

11 09-30-2025

11.1 Section 4.5, Checkpoint 4.23

Calculate $\frac{dz}{dt}$ given the following functions. Express your final answer in terms of t .

$$z = f(x, y) = x^2 - 3xy + 2y^2$$

$$x = x(t) = 3 \sin 2t$$

$$y = y(t) = 4 \cos 2t$$

11.2 Section 4.5, Exercise 253

The radius of a right circular cone is increasing at 3 cm/min whereas the height of the cone is decreasing at 2 cm/min. Find the rate of change of the volume of the cone when the radius is 13 cm and the height is 18 cm.

11.3 Section 4.5, Example 4.30

- (a) Calculate $\frac{dy}{dx}$ if y is defined implicitly as a function of x via the equation

$$3x^2 - 2xy + y^2 + 4x - 6y - 11 = 0$$

What is the equation of the tangent line to the graph of this curve at point $(2, 1)$?

- (b) Calculate $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$, given $x^2e^y - yze^x = 0$.

11.4 Section 4.6, Example 4.31

Let $\theta = \arccos(\frac{3}{5})$. Find the directional derivative $D_u f(x, y)$ of $f(x, y) = x^2 - xy + 3y^2$ in the direction of $u = \cos \theta \hat{i} + \sin \theta \hat{j}$. What is $D_u f(-1, 2)$?

Use the definition of directional derivative (x-h defn)

11.5 Section 4.6, Example 4.32

Let $\theta = \arccos(\frac{3}{5})$. Find the directional derivative $D_u f(x, y)$ of $f(x, y) = x^2 - xy + 3y^2$ in the direction of $u = \cos \theta \hat{i} + \sin \theta \hat{j}$. What is $D_u f(-1, 2)$?

Use the partial derivatives

11.6 Section 4.6, Checkpoint 4.30

Find the direction for which the directional derivative of $g(x, y) = 4x - xy + 2y^2$ at $(-2, 3)$ is a maximum. What is the maximum value?