6 Dec 2001

1. \( v(t) = \langle 6 \sin t, 6 \cos t, 8 \rangle, \ a(t) = \langle 6 \cos t, -6 \sin t, 0 \rangle, \) and \( \kappa(t) = \frac{3}{50} \).

2. \( D_{\langle 3,4 \rangle} f = \frac{4}{5} \) and \( f \) increases fastest in the direction \( \langle 1, 0 \rangle \).

3. Max at \( (2, \frac{3}{2}, -2) \) and min at \( (-2, -\frac{3}{2}, 2) \).

4. \( \int_{-2}^{2} \int_{-2}^{0} \frac{uv}{2} \ du \ dv = -6 \).

5. (a) This follows from (b), but nonetheless, you should argue that

\[ \frac{\partial P}{\partial y} = 2e^{2x} = \frac{\partial Q}{\partial x} \]

and that \( \mathbb{R}^2 \) is open and simply-connected.

(b) \( f(x, y) = x + ye^{2x} + y^2 \).

(c) \( c + e^2 - 1 \).

6. \( 18\pi \).

7. \( 4\pi \).

8. Answers will vary wildly. I got \(-x - 9y + 5z = -16\).

9. \( \int_{0}^{4} \int_{0}^{\sqrt{x}} f(x, y) \ dx \ dy. \)