

# Questions: Multivariate implicit differentiation

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## Summary

A selection of questions for the study guide on multivariate implicit differentiation.

*Before attempting these questions, it is highly recommended that you read [Guide: Multivariate implicit differentiation](#).*

## Q1

Decide whether the following equations represent explicit or implicit functions.

1.1.  $x^3 + y^3 - 6xy = 0$

1.2.  $y = 3x^2 + 2x - 5$

1.3.  $y = \frac{4x}{x-1}$

1.4.  $x^2 + y^2 - 9 = 0$

1.5.  $y = \sqrt{x^2 + 4}$

1.6.  $x^2 + y^2 - 25 = 0$

1.7.  $x + y = 4$

1.8.  $x^2 + y^2 + 2xy = 4$

1.9.  $x^2 - 3y = 7$

1.10.  $x^3 + 2xy + y^2 = 10$

## Q2

Use the multivariate implicit differentiation rule to find  $\frac{dy}{dx}$  for each equation of the form  $w = f(x, y) = 0$ , where  $y$  is defined implicitly as a function of  $x$ .

2.1.  $x^2 + y^2 - 25 = 0$

2.2.  $x^3y + y^3 - 7 = 0$

- 2.3.  $x^2 - \frac{3y+2}{y-1} = 0$
- 2.4.  $\sin(xy) + x = y$
- 2.5.  $xe^y + y^2 = 4$
- 2.6.  $x^2y - 3xy^2 + 5 = 0$
- 2.7.  $\ln(x) + \ln(y) = 1$
- 2.8.  $\tan^{-1}\left(\frac{y}{x}\right) - x^2 = 0$
- 2.9.  $y^3 + \cos(xy) = x$
- 2.10.  $x \sin(y) + y \cos(x) = 0$
- 2.11.  $x^2 + 2xy + y^2 - 1 = 0$
- 2.12.  $e^{xy} + x - y = 0$
- 2.13.  $x^3 + y^3 - 3xy - 7 = 0$
- 2.14.  $\sqrt{x} + y^2 - 3 = 0$
- 2.15.  $\frac{x+y}{x-y} - \ln(x) = 0$

### Q3

Use the multivariate implicit differentiation rule to find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$  for each equation of the form  $w = f(x, y, z) = 0$ , where  $z$  is defined implicitly as a function of  $x$  and  $y$ .

- 3.1.  $x^2 + y^2 + z^2 = 1$
- 3.2.  $4x^2 + 3y^2z^2 - 5x^2y + 2z^3 - 7 = 0$
- 3.3.  $xyz = 1$
- 3.4.  $e^{xz} + y - z = 0$
- 3.5.  $\sin(xz) + \cos(yz) - 2 = 0$
- 3.6.  $\ln(x) + \ln(y) + \ln(z) - 1 = 0$
- 3.7.  $x^3 + y^3 + z^3 - 3xyz = 0$
- 3.8.  $x^2z + y^2z + \sqrt{z} - 4 = 0$
- 3.9.  $e^x + y^2z - \tan^{-1}(z) = 0$
- 3.10.  $\ln(xz) + xy - z = 0$
- 3.11.  $xe^{yz} + ye^{xz} - 5 = 0$
- 3.12.  $\sin(x) \cos(z) + yz^2 - 1 = 0$

3.13.  $x^2 + ye^z + z = 0$

3.14.  $\frac{x+y}{z} + \ln(z) - 3 = 0$

3.15.  $\sqrt{xyz} + x - y - z = 0$

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[After attempting the questions above, please click this link to find the answers.](#)

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## Version history and licensing

v1.0: initial version created 05/25 by Donald Campbell as part of a University of St Andrews VIP project.

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