

Name: Key

Calculus 251:C3 Quiz #7 - 6/10/2021 Topic: Sections 14.1-14.2

Instructions. Answer the questions in the spaces provided or on your own paper, then scan and upload to Canvas. Show and label all of your work. Responses with no work may receive no credit even if the answer is correct.

- (1) For each function f , describe the contour curves. You should give a complete, concise, and clear English description. You may also sketch several contour curves to support your answer, but the English description is required.

2 pts (a) $f(x, y) = y - x^2$

parabolas opening upward, vertex on y -axis, evenly spaced

Examples $c=0$: $f(x, y) = y - x^2 = 0 \Rightarrow y = x^2$
 $c=1$: $f(x, y) = y - x^2 = 1 \Rightarrow y = x^2 + 1$
 $c=2$: $y - x^2 = 2 \Rightarrow y = x^2 + 2$

2 pts (b) $f(x, y) = e^{3x+y}$

lines with a slope of -3 and y -intercept $\ln(c)$

Examples: $c=1$ $f(x, y) = e^{3x+y} = 1 \Rightarrow 3x+y=0 \Rightarrow y=-3x$
 $c=e$ $f(x, y) = e^{3x+y} = e \Rightarrow 3x+y=1 \Rightarrow y=-3x+1$
 $c=e^2$ $e^{3x+y} = e^2 \Rightarrow 3x+y=2 \Rightarrow y=-3x+2$

Note: NO level curves for $c \leq 0$ because e^{3x+y} is always positive

2 pts (c) $f(x, y) = \ln(4x^2 + y^2)$

ellipses with center at origin, major axis from $-\sqrt{e^c}$ to $+\sqrt{e^c}$
and minor axis from $x = \frac{-\sqrt{e^c}}{2}$ to $\frac{\sqrt{e^c}}{2}$

Examples:

$c=0$ $f(x, y) = \ln(4x^2 + y^2) = 0 \Rightarrow 4x^2 + y^2 = 1$
 $c=1$ $f(x, y) = \ln(4x^2 + y^2) = 1 \Rightarrow 4x^2 + y^2 = e$
 $c=-1$ $f(x, y) = \ln(4x^2 + y^2) = -1 \Rightarrow 4x^2 + y^2 = e^{-1}$

4 pts (2) Calculate the following limit or show that it does not exist.

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x+xy}{\sqrt{x^2+y^2}}$$

Easiest

positive x-axis ($y=0, x>0$)

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x+xy}{\sqrt{x^2+y^2}} = \lim_{x \rightarrow 0^+} \frac{x}{\sqrt{x^2}} = \lim_{x \rightarrow 0^+} \frac{x}{x} = 1$$

negative x-axis ($y=0, x<0$)

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x+xy}{\sqrt{x^2+y^2}} = \lim_{x \rightarrow 0^-} \frac{x}{\sqrt{x^2}} = \lim_{x \rightarrow 0^-} \frac{x}{-x} = -1$$

} lim DNE

Could also use y-axis ($x=0$)

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x+xy}{\sqrt{x^2+y^2}} = \lim_{y \rightarrow 0} \frac{0}{\sqrt{y^2}} = 0$$