

1. State the definition for the derivative of  $f(x)$  with respect to  $x$ .

2. Fill in the table of derivatives:

Function	Derivative wrt $x$
$c$	
$x$	
$x^n$	
$f(x)+g(x)$	
$f(x) g(x)$	
$f(x)/g(x)$	
$c f(x)$	
$f(y)$	
$f(g(x))$	
$\sin(x)$	
$\cos(x)$	
$\tan(x)$	
$\sec(x)$	

Function	Derivative wrt $x$
$u^n$	
$f(u) + g(u)$	
$f(u) g(u)$	
$f(u)/g(u)$	
$f(g(u))$	
$\sin(u)$	
$\cos(u)$	
$\tan(u)$	
$\sec(u)$	
$\sin^2(u)$	
$\sin(2u)$	
$f(x^2+x)$	
$f(\sin(x))$	

3. Find derivatives:

3.1

$$y = x^3 + \sin(x) + \sin(x) \cos(x)$$

$$dy/dx =$$

3.2

$$y = u^3 + \sin(x) + \sin(x)/x$$

$$dy/dx =$$

3.3

$$9x^2 + 16y^2 = 25$$

$$dy/dx =$$

4. Find the relationship between the rates

4.1

A boat is being pulled into a dock by means of a winch. The line (rope) goes from the winch to the bow cleat (place where rope is tied to the boat). The winch is twenty feet above the water. The bow cleat is five feet above the water.

Draw the picture. Assign variables. Specify the fundamental static relationship. Determine the relationship between the rates.

If the boat comes in at two feet every second, how fast is the winch pulling in the bow line (rope) when there is 50 feet of bow line extended?

4.2

A man six feet tall walks at a rate of five feet per second away from a light that is 15 feet above the ground. Consider his position and the tip of the shadow.

Draw the picture. Assign variables. Specify the fundamental static relationship. Determine the relationship between the rates.

At what rate is the tip of his shadow moving?

At what rate is the length of his shadow changing?