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Sheet 1

Q1) Find the following limits, if they exist:

1-
$$\lim_{(x,y) \rightarrow (2,1)} \frac{(y-1)(x-2)^2}{(y-1)^3 + (x-2)^3}$$

2-
$$\lim_{(x,y) \rightarrow (0,0)} \frac{xy^3}{x^3 + y^6}$$

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

4-
$$\lim_{(x,y) \rightarrow (0,0)} \frac{10xy}{5x^3 + 2y^3}$$

5-
$$\lim_{(x,y) \rightarrow (0,0)} \frac{x^3 - x^2y + xy^2 - y^3}{x^2 + y^2}$$

6-
$$\lim_{(x,y) \rightarrow (0,0)} \left[\frac{3x^2y}{x^4 + y^2} + \frac{y^4}{x^2 + y^2} \right]$$

7-
$$\lim_{(x,y) \rightarrow (1,-1)} \frac{2x-y}{x^2 + y^2}$$

Q2) Discuss the continuity of the following functions on their domain:

1-
$$F(x, y) = \begin{cases} \frac{x^2y}{x^4 + y^2}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$$

2-
$$f(x, y) = e^{x^2 + 5xy + y^3}$$

3-
$$h(x, y) = \sin(\sqrt{y - 4x^2})$$