

## SOME BASIC CALCULUS

### Derivative and Total derivative of a function of one variable

$$f[x] = x^2 \quad \frac{df}{dx} = 2x \quad \rightarrow \quad df = (2x)dx$$

$$f[x] = a x^3 \quad \frac{df}{dx} = 3a x^2 \quad \rightarrow \quad df = (3a x^2) dx$$

### Derivative/Total derivative have to be adjusted for functions of more than one variable

$$df[x,y] = \frac{\partial f}{\partial x} dx + \frac{\partial f}{\partial y} dy$$

$$f[x,y] = x^2 y^3 \quad df = 2x(y^3) dx + (x^2) 3y^2 dy$$

**Change in notation to account for the function of more than one variable.**

**Black Scholes option price function has more than one variable:  $S$  and  $t$**

*The interest rate, exercise price, expiration date and volatility are conceived of as parameters in deriving the formula*

**Riskless hedge portfolio involves a partial derivative:  $\frac{\partial V}{\partial S}$**