

Math 250B Test Two
Section X01

Time: 50 Minutes
Total: 23 Marks

Name: _____

1. [6 marks] $T = 0.02x^2y - 0.03xy^2$ gives temperature (in °C) in a small flat town. The variables x and y represent position (in km).

a) A runner travels in a straight line from $(x, y) = (5, -4)$ to $(x, y) = (7, 1)$. What initial rate of change of temperature does the runner experience?

b) Starting from $(x, y) = (5, -4)$, what is the maximum rate of change of temperature the runner could experience?

c) Starting from $(x, y) = (5, -4)$, in which direction does the temperature increase fastest?

2. [4 marks] Evaluate: $\int_{\frac{\pi}{2}}^{\pi} \int_3^{4+\sin \theta} r \, dr \, d\theta$

3. [4 marks] Set up a triple integral for the volume of the solid bounded by $z = x^2$, $y + z = 36$, and $y = 0$. Do not evaluate the integral.

4. [3 marks] Rewrite the integral using vertical slices instead of horizontal slices. Do not evaluate.

$$\int_0^{81} \int_{\sqrt[4]{y}}^3 \sqrt{1+x^5} \, dx \, dy$$

5. [6 marks] Given $2x + 5y + 3z = 26$. Use the Lagrange Multiplier method to find the point (x, y, z) at which $f = (x - 4)^2 + (y + 2)^2 + (z - 3)^2$ is minimized.