

1. Find the limits:

$$\lim_{x \rightarrow 0} \frac{x^2 - 3x}{-3x^2 + 2x}$$

$$\lim_{x \rightarrow -\infty} \frac{2x^3 - x^2 + 1}{x^2}$$

$$\lim_{x \rightarrow 0} \frac{3 \sin(2x)}{\sin(-3x)}$$

2. Find the derivatives:

$$\frac{d}{dx} \cos \sqrt{x}$$

$$\frac{d}{dx} \frac{x^2}{x^3 - 1}$$

$$\frac{d}{dr} \sqrt[3]{\cos(r^2 - r^{-2})}$$

$$\frac{d}{dt} \int_1^t \sin(3x^2 - 1) dx$$

3. A stone thrown upwards from the roof of a 28 ft. tall building is at the height $h(t) = 28 + 48t - 16t^2$ ft. at time t seconds. Find when the stone will fall back to the ground, and what will be its velocity at that moment.
4. Find the absolute minimum and maximum of $f(t) = t\sqrt{4-t^2}$ on the interval $[-1, 2]$.
5. A rectangle is inscribed in a right triangle with legs of length 3 and 4 so that one of its vertices lies on the hypotenuse. Find which rectangle has the largest possible area.
6. Given that u is a function of x which satisfies the relation $xu^2 - \sin u = 2x$, express the derivative $\frac{du}{dx}$ in terms of u and x

7. Find the antiderivatives:

$$\int \frac{x^2 + 1}{\sqrt[3]{x}} dx$$

$$\int \frac{\cos \sqrt{x}}{\sqrt{x}} dx$$

$$\int 2 \sec(x) \tan(x) - \sec^2(2x) dx$$