

**Question 8**

Consider the equation:

$$\ln(x + y) + x^2y = y^2 + 3x + \ln 2 - 3$$

- (a) Use implicit differentiation to find  $\frac{dy}{dx}$ .
- (b) Find the slope of the tangent line to the curve at the point  $(1, 1)$ .

**Question 8 - Solution**

At  $(1, 1)$  both sides of the corrected equation equal  $\ln 2 + 1$ .

**(a) Implicit derivative**

Differentiating (with  $x + y > 0$ ) gives

$$\frac{1 + y'}{x + y} + 2xy + x^2y' = 2yy' + 3.$$

Therefore

$$y' = \frac{3 - 2xy - 1/(x + y)}{1/(x + y) + x^2 - 2y}.$$

**(b) Tangent slope**

At  $(1, 1)$  the numerator is  $1/2$  and the denominator is  $-1/2$ , hence the slope is  $\boxed{-1}$ .