

<u>Help</u>

sandipan\_dey ~

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Part A due Oct 5, 2021 20:30 IST



**Practice** 

#### 5A-8

1/1 point (graded)

Let  $f(x,y)=x^3+y^2+xy$ . Suppose that a point is moving through the plane. At time t, the point is at  $(x(t),y(t))=(t^2,e^{t-1})$ . Use linear approximation to estimate the change in f as t goes from f to f. In other words, approximate

$$f\left( x\left( 1.01
ight) ,y\left( 1.01
ight) 
ight) -f\left( x\left( 1
ight) ,y\left( 1
ight) 
ight) .$$

Hint: Use the chain rule.

0.11

**✓ Answer:** 0.11

#### **Solution:**

We want to compute df where  $f\left(x,y
ight)=x^{3}+y^{2}+xy$  and  $\left(x\left(t
ight),y\left(t
ight)
ight)=(t^{2},e^{t-1})$  .

We compute the differential of f using the chain rule:

$$df = \left(\frac{\partial f}{\partial x}\frac{dx}{dt} + \frac{\partial f}{\partial y}\frac{dy}{dt}\right) dt. \tag{6.271}$$

We compute the partial derivatives and derivatives we need to evaluate this.

$$\frac{\partial f}{\partial x} = 3x^2 + y \tag{6.272}$$

$$\frac{\partial f}{\partial y} = 2y + x \tag{6.273}$$

$$x'(t) = 2t ag{6.274}$$

$$y'(t) = e^{t-1}$$
 (6.275)

To evaluate these partial derivatives at time t=1, we need to know that  $x\left(1\right)=1$ , and  $y\left(1\right)=1$ .

Thus

$$\Delta f = \frac{\partial f}{\partial x} \frac{dx}{dt} + \frac{\partial f}{\partial y} \frac{dy}{dt} dt \tag{6.276}$$

$$\Delta f \approx \left( (3(1)^2 + 1) \, 2 + (2(1) + 1) \, (1) \right) \Delta t = (8 + 3) \, \Delta t = 11 \Delta t.$$
 (6.277)

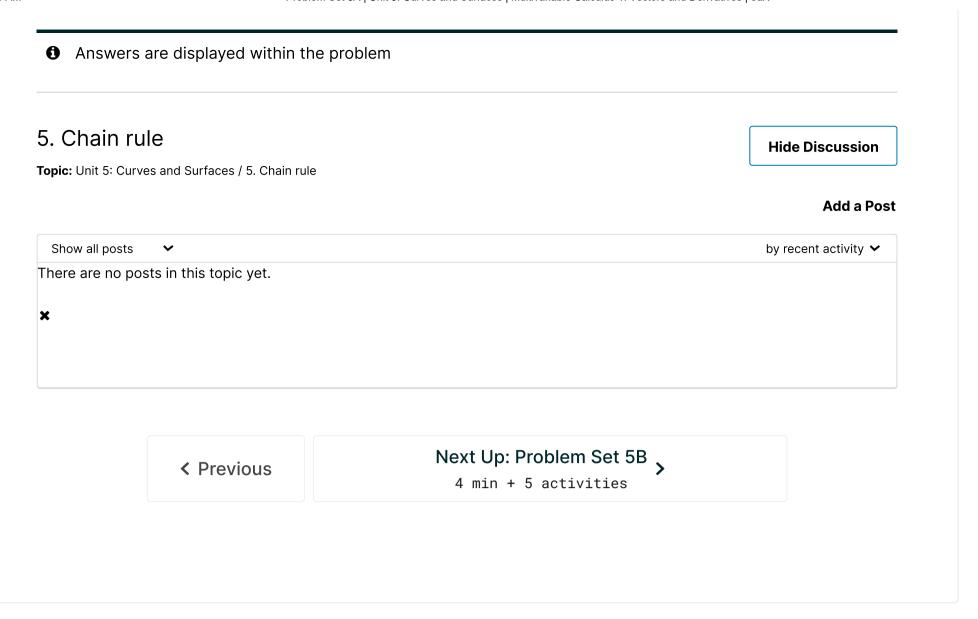
This tells us that

$$f(x(1.01), y(1.01)) - f(x(1), y(1)) \approx 11(0.01) = 0.11$$

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You have used 1 of 5 attempts





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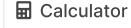


















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