# 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. $\mathbb{D}_{\langle 3,4\rangle} f = \frac{4}{5}$ and $f$ increases fasted in the direction $\langle 1, 0\rangle$.
3. Max at $\left(2, \frac{3}{2}, -2\right)$ and min at $\left(-2, -\frac{3}{2}, 2\right)$.
4. $\displaystyle\int_2^4 \int_{-2}^0 \frac{uv}{2}\, du\, dv = -6$.
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) $e + e^2 - 1$.
6. $18\pi$.
7. $4\pi$.
8. Answers will vary wildly. I got $-x - 9y + 5z = -16$.
9. $\displaystyle\int_0^4 \int_{\frac{y}{2}}^{\sqrt{x}} f(x, y)\; dx\; dy$.