

MAC 2313, Section 03 with Dr. Hurdal
Fall 2003 Final Exam Answers

1. 97.5π

2. $-a^2\pi$

3. a) The level surface is the surface $x^2 + y^2 + 3z^2 = 4$. The level surface is an ellipsoid that crosses x-axis at ± 2 , the y-axis at ± 2 and the z-axis at $\pm \frac{2}{\sqrt{3}} \approx \pm 1.15$.

b) $\nabla T(0.6, 0.8, 1) = 1.2\vec{i} + 1.6\vec{j} + 6\vec{k}$

c) $|\nabla T| = 2\sqrt{x^2 + y^2 + 9z^2}$ or if you assume the question is asking for the maximum rate of increase at the point $(0.6, 0.8, 1)$, then $|\nabla T(0.6, 0.8, 1)| = 2\sqrt{10}$

d) $6x + 8y + 30z = 40$

4. a) Since $\text{curl } \vec{F} \neq 0$, then \vec{F} is not path-independent by the curl test and so \vec{F} is not a gradient field. Since $\text{curl } \vec{G} = 0$, then \vec{G} is path-independent by the curl test and so \vec{G} is a gradient vector field.

b) Potential function of \vec{G} is $g(x, y, z) = xy^3z^2 + y^2z^3 + C$.

5. Dimensions are 20.4 m, 7.7 m and 25.5 m.

6. The particles intersect at $(1, 2, 3)$. For particle one, this occurs at $t = 2$; for particle two, this occurs at $t = 4$.

7. -500π

8. $\frac{104}{3} \approx 34.67$

9. $\frac{11}{6}$

10. The surface is a quarter cylinder of radius 2, with $0 \leq x \leq 2$. The cylinder is lying along the y-axis from $y = -1$ to $y = 1$. Flux = 4π .

Bonus: Maximum value of f is $3 + \sqrt{29}$ at $(\frac{-2}{\sqrt{29}}, \frac{5}{\sqrt{29}}, 1 + \frac{7}{\sqrt{29}})$.