Advanced Derivative Rules
4.2 – Derivatives & Trigonometry

Derivatives of the Six Trigonometric Functions

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

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

$$\frac{d}{dx}\sec(x) = \sec(x)\tan(x)$$

$$\frac{d}{dx}\csc(x) = -\csc(x)\cot(x)$$

$$\frac{d}{dx}\tan(x) = \sec^2(x)$$

$$\frac{d}{dx}\cot(x) = -\csc^2(x)$$

Basic Identities

Reciprocal Identities: The following trig identities hold for all values of *A* except those for which any function is undefined.

$$\sin(x) = \frac{1}{\csc(x)} \qquad \csc(x) = \frac{1}{\sin(x)}$$
$$\cos(x) = \frac{1}{\sec(x)} \qquad \sec(x) = \frac{1}{\cos(x)}$$
$$\tan(x) = \frac{1}{\cot(x)} \qquad \cot(x) = \frac{1}{\tan(x)}$$

Quotient Identities: The following trig identities hold for all values of *A* except those for which any function is undefined.

$$\tan(x) = \frac{\sin(x)}{\cos(x)} \qquad \cot(x) = \frac{\cos(x)}{\sin(x)}$$

Pythagorean Identities: The following trig identities hold for all values of *A* except those for which any function is undefined.

$$\sin^2(x) + \cos^2(x) = 1$$

$$\tan^2(x) + 1 = \sec^2(x)$$

$$1 + \cot^2(x) = \csc^2(x)$$

Even & Odd Trig Functions

Recall that an even function is said to be even if its symmetric with respect to the y-axis, f(x) = f(-x).

$$\cos(-x) = \cos(x)$$

Recall that an odd function is said to be odd if it is symmetric with respect to the origin,–f(x) = f(-x).

$$\sin(-x) = -\sin(x)$$

$$\tan(-x) = -\tan(x)$$

Ex A: Differentiating using the Chain Rule.

#1) $\frac{d}{dx}[\sin^4(x)]$

#2) $\frac{d}{dx}[\sin(x^4)]$

#3) $\frac{d}{dx}[\cos^4(x)]$

#4) $\frac{d}{dx}[\cos(x^4)]$

Ex B: Differentiating using the Product Rule.

#5) $\frac{d}{dx}(x^4\sin(x))$

Advanced Derivative Rules
4.2 – Derivatives & Trigonometry

#6) If $f(x) = \sin(x)\sec(x)$, find $f'(x)$.

#8) Use the identity $\cot(x) = \frac{\cos(x)}{\sin(x)}$ to prove $\frac{d}{dx}\cot(x) = -\csc^2(x)$

Ex C: Differentiating using the Quotient Rule.

#7) If $y = \frac{x^2}{\sin(x)}$, find y'.

#9) Differentiating using Regret, Sadness and a heavy dose of Eraser.

If $y = \frac{\tan(x)}{\sin(x)}$, find y'.