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6. Practice Exam

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6

2.0/2 points (ungraded)

Let c be the curve $x^2 + xy + 2y^2 = 4$. The point $(1, 1)$ is in the curve c.

Find a vector which is normal to c at $(1, 1)$.

[3,5] ✔ **Answer:** [3,5]

Then find a vector which is tangent to c at $(1, 1)$.

[5,-3] ✔ **Answer:** [5,-3]

? INPUT HELP

Solution:

Let $f(x, y) = x^2 + xy + 2y^2$. Hence c is the level curve of f given by $f(x, y) = 4$. We know that $\nabla f(1, 1)$ will be normal to c at $(1, 1)$. Computing f_x and f_y gives

$$f_x = 2x + y \qquad f_y = x + 4y$$

Hence a normal vector will be

$$\nabla f(1, 1) = \boxed{\langle 3, 5 \rangle.}$$

To find a tangent vector, we must rotate the normal vector by 90 degrees; this gives $\boxed{\langle -5, 3 \rangle}$ as a tangent vector.

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Answers are displayed within the problem

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