

Math 215 - Derivatives

Note: You will **not** be given the general rules or the derivatives of the trigonometric functions on the test. They are given here for instructional value only.

General Rules

1. If $f(x) = c$, c is a constant, then $f'(x) = 0$. (The derivative of a constant is zero.)
2. If $f(x) = x^r$, then $f'(x) = rx^{r-1}$. (Power Rule)
3. If c is a constant, then $[cf(x)]' = cf'(x)$.
4. $[f(x) + g(x)]' = f'(x) + g'(x)$. (The derivative of the sum is the sum of the derivatives.)
5. $[f(x) \cdot g(x)]' = f'(x) \cdot g(x) + g'(x) \cdot f(x)$. (Product Rule)
6. $\left[\frac{f(x)}{g(x)}\right]' = \frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{[g(x)]^2}$. (Quotient Rule)
7. $[f(g(x))]' = f'(g(x)) \cdot g'(x)$ or $\frac{d}{dx} [f(g(x))] = \frac{d}{dg} (f(g(x))) \cdot \frac{d}{dx} (g(x))$.
(Chain Rule)

Derivatives of Trigonometric Functions

1. $\frac{d}{dx}(\sin x) = \cos x$
2. $\frac{d}{dx}(\cos x) = -\sin x$
3. $\frac{d}{dx}(\tan x) = \sec^2 x$
4. $\frac{d}{dx}(\csc x) = -\csc x \cot x$
5. $\frac{d}{dx}(\sec x) = \sec x \tan x$
6. $\frac{d}{dx}(\cot x) = -\csc^2 x$

Practice Problems - Calculate the derivatives of the following functions.

1. $f(x) = \sqrt[3]{x} + \frac{1}{\sqrt[3]{x}}$
2. $f(x) = (x + 2)^8(x + 3)^6$

3. $f(x) = \frac{x}{\sqrt{9-4x}}$
4. $f(x) = \left(x + \frac{1}{x^2}\right)^{\sqrt{7}}$
5. $f(x) = (1 - x^{-1})^{-1}$
6. $f(\theta) = \sec(2\theta)$
7. $f(t) = \frac{-2}{\sqrt[4]{t^3}}$
8. $f(x) = \sqrt[5]{\tan x}$
9. $f(x) = \sin(\cos x)$
10. $f(x) = \frac{1}{\sqrt[3]{x + \sqrt{x}}}$
11. $f(x) = \frac{(x-1)(x-4)}{(x-2)(x-3)}$
12. $f(x) = \sqrt{\sin \sqrt{x}}$
13. $f(x) = \tan \sqrt{1-x}$
14. $f(x) = \frac{1}{\sin(x - \sin x)}$
15. $f(x) = \sin(\tan \sqrt{1+x^3})$
16. $f(x) = \frac{(x+\lambda)^4}{x^4 + \lambda^4}$, where λ is a constant.
17. $f(x) = \cot(3x^2 + 5)$
18. $f(x) = \frac{\sin mx}{x}$, where m is a constant.
19. $f(x) = \cos^2(\tan x)$
20. $x^2y^3 + 3y^2 = x - 4y$
21. $y\sqrt{x-1} + x\sqrt{y-1} = xy$
22. $x^2 = y(y+1)$
23. $x \tan y = y - 1$