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sandipan\_dey ~

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\* Course / Review / Practice exam (untimed, with solutions)

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7

1.0/1 point (ungraded)

Let c be the curve  $x^2 + xy + y^2 = 3$ . (This is not the same curve as in the previous problem.) Let f(x,y) = x. Find the point of the curve c where f is maximal.

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#### Solution:

Let  $g(x,y)=x^2+xy+y^2$ . We seek to maximize the target function f(x,y)=x subject to the constraint g(x,y)=3. Setting up the Lagrange equation

$$abla g = \lambda 
abla f$$

gives

$$\left(egin{array}{c} 2x+y \ x+2y \end{array}
ight)=\lambda\left(egin{array}{c} 1 \ 0 \end{array}
ight).$$

This becomes the two equations

$$2x + y = \lambda,$$
  
 $x + 2y = 0.$ 

The second equation tells us that x=-2y. Substituting this into the constraint equation  $x^2+xy+y^2=3$  then gives

$$egin{aligned} 3 &= x^2 + xy + y^2 = (-2y)^2 + (-2y)\,y + y^2 \ &= 4y^2 - 2y^2 + y^2 \ &= 3y^2 \ &\Longrightarrow y = \pm 1. \end{aligned}$$

$$(x,y) = \pm (2,-1)$$
.

Evaluating the target function f(x,y)=x at these two points gives that the maximum must either be f(2,-1)=2 or f(-2,1)=-2. Therefore the maximum value is 2 and it is attained at the point (2,-1).

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**1** Answers are displayed within the problem

#### 7. Practice Exam

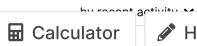
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