



# Calculus 1 Workbook

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Implicit differentiation

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MATH

## IMPLICIT DIFFERENTIATION

- 1. Use implicit differentiation to find  $dy/dx$  at  $(3,4)$ .

$$4x^3 - 3xy^2 + y^3 = 28$$

- 2. Use implicit differentiation to find  $dy/dx$ .

$$5x^3 + xy^2 = 4x^3y^3$$

- 3. Use implicit differentiation to find  $dy/dx$ .

$$3x^2 = (3xy - 1)^2$$

- 4. Use implicit differentiation to find  $dy/dx$ .

$$\sin(2x + 5y) = \cos^2 x + \cos^2 y$$

- 5. Use implicit differentiation to find  $dy/dx$ .

$$e^{2xy} = 3x^3 - \ln(xy^2)$$

- 6. Use implicit differentiation to find  $dy/dx$  at  $(0, -5)$ .



$$\frac{2x - y^3}{y + x^2} = 5x - 4$$



## EQUATION OF THE TANGENT LINE WITH IMPLICIT DIFFERENTIATION

- 1. Use implicit differentiation to find the equation of the tangent line to  $5y^2 = 2x^3 - 5y + 6$  at  $(3,3)$ .
- 2. Use implicit differentiation to find the equation of the tangent line to  $5x^3 = -3xy + 4$  at  $(2, -6)$ .
- 3. Use implicit differentiation to find the equation of the tangent line to  $4y^2 + 8 = 3x^2$  at  $(6, -5)$ .
- 4. Use implicit differentiation to find the equation of the tangent line to  $2x + 3y - 5 = \ln(x^5 + y^5)$  at  $(1,0)$ .
- 5. Use implicit differentiation to find the equations of the tangent and normal line to  $\cos x = \sin(2y) + 9$  at  $(\pi/2, \pi)$ .
- 6. Use implicit differentiation to find the equation of the tangent line to  $4x^2 - xy + y^2 = 6$  at the points in the second and third quadrant when  $x = -1$ .



## HIGHER-ORDER DERIVATIVES

- 1. Find the second and third derivatives of the function at  $x = -1$ .

$$y = 2x^5 - 3x^4 + x^3 + x^2 - 7$$

- 2. Find the second derivative of the function  $y = -3x^{\frac{2}{3}} + x^{-\frac{1}{2}}$ .

- 3. Find the second derivative of the function.

$$y = -3x^7 \sin x$$

- 4. Find the second and the third derivatives of the function.

$$y = \ln(x^5 \sqrt{x})$$

- 5. Find the second derivative of the function.

$$y = \frac{2x}{\sin(x^2)}$$

- 6. Find the second derivative of the function at  $x = 0$ .



$$y = \frac{e^x}{4x - 9}$$



## SECOND DERIVATIVES WITH IMPLICIT DIFFERENTIATION

- 1. Use implicit differentiation to find  $d^2y/dx^2$ .

$$2x^3 = 2y^2 + 4$$

- 2. Use implicit differentiation to find  $d^2y/dx^2$ .

$$4x^2 = 2y^3 + 4y - 2$$

- 3. Use implicit differentiation to find  $d^2y/dx^2$  at (0,3).

$$3x^2 + 3y^2 = 27$$

- 4. Use implicit differentiation to find  $d^2y/dx^2$  at (2,1).

$$e^{x-2y} = 2x - y$$

- 5. Use implicit differentiation to find  $y''$ .

$$y \sin x = 7 - 2y^2$$

- 6. Use implicit differentiation to find  $y''$  at (0,3).



$$e^{2y} - 2x = y^4 - 2$$





