

## Math 2313, Test II

Name \_\_\_\_\_

1. If  $f(x, y) = \ln(x^2y^3)$  find  $f_{xx} + f_{yy}$ .

answer:  $-\frac{2}{x^2} - \frac{3}{y^2}$

2. If  $f(x, y, z) = e^{2x+2y-z^2}$ ,

- a. Find the directional derivative of  $f$  at  $(1, 1, 2)$  in the direction of the vector  $\langle 12, -3, 4 \rangle$ .

answer:  $2/13$

- b. Find the equation of the tangent plane to the surface  $f(x, y, z) = 1$  at  $(1, 1, 2)$ .

answer:  $2x + 2y - 4z + 4 = 0$

3. A cylinder initially has radius  $r = 5$  and height  $h = 10$ , then the radius is increased to 5.1 and the height is decreased to 9.8. Given that the surface area is  $A = 2\pi(r^2 + rh)$ , calculate both

- a. The exact change in surface area,  $\Delta A$ , and

answer:  $1.98\pi$

- b. The approximate change in surface area,  $dA$ .

answer:  $2\pi$

4. Write  $U_r$  and  $U_\theta$  in terms of  $U_x$  and  $U_y$ , where  $x = r \cos(\theta)$ ,  $y = r \sin(\theta)$ .

answer:  $U_r = U_x \cos(\theta) + U_y \sin(\theta)$ ,  $U_\theta = -U_x r \sin(\theta) + U_y r \cos(\theta)$

5. The temperature in space is given by  $T(x, y, z) = 2x^2 - 3y^2 - z^2$ . A rocket at  $(1, 2, 4)$  has a velocity of  $(0.1, 0.3, -0.2)$ . How fast is the temperature in the rocket changing?

answer:  $-1.6$