

- $\frac{\partial}{\partial x}(x^2y)$ equals

☐ $2x$
☐ $2xy + x^2$
☐ x^2
☐ $2xy$
- For $f = x^2 + y^2$, find the directional derivative at $(1, 2)$ in the direction of $(3, 4)$.
- If $f_{xy} = 0$ everywhere on $\mathbb{R}^2$, the graph of f is a plane.

☐ True

 ☐ False
- The area element in polar coordinates is

☐ $r \, dr \, d\theta$
☐ $dr \, d\theta$
☐ $\sin \theta \, dr \, d\theta$
☐ $r^2 \, dr \, d\theta$
- Evaluate $\iint_D (x^2 + y^2) \, dA$ over the unit disc D , to three decimal places.
- If f is differentiable at a point and its gradient there is zero, what follows?

☐ The function is constant in a neighbourhood
 ☐ There is one unique steepest direction
 ☐ No directional derivative exists
 ☐ Every unit directional derivative there is zero
- For $g(x, y) = xy/(x^2 + y^2)$ away from the origin, what is $g(t, t)$ for nonzero t ?
- For $f = x^2 + 3y^2$, $x = t^2$ and $y = t$, find the path derivative at $t = 1$.
- Which reverses the order of $\int_0^1 \int_0^x 1 \, dy \, dx$ over the same triangle?

☐ $\int_0^1 \int_1^y 1 \, dx \, dy$

☐ $\int_0^1 \int_y^1 1 \, dx \, dy$

☐ $\int_0^1 \int_0^1 1 \, dx \, dy$

- The map $x = 2u$, $y = -3v$ has determinant -6. What positive area factor belongs in a double-integral substitution?

1. $2xy$

Treat y as fixed: differentiating x^2y with respect to x gives $2xy$. Differentiating y as well would not be this partial derivative.

2. **4.4**

$\nabla f = (2, 4)$, $\mathbf{u} = (0.6, 0.8)$: $1.2 + 3.2 = 4.4$.

3. **False**

$x^2 + y^2$ has zero mixed partial.

4. $r\,dr\,d\theta$

With radius r nonnegative, the determinant and absolute area factor of the standard polar map are r .

5. **1.571**

$\int_0^{2\pi} \int_0^1 r^3\,dr\,d\theta = \pi/2$.

6. **Every unit directional derivative there is zero**

The dot product with the zero gradient is zero for every unit direction. Higher-order changes may still occur, so local constancy does not follow.

7. **0.5**

The numerator is t^2 and the denominator is $2t^2$, giving $1/2$. This conflicts with an assigned origin value of zero when checking continuity.

8. **10**

The composite is $t^4 + 3t^2$; its derivative is $4t^3 + 6t$, giving 10.

9. $\int_0^1 \int_y^1 1\,dx\,dy$

For a fixed y between 0 and 1, the region has x between y and 1. Both orders describe $0 \leq y \leq x \leq 1$.

10. **6**

The absolute determinant is 6. The negative sign concerns orientation rather than a negative area.