

## 3.5 Derivatives of Trigonometric Functions

### Derivatives of sine and cosine

EXAMPLE: Let  $f(x) = \sin(x)$ . Find  $f'(x)$  by using the limit process.

### Derivatives for sine and cosine

$$\frac{d}{dx}[\sin x] = \cos x \quad \text{and} \quad \frac{d}{dx}[\cos x] = -\sin x$$

EXAMPLE: Given  $f(x) = 4x - 5\cos x$ , find  $f'(x)$ .

EXAMPLE: Given  $f(\theta) = \pi \sin \theta + \frac{1}{3\sqrt{\theta}}$ , find  $f'(\theta)$ .

EXAMPLE: Given  $f(\theta) = \theta^2 \sin \theta - 3\cos \theta$ , find  $f'(\theta)$ .

EXAMPLE: Given  $p = \frac{\cos q}{q^3}$ , find  $\frac{dp}{dq}$ .

EXAMPLE: Use the quotient rule to find  $\frac{dr}{d\theta}$  if  $r = \frac{\cos \theta}{1 + \sin \theta}$ .

EXAMPLE: Given  $y = \tan x$ , find  $y'$ .

### Derivatives of Trig Functions

$$\frac{d}{dx}[\tan x] = \sec^2 x \quad \frac{d}{dx}[\cot x] = -\csc^2 x \quad \frac{d}{dx}[\sec x] = \sec x \tan x \quad \frac{d}{dx}[\csc x] = -\csc x \cot x$$

EXAMPLE: Find  $y'$  if  $y = \frac{\sec x}{x}$ .

EXAMPLE: Given  $M(x) = (\cos x + 2 \sin x) \csc x$ , find  $M'(x)$ .

EXAMPLE: Find  $y''$  given  $y = -3\sec x$ . Write your answer in terms of secant only.

EXAMPLE: Determine the point(s) at which  $y = x + \cos x$  has a horizontal tangent line on  $[0, 2\pi]$ .