{-6} \cos 9t$

C) $-5(1 + \sin 9t)^{-6}$

D) $-5(1 + \sin 9t)^{-6} \cos 9t$

17) $y = \cos(\sqrt{8t + 12})$ 17) _____

A) $-\sin\left(\frac{4}{\sqrt{8t + 12}}\right)$

B) $-\sin(\sqrt{8t + 12})$

C) $-\frac{1}{2\sqrt{8t + 12}} \sin(\sqrt{8t + 12})$

D) $\frac{4}{\sqrt{8t + 12}} \sin(\sqrt{8t + 12})$

**Find $y''$.**

18) $y = 6 \sin(2x + 10)$ 18) _____

A) $-12 \sin(2x + 10)$

B) $-24 \cos(2x + 10)$

C) $12 \cos(2x + 10)$

D) $-24 \sin(2x + 10)$

19) $y = \frac{1}{4} \tan(10x - 4)$ 19) _____

A) $\frac{1}{2} \sec^2(10x - 4) \tan(10x - 4)$

B) $50 \sec^2(10x - 4) \tan(10x - 4)$

C) $\frac{5}{2} \sec^2(10x - 4)$

D) $\frac{1}{2} \sec(10x - 4)$

Answer Key
Testname: THE CHAIN RULE

1) B
2) D
3) C
4) C
5) C
6) D
7) A
8) C
9) C
10) A
11) A
12) D
13) C
14) B
15) B
16) B
17) D
18) D
19) B