



Name _____ Class _____ Date _____

AFTER THIS WORKSHEET YOU CAN

- ✓ Compute the gradient $\nabla f = (f_x, f_y)$. ✓ Evaluate the gradient at a point.
- ✓ Interpret the gradient as the direction of steepest increase. ✓ Find critical points where $\nabla f = 0$.



Section A · Concept Check

• BEGINNER

4 × 1 = 4

- 1 ∇f for $f(x,y) = 5x^2 + 2y = ?$
☐ A. $(10x, 2)$ ☐ B. $(5x, 2)$ ☐ C. $(10x, 2y)$
☐ D. $(10, 2)$
- 2 ∇f for $f(x,y) = x^3 + y^2$ at $(2,1) = ?$
☐ A. $(12, 2)$ ☐ B. $(6, 2)$ ☐ C. $(12, 1)$ ☐ D. $(3, 2)$
- 3 The gradient points in the direction of:
☐ A. steepest decrease ☐ B. steepest increase
☐ C. no change ☐ D. the x-axis
- 4 Critical points satisfy:
☐ A. $\nabla f = 0$ ☐ B. $f = 0$ ☐ C. $f_x = f$ ☐ D. $\nabla f = 1$



Section B · Problem Solving

• INTERMEDIATE

2 + 3 × 3 = 11

- 5 The gradient is $\nabla f =$ _____
- 6 ∇f for $f = 5x^2 + 2y =$ _____
- 7 Find the gradient of $f(x,y) = 5x^2 + 2y$.

- 8 Find the gradient of $f(x,y) = x^3 + y^2$ at $(2,1)$.

- 9 Find the gradient of $f(x,y) = x^2y$ at $(1,4)$.



Section C · Challenge

• CHALLENGE

5

- 10 Find where $\nabla f = (0,0)$ for $f(x,y) = x^2 + y^2 - 4x$.

Reflection — the most useful thing I learned: _____

A ___/4 B ___/11 C ___/5 Total ___/20

Teacher's Signature _____

Parent's Signature _____

ANSWER KEY — FOLD OR CUT BEFORE HANDING OUT

1-A 2-A 3-B 4-A | 5 (f_x, f_y) 6 $(10x, 2)$ 7 = $(10x, 2)$ 8 = $(12, 2)$ 9 = $(8, 1)$ | 10 =
 $x = 2, y = 0$

