

Each problem is worth 5 points. Clear and complete justification is required for full credit.

1. Evaluate $\lim_{(x,y) \rightarrow (0,0)} \frac{3x+y}{3x-y}$.

Approaching from $x=0$

$$\lim_{(0,y) \rightarrow (0,0)} \frac{3(0)+y}{3(0)-y} = \lim_{y \rightarrow 0} \frac{y}{(-y)} = \underline{-1}$$

Approaching from $y=0$

$$\lim_{(x,0) \rightarrow (0,0)} \frac{3x+(0)}{3x-(0)} = \lim_{x \rightarrow 0} \frac{3x}{3x} = \underline{1}$$

Approaching from $x=y$

$$\lim_{(x,x) \rightarrow (0,0)} \frac{3x+x}{3x-x} = \lim_{x \rightarrow 0} \frac{4x}{2x} = \underline{2}$$

Since the value of limit is different from different approaches,
the limit does not exist.

Excellent!