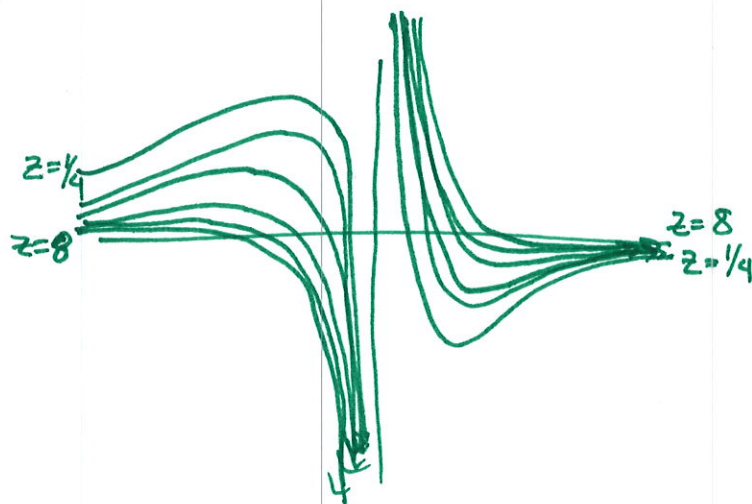
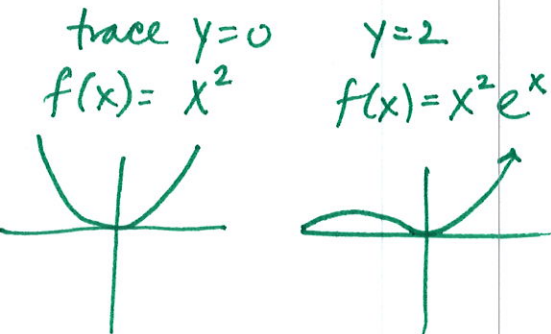


Instructions: Show all work. Use exact answers unless specifically asked to round. Be sure to complete all parts of each question.

1. For the function  $f(x, y) = x^2 e^{xy/2}$ , sketch the trace of the graph when  $y=0$  and  $y=2$ . Sketch at least 5 level curves of the graph. Put the traces on one graph, and the five level curves on another.



Range of  $f$ :  $(0, \infty)$

$$z = x^2 e^{xy/2}$$

$$\frac{z}{x^2} = e^{xy/2} \Rightarrow \ln\left(\frac{z}{x^2}\right) = xy/2$$

$$z = 1/4 \quad z = 2$$

$$z = 1/2 \quad z = 4$$

$$z = 1 \quad z = 8$$

$$\frac{z}{x} \ln\left(\frac{z}{x^2}\right) = y = \frac{2}{x} [\ln z - \ln x^2]$$

2. Rewrite the equation  $x^2 + y^2 + z^2 - 9z = 0$  in cylindrical and spherical coordinates.

Cylindrical:  $r^2 + z^2 - 9z = 0$

Spherical:  $\rho^2 - 9\rho \cos\phi = 0 \Rightarrow \rho = 9\cos\phi$

3. Determine if the  $\lim_{(x,y) \rightarrow (0,0)} \frac{xy^2}{x^2+y^4}$  exists or is undefined. If it does exist, say what it is.

Path

$$x=0 \quad \lim_{y \rightarrow 0} \frac{0}{y^4} = 0$$

$$y=0 \quad \lim_{x \rightarrow 0} \frac{0}{x^2} = 0$$

$$x=y \quad \lim_{x \rightarrow 0} \frac{x^3}{x^2+x^4} = \lim_{x \rightarrow 0} \frac{x^3}{x^2(1+x^2)} = \frac{x}{1+x^2} = 0$$

$$x=y^2 \quad \lim_{y \rightarrow 0} \frac{y^4}{y^4+y^4} = \lim_{y \rightarrow 0} \frac{y^4}{2y^4} = \frac{1}{2}$$

DNE  
 limits on different  
 paths not all  
 equal