**Homework Section 14.4**

**NOTE: FOR NUMBERS 2-4, TO FIND A "LINEARIZATION" OR L(x,y), SOLVE THE EQUATION OF THE TANGENT PLANE FOR z AND REPLACE z WITH L(x,y).**

1. Find an equation of the tangent plane to the surface at the given point:

   a) $z = 2x^2 - y^2 + 4y$, $(1,2,6)$ b) $z = 2ye^x$, $(0,1,2)$

2. Explain why the function is differentiable at the given point. Then find the linearization $L(x, y)$ of the function at that point.

   a) $f(x, y) = y\sqrt{x}$, $(4,1)$ b) $f(x, y) = e^x \sin xy$, $(0,3)$

3. Find the linear approximation of the function $f(x, y) = \sqrt{20 - 7x^2 - y^2}$ at (1,2) and use it to estimate $f(1.08,1.96)$.

4. Find the linear approximation of the function $f(x, y, z) = \sqrt{x^2 + y^2 + z^2}$ at (1,4,8) and use it to approximate the number $\sqrt{0.98^2 + 4.02^2 + 7.99^2}$. (**Note**: the equation of the tangent plane generalizes to any number of variables.)

5. Find the total differential of the function. For part (b), note that the total differential generalizes to functions of more than two variables.

   a) $z = x^2 \ln y^3$ b) $w = xze^{xy}$

6. Suppose the function $P(w,d)$ gives blood alcohol percentage values, where *w* stands for body weight in pounds and *d* stands for the number of drinks consumed in less than 1 hour. The following chart gives certain values of *P*.

| | Number of Drinks | | | | | | |
|---|---|---|---|---|---|---|---|
| **Body Weight** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 120 lb. | 0.031 | 0.063 | 0.094 | 0.125 | 0.156 | 0.188 | 0.219 |
| 130 lb. | 0.029 | 0.058 | 0.087 | 0.116 | 0.145 | 0.174 | 0.203 |
| 140 lb. | 0.027 | 0.054 | 0.08 | 0.107 | 0.134 | 0.161 | 0.188 |
| 150 lb. | 0.025 | 0.05 | 0.075 | 0.1 | 0.125 | 0.151 | 0.176 |

Use the table to find a linear approximation to *P* when *w* is close to 140 pounds and *d* is close to 3 drinks.