NAME: _____ **Panther ID:** _____

Take-home Quiz 4 - Due Tue. Mar. 6 MAC 2313, Spring 2012

To receive credit you MUST SHOW ALL YOUR WORK. Answers which are not supported by work will not be considered.

1. (6 pts) Consider a right circular cylinder with radius of the base r and height h. It is known that measurements of r and h can have each a 1% possible percentage error. Use differentials to estimate the percentage error in measuring the volume.

2. (8 pts) The temperature at the point (x, y) of a horizontal plate is given by $T(x, y) = 2y^2 - 4xy - 10x - 2y + 5$ Celsius degrees. Suppose that the y-axis points toward North, the x-axis towards East and that the distances on the plate are measured in meters.

(a) (4 pts) A bug stands at the point $(1, 5)$ and heads directly North-East. Will it experience an increase or decrease in temperature? At what rate?

(b) (4 pts) If our bug initially stands at the point $(1, 5)$, in which direction should the bug head to experience the greatest rate of increase in temperature? (Give your answer as a vector and as an approximate geographical direction.)

3. (8 pts) Suppose that $w = f(x, y), x = r\cos\theta$, and $y = r\sin\theta$. Show that

$$\left(\frac{\partial w}{\partial x}\right)^2 + \left(\frac{\partial w}{\partial y}\right)^2 = \left(\frac{\partial w}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial w}{\partial \theta}\right)^2.$$

Hint: Use chain rule to find $\frac{\partial w}{\partial r}$, $\frac{\partial w}{\partial \theta}$ in terms of $\frac{\partial w}{\partial x}$, $\frac{\partial w}{\partial y}$.