

# Questions: Multivariate implicit differentiation

Donald Campbell

## 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

Let  $z = f(x, y) = 0$  and define  $y$  as an implicit function of  $x$ .

For each function, use the multivariate implicit differentiation rule to find  $\frac{dy}{dx}$ .

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

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

1.3.  $x^2 - \frac{3y+2}{y-1} = 0$

1.4.  $\sin(xy) + x = y$

1.5.  $xe^y + y^2 = 4$

1.6.  $x^2y - 3xy^2 + 5 = 0$

1.7.  $\ln(x) + \ln(y) = 1$

1.8.  $\tan^{-1}\left(\frac{y}{x}\right) - x^2 = 0$

1.9.  $y^3 + \cos(xy) = x$

1.10.  $x \sin(y) + y \cos(x) = 0$

1.11.  $x^2 + 2xy + y^2 - 1 = 0$

1.12.  $e^{xy} + x - y = 0$

1.13.  $x^3 + y^3 - 3xy - 7 = 0$

1.14.  $\sqrt{x} + y^2 - 3 = 0$

1.15.  $\frac{x+y}{x-y} - \ln(x) = 0$

## Q2

Let  $w = f(x, y, z) = 0$  and define  $z$  as an implicit function of  $x$  and  $y$ .

For each function, use the multivariate implicit differentiation rule to find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$ .

2.1.  $4x^2 + 3y^2z^2 - 5x^2y + 2z^3 - 7 = 0$

2.2.  $x^2 + y^2 + z^2 = 1$

2.3.  $xyz = 1$

2.4.  $e^{xz} + y - z = 0$

2.5.  $\sin(xz) + \cos(yz) - 2 = 0$

2.6.  $\ln(x) + \ln(y) + \ln(z) - 1 = 0$

2.7.  $x^3 + y^3 + z^3 - 3xyz = 0$

2.8.  $x^2z + y^2z + \sqrt{z} - 4 = 0$

2.9.  $e^x + y^2z - \tan^{-1}(z) = 0$

2.10.  $\ln(xz) + xy - z = 0$

2.11.  $xe^{yz} + ye^{xz} - 5 = 0$

2.12.  $\sin(x) \cos(z) + yz^2 - 1 = 0$

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

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

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

---

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

---

## Version history and licensing

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

[This work is licensed under CC BY-NC-SA 4.0.](#)