

**Exercise 23. First order partial derivatives**

In Problems 1 to 6, find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$

1.  $z = 2xy$

2.  $z = x^3 - 2xy + y^2$

3.  $z = \frac{x}{y}$

4.  $z = \sin(4x + 3y)$

5.  $z = x^3y^2 - \frac{y}{x^2} + \frac{1}{y}$

6.  $z = \cos 3x \sin 4y$

### Exercise 24. Second order partial derivatives

In Problems 1 to 4, find (a)  $\frac{\partial^2 z}{\partial x^2}$  (b)  $\frac{\partial^2 z}{\partial y^2}$  (c)  $\frac{\partial^2 z}{\partial x \partial y}$  (d)  $\frac{\partial^2 z}{\partial y \partial x}$

1.  $z = (2x - 3y)^2$

2.  $z = 2 \ln xy$

3.  $z = \frac{(x - y)}{(x + y)}$

4.  $z = \sinh x \cosh 2y$

5. Given  $z = x^2 \sin(x - 2y)$  find (a)  $\frac{\partial^2 z}{\partial x^2}$  and  
(b)  $\frac{\partial^2 z}{\partial y^2}$

Show also that  $\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial y \partial x}$   
 $= 2x^2 \sin(x - 2y) - 4x \cos(x - 2y).$