§ 15.7: p. 3 METhod of FINDing ABS. MAX/MIN.

A 3 Steps.

1. Find values of \( z = f(x, y) \) at critical points of \( D \). Closed & Bounded. Set.

2. Find extreme values on \( \partial D \).

3. The largest of the values from 1 and 2 is the ABS. MAX.
   The smallest is the ABS. MIN.

B EXAMPLE: § 15.7: #27

\( f(x, y) = 1 + 4x - 5y \)

\( D \) is closed triangular region w/ Vertices \((0,0), (2,0), (0,3)\).

SOL

1. Critical points

\( f_x(x, y) = 4 \quad f_y(x, y) = -5 \)

No critical points

2. Check \( \partial D \):

\[ x = 0 \quad f_a(0, y) = 1 - 5y \quad z = 1 - 5y \]

\[ y = 0 \quad f_b(x, 0) = 1 + 4x \quad z = 1 + 4x \]

\[ \frac{dy}{dx} = 4 \neq 0 \quad f_b(0, 0) = 1 \quad f_b(3, 0) = 9 \]

3. \( m = -\frac{3}{2} \)

\[ y - b = m(x - a) \quad (x, 0) \]

\[ y = -\frac{3}{2}(x - 2) = -\frac{3}{2}x + 3 \quad y = -\frac{3}{2}x + 3 \]

\[ f_c(x, -\frac{3}{2}x + 3) = 1 + 4x - 5\left(-\frac{3}{2}x + 3\right) = 1 + 4x + \frac{15}{2}x - 15 \]

\[ f_c(x) = \frac{23}{2}x - 14 \]

\[ \frac{df_c}{dx}(x) = \frac{23}{2} \neq 0 \quad f_c(0) = -14 \quad f_c(2) = 9 \]
List

\[(x, y) \quad f(x, y)\]
\[(0, 0) \quad 1\]
\[(2, 0) \quad 9\]
\[(0, 3) \quad -14\]

Conclusion:

\[f(x, y)\] has an abs. max. val. of 9 on \(D\) at \((2, 0)\) and an abs. min. val. of -14 on \(D\) at \((0, 3)\).