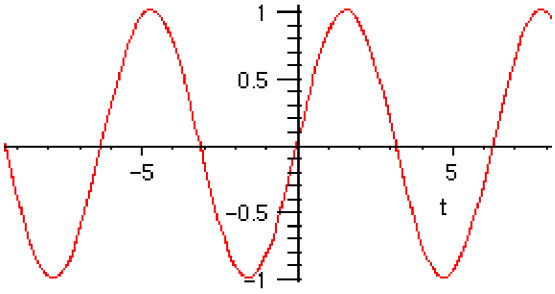
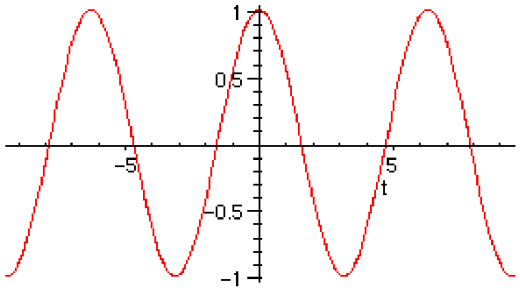
Calculus & Analytic Geometry I

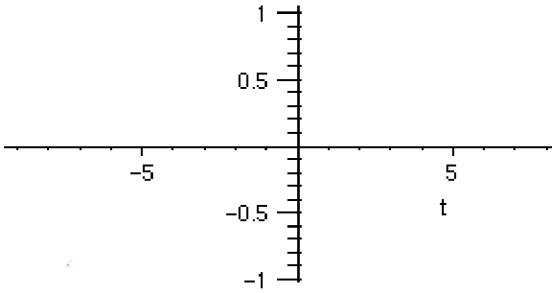
The Derivative: Analytic Viewpoint

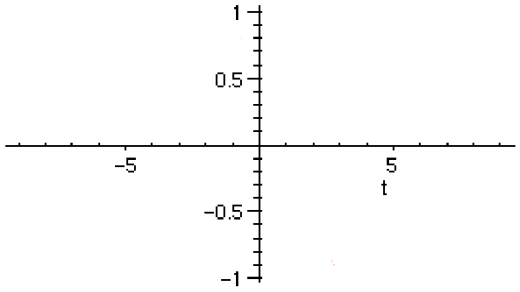
Recall the graphs of your favorite trig functions...





Now sketch their derivative functions based one where they are increasing, decreasing, or have a slope of zero.





So we conjecture that

$\frac{d}{dx}\sin x =$ $\qquad\qquad$ $\frac{d}{dx}\cos x =$

Apply this knowledge.

1. Find $\frac{d}{d\theta}\left(\theta\sin\theta+\cos\theta\right)$.

2. Find $[(\sin t+\cos t)(\sin t-\cos t)]'$.

3. Find the derivatives for the remaining trigonometric functions.

$(\tan x)' =$ $(\sec x)' =$

$(\cot x)' =$ $(\csc x)' =$

Last but not least, it is time to analytically verify that $\frac{d}{dx}\sin x = \cos x$ and $\frac{d}{dx}\cos x = -\sin x$. Recall the sum formulas:

$\sin(x+h) = \sin(x)\cos(h) + \sin(h)\cos(x)$ $\cos(x+h) = \cos(x)\cos(h) - \sin(x)\sin(h)$

$$\sin'(x) = \lim_{h\to 0} \frac{\sin(x+h) - \sin(x-h)}{2h}$$

$$\cos'(x) = \lim_{h\to 0} \frac{\cos(x+h) - \cos(x-h)}{2h}$$