

Question 2

For

$$g(x, y) = \frac{x^2 + 3y}{2x - y},$$

find its first partial derivatives on its domain.

Tasks

1. State the domain restriction.
2. Compute g_x and g_y using the quotient rule.
3. Simplify and check the denominators.

Question 2 – Solution

Strategy. Apply the one-variable quotient rule separately in each variable and preserve the original domain.

Step 1: Domain The function and its partial derivatives are defined where

$$\boxed{2x - y \neq 0}.$$

Step 2: x -partial Holding y fixed,

$$\begin{aligned} g_x &= \frac{(2x)(2x - y) - 2(x^2 + 3y)}{(2x - y)^2} \\ &= \boxed{\frac{2x^2 - 2xy - 6y}{(2x - y)^2}}. \end{aligned}$$

Step 3: y -partial Holding x fixed,

$$\begin{aligned} g_y &= \frac{3(2x - y) - (x^2 + 3y)(-1)}{(2x - y)^2} \\ &= \boxed{\frac{x^2 + 6x}{(2x - y)^2}}. \end{aligned}$$

Verification. Both results have the squared quotient-rule denominator and remain restricted to $2x - y \neq 0$; expanding each unsimplified numerator reproduces the displayed form.