Department of biology

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((GENERAL MATHEMATICS))

1ˢᵗ stage

Week 10- lecture 10

Partial Derivatives
المشتقات الجزئية

By

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Partial Derivatives

Partial derivatives are derivatives of functions with multiple variables, where we focus on differentiating with respect to one variable while treating the others as constants.

For example, if we have a function $f(x, y)$, we can compute the partial derivative with respect to x or y.

> **Notation**

1. Partial derivative of $f(x, y)$ with respect to x:

$$\frac{\partial f}{\partial x}$$

2. Partial derivative of $f(x, y)$ with respect to y:

$$\frac{\partial f}{\partial y}$$

Examples:-

1. $f(x, y) = x + y$**:**

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 1$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 1$$

2. $f(x, y) = 2x + 3y$**:**

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 2$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 3$$

3. $f(x, y) = x^2 + y$**:**

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 2x$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 1$$

4. $f(x, y) = x + y^2$**:**

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 1$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 2y$$

5. $f(x, y) = 5x - 4y$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 5$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = -4$$

6. $f(x, y) = x^2 + y^2$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 2x$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 2y$$

7. $f(x, y) = 3x + 2y + 1$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 3$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 2$$

8. $f(x, y) = 7x$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 7$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 0$$

9. $f(x, y) = x + y^2$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 1$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 2y$$

10. $f(x, y) = 10x + 20y$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 10$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 20$$

11. $f(x, y, z) = x + y + z$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 1$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 1$$

- Partial derivative with respect to z:

$$\frac{\partial f}{\partial z} = 1$$

12. $f(x, y, z) = x^2 + y^2 + z^2$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 2x$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 2y$$

- Partial derivative with respect to z:

$$\frac{\partial f}{\partial z} = 2z$$

13. $f(x, y) = 3x^2 + 2y^2 + 7$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 6x$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 4y$$

14. $f(x, y) = x^3 + y^3$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 3x^2$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = 3y^2$$

15. $f(x, y) = 7x - 4y$:

- Partial derivative with respect to x:

$$\frac{\partial f}{\partial x} = 7$$

- Partial derivative with respect to y:

$$\frac{\partial f}{\partial y} = -4$$