

## Answer on Question #45841 – Math - Vector Calculus

### Problem:

Find the direction in which the function  $f = x^2 - y^2 + xy$  decreases most rapidly at the point (1,1).

### Solution:

The direction of the fastest decrease is given by the anti-gradient. So let's find the gradient of  $f$ :

$$\begin{aligned}f'_x &= (x^2 - y^2 + xy)'_x = 2x + y \\f'_y &= (x^2 - y^2 + xy)'_y = -2y + x \\grad(f) &= (2x + y, x - 2y)^T\end{aligned}$$

At the point (1,1) this is:

$$grad(f)|_{x=1,y=1} = (2 \cdot 1 + 1, 1 - 2 \cdot 1) = (3, -1)$$

Then the fastest decrease is in the reverse direction (anti-gradient)  $(-3, 1)$ .