12.5 Functions of Three Variables

1. Level surfaces of the function \( f(x, y, z) = \sqrt{x^2 + y^2} \) are
   (a) Circles centered at the origin
   (b) Spheres centered at the origin
   (c) Cylinders centered around the \( z \)-axis
   (d) Upper-hemispheres centered at the origin

2. Any level surface of a function of 3 variables can be thought of as a surface in 3 space.
   (a) True, and I am very confident
   (b) True, but I am not very confident
   (c) False, but I am not very confident
   (d) False, and I am very confident

3. Any surface that is a graph of a 2-variable function \( z = f(x, y) \) can be thought of as a level surface of a function of 3 variables.
   (a) True, and I am very confident
   (b) True, but I am not very confident
   (c) False, but I am not very confident
   (d) False, and I am very confident

4. Any level surface of a function of 3 variables can be thought of as the graph of a function \( z = f(x, y) \).
   (a) True, and I am very confident
   (b) True, but I am not very confident
   (c) False, but I am not very confident
   (d) False, and I am very confident
5. Suppose the temperature at time $t$ at the point $(x, y)$ is given by the function $T(x, y, t) = 5t - x^2 - y^2$. Which of the following will not cause temperature to decrease?

(a) moving away from the origin in the positive $x$ direction
(b) moving away from the origin in the positive $y$ direction
(c) moving away from the origin in the direction of the line $y = x$
(d) standing still and letting time pass

6. If temperature at the point $(x, y, z)$ is given by $T(x, y, z) = \cos(z - x^2 - y^2)$, the level surfaces look like:

(a) spheres
(b) Pringles brand potato chips
(c) planes
(d) bowls

7. The level surfaces of the function $f(x, y, z) = x^2 + y^2 + z^2$ are cylinders with axis along the $y$-axis.

(a) True, and I am very confident
(b) True, but I am not very confident
(c) False, but I am not very confident
(d) False, and I am very confident