

Question #52184, Math, Vector Calculus

Find the differential coefficient of $y = \sin 3x$

a)	$3\cos 3x$
b)	$3\sin x$
c)	$\cos(-3x)$
d)	$\cos 3x$

Solution

In mathematics, **the differential coefficient of a function** $y(x)$ is what is now called its derivative $\frac{dy(x)}{dx}$,

the (not necessarily constant) multiplicative factor or coefficient of the differential dx in the differential $dy(x)$.

When the differential coefficient of a function of x has been found, the result, being a function of x , may be also differentiated, which gives the differential coefficient of the differential coefficient, or, as it is called, the second differential coefficient. Similarly the differential coefficient of the second differential coefficient is called the third differential coefficient, and so on.

The function	$y = \sin 3x$
The differential coefficient	$\frac{dy}{dx} = \frac{d(\sin 3x)}{d(3x)} \frac{d(3x)}{dx} = \cos 3x \cdot 3 = 3\cos 3x$
The second differential coefficient	$\frac{d^2 y}{dx^2} = \frac{d}{dx} \frac{dy}{dx} = \frac{d(3\cos 3x)}{d(3x)} \frac{d(3x)}{dx} = -3\sin 3x \cdot 3 = -9\sin 3x$
The third differential coefficient	$\frac{d^3 y}{dx^3} = \frac{d}{dx} \frac{d^2 y}{dx^2} = \frac{d(-9\sin 3x)}{d(3x)} \frac{d(3x)}{dx} = -9\cos 3x \cdot 3 = -27\cos 3x$

Answer: a) $\frac{dy}{dx} = 3\cos 3x$.