Homework Help: Calculus 2

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or

1. Si \(r(t)= \) cost, sent, \(t \), entonces \(\lim _{\top}(t \rightarrow \pi / 4) r(t) \)
2. e un cuerpo en movimiento en el tiempo t , es \(r(t)=\left(3 \operatorname{cost}, 3 \operatorname{sen} t, t^{2}\right) \), encuentre la rapidez del cuerpo cuando \(t=2 \), en que tiempo son ortogonales la velocidad \(y \) aceleración del cuerpo?

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1. Si $r(t) = \text{cost, sent, } t$, entonces $\lim_{\top}(t \to \pi/4) r(t)$
2. e un cuerpo en movimiento en el tiempo t , es $r(t) = (3\,\text{cost}, 3\,\text{sen}\,t, t^2)$, encuentre la rapidez del cuerpo cuando $t = 2$, en que tiempo son ortogonales la velocidad y aceleración del cuerpo?
3. El dominio de la función $f(x) = \ln x - \ln \operatorname{sen} y$
4. Resolver: $\int_0^{\pi} (\cos t, 1, -2t) dt$
5. De la función $f(x, y) = \ln\left(2 + x^2 + y^2\right)$

Questions: 1

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Let's solve each part of the problem step by step.

Problem 1:

Question: If $r(t) = (\cos t, \sin t, t)$, find $\lim_{t \to \pi/4} r(t)$.

Solution:

1. Substitute $t = \pi/4$ into $r(t)$.
2. Calculate $\cos(\pi/4) = \sin(\pi/4) = \frac{\sqrt{2}}{2}$.
3. Thus, $r(\pi/4) = \left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, \frac{\pi}{4}\right)$.

Answer: $\lim_{t \to \pi/4} r(t) = \left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, \frac{\pi}{4}\right)$

Problem 2:

Question: Given $r(t) = (3\cos t, 3\sin t, t^2)$, find the speed of the body at $t = 2$ and determine when the velocity and acceleration vectors are orthogonal.

Solution:

1. **Velocity $v(t)$:** Differentiate $r(t)$ with respect to t.

$$v(t) = (-3\sin t, 3\cos t, 2t)$$

2. **Acceleration $a(t)$:** Differentiate $v(t)$ with respect to t.

$$a(t) = (-3\cos t, -3\sin t, 2)$$

3. **Speed at $t = 2$:**

$$v(2) = (-3\sin 2, 3\cos 2, 4)$$

$$\text{Speed} = \sqrt{(-3\sin 2)^2 + (3\cos 2)^2 + 4^2}$$

$$= \sqrt{9\sin^2 2 + 9\cos^2 2 + 16} = \sqrt{25} = 5$$

4. **Orthogonality condition $v(t) \cdot a(t) = 0$:**

$$(-3\sin t)(-3\cos t) + (3\cos t)(-3\sin t) + (2t)(2) = 0$$

$$9\sin t\cos t - 9\sin t\cos t + 4t^2 = 0 \Rightarrow 4t^2 = 0 \Rightarrow t = 0$$

Answer: Speed at $t = 2$ is 5. Velocity and acceleration are orthogonal at $t = 0$.

Problem 3:

Question: Find the domain of $f(x) = \ln x - \ln \sin y$.

Solution:

1. $\ln x$ is defined for $x > 0$.
2. $\ln \sin y$ is defined for $\sin y > 0$.
3. $\sin y > 0$ for y in intervals $(2k\pi, (2k+1)\pi)$ for integers k.

Answer: Domain of $f(x)$ is $x > 0$ and y in intervals $(2k\pi, (2k+1)\pi)$ for integers k.

Problem 4:

Question: Evaluate $\int_0^{\pi} (\cos t, 1, -2t)\, dt$.

Solution:

1. Integrate each component separately: \[\int_{0}^{\pi} \cos t \, dt = \sin t \bigg|0^\pi = 0 \] \[\int{0}^{\pi} 1 \, dt = t \bigg|0^\pi = \pi \] \[\int{0}^{\pi} -2t \, dt = -t^2 \bigg|_0^\pi = -\pi^2 \]

Answer: $\int_0^{\pi} (\cos t, 1, -2t)\, dt = (0, \pi, -\pi^2)$

Problem 5:

Question: True or false about $f(x, y) = \ln(2 + x^2 + y^2)$.

Solution:

1. The function $f(x, y)$ is defined for all x, y since $2 + x^2 + y^2 > 0$.
2. $f(x, y)$ is continuously differentiable everywhere in its domain.

Answer: True: $f(x, y)$ is defined and differentiable for all x, y.