

Derivative Rules - Math 141

(You will not be able to use this on quizzes or exams)

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$$\frac{d}{dx}(cf(x)) = cf'(x); \quad \frac{d}{dx}(f \pm g(x)) = f'(x) \pm g'(x)$$

(1) (Power Rule)

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

(2) (Exponent Rule)

$$\frac{d}{dx}(a^x) = \ln a \cdot a^x; \quad \frac{d}{dx}(e^{kx}) = ke^{kx}$$

(3) (Logarithm Rule)

$$\frac{d}{dx}(\log_a(x)) = \frac{1}{x \ln a}; \quad \frac{d}{dx}(\ln x) = \frac{1}{x}$$

(4) (Trig Rules)

$$\frac{d}{dx}(\sin x) = \cos x; \quad \frac{d}{dx}(\cos x) = -\sin x$$

The derivatives of the remaining 4 basic trig functions can be deduced from the derivatives of $\sin x$ and $\cos x$ along with the Product, Chain and Quotient rules below. Space has been left for you to derive these yourselves.

(5) (Product Rule)

$$\frac{d}{dx}(f \cdot g(x)) = f'(x)g(x) + f(x)g'(x)$$

(6) (Chain Rule)

$$\frac{d}{dx}(f(g(x))) = f'(g(x))g'(x)$$

(7) (Quotient Rule)

$$\frac{d}{dx}\left(\frac{f}{g}(x)\right) = \frac{g(x)f'(x) - f(x)g'(x)}{g^2(x)}$$

(8) (Inverse Trig Rules)

$$\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}; \quad \frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}} \quad \text{when } |x| < 1$$

$$\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}; \quad \frac{d}{dx}(\cot^{-1} x) = -\frac{1}{1+x^2} \quad \text{when } x \in \mathbb{R}$$

$$\frac{d}{dx}(\sec^{-1} x) = \frac{1}{|x|\sqrt{x^2-1}}; \quad \frac{d}{dx}(\csc^{-1} x) = -\frac{1}{|x|\sqrt{x^2-1}} \quad \text{when } |x| > 1$$