1. (a) False ($\nabla f$ is a vector)
   (b) False

2. Equally spaced concentric circles.

3. 0. Because, this simplifies to $x - y$ wherever the function is defined. And $x - y$ is a continuous function.

4. (a) $z = 5(x - 1) - 4(y - 1)$
   (b) 0.14

5. (a) $\cos(xyz)(1 - x^2y^2z^2) - 3 \sin(xyz) xyz$
   (b) $(\sin \theta)(t) + (r \cos \theta)(\frac{1}{3})$

6. Critical point is (1,1). On boundary midpoint of each line-segment is a local extremum.
   Answer: minimum is $-2$ at (1,1); maximum is 0 at all four corners.

7. $2^23^34^4$.

8. $dV = 4\pi r^2 dr$. $\Delta r = T$ so answer is $4\pi r^2 T$. 