

1. Find the following derivatives.

a. $\frac{d}{dx} \left(\frac{1}{3} x^3 - \cos x \right)$

b. $\frac{d}{dx} x^3 \cos x$

c. $\frac{d}{dx} \frac{x^3}{\tan x}$

2. Find the equation of the tangent line at the indicated point.

a. $y = \cos t, \quad t = \frac{\pi}{3}$

b. $y = \csc x, \quad x = \frac{\pi}{4}$

3. Show that both $y = \cos x$ and $y = \sin x$ satisfy $y'' = -y$

4. Calculate the first five derivatives of $f(x) = \cos x$ then determine the 8th and 37th derivatives of $f(x) = \cos x$

Jerk

Jerk is the derivative of acceleration. If a body's position at time t is $s(t)$, the body's jerk at time t is

$$j(t) = \frac{da}{dt} = \frac{d^3s}{dt^3}$$

6. A body is moving in simple harmonic motion with position function $s = f(t)$ (s in meters, t in seconds). Find the jerk at time t given $s = 2 + 3 \sin t$.
7. Find the values of x on the interval $(0, 2\pi)$ where the tangent line to the graph of $f(x) = \sin x \cos x$ is horizontal. Check your solutions on your graphing calculator.