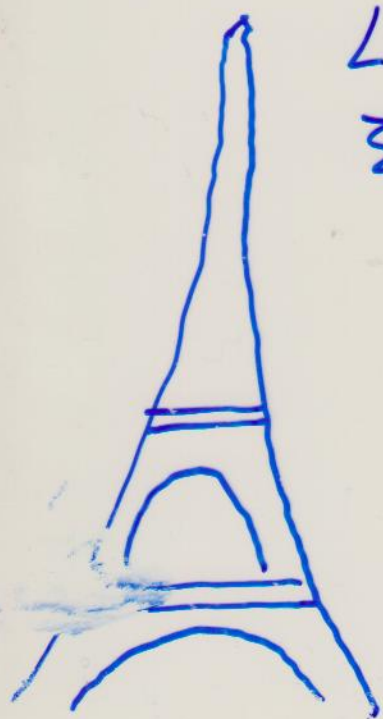


# MA180 Calculus (I)

## Topics

- 1) Functions
- 2) Rates of change
- 3) Differential Equations

## Quick intro to Topics (1) & (2)



La Tour  
Eiffel



stone falls  
 $y$  metres  
in  $t$  secs

Experience suggests

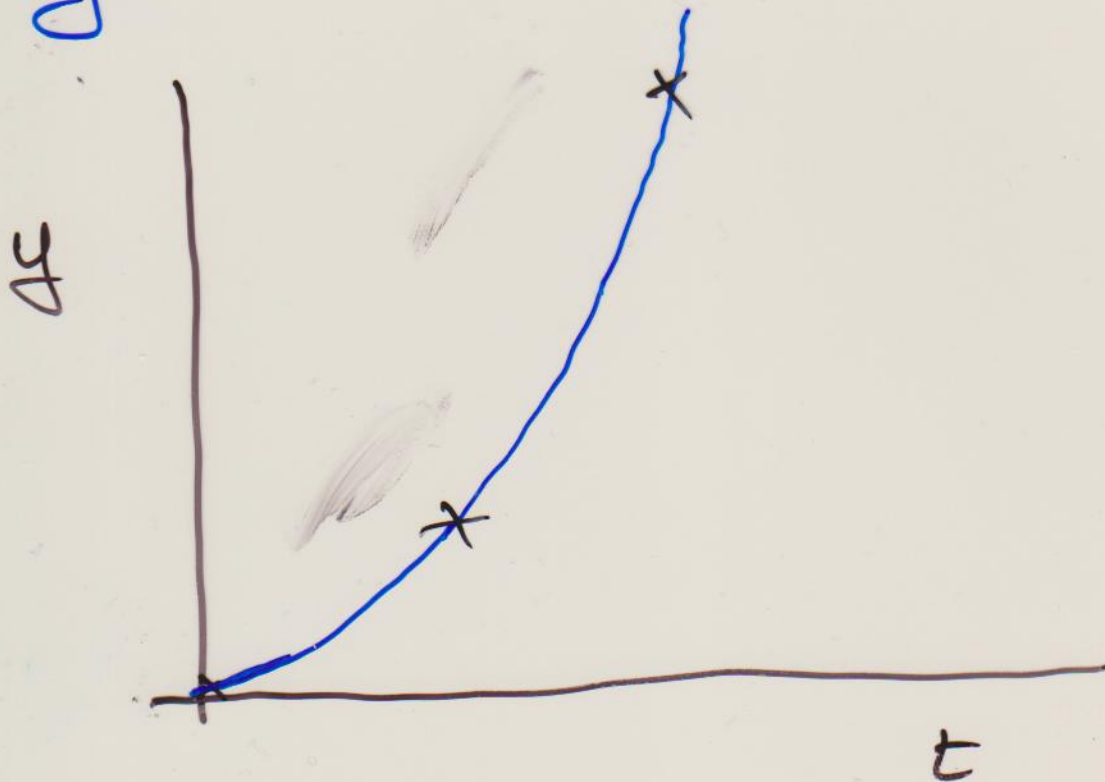
$$y = 4.9 t^2$$

We say that  $y$  is a function  
of  $t$ .

This means:

For each value of  $t$  there is one corresponding value of  $y$ .

Functions can be represented by their graph



Question What is the average speed of the stone between  $t=2$  and  $t=3$  secs?

$$\text{Average Speed} = \frac{\text{distance travelled}}{\text{time}}$$

$$= \frac{4.9(3^2) - 4.9(2^2)}{1}$$

$$= 4.9(9-4)$$

$$= 24.5 \text{ m/s}.$$

Now let

$v(t)$  = speed of stone  
at time  $t$

Question: What is the  
speed at  $t=2$ .

$$v(2) = \lim_{h \rightarrow 0} \frac{y(2+h) - y(2)}{h}$$



$$= \lim_{h \rightarrow 0} \frac{4.9(2+h)^2 - 4.9(2^2)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{4.9 \{ h^2 + 4h + \cancel{4} - \cancel{4} \}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{4.9 \{ h^{\cancel{2}} + 4\cancel{h} \}}{\cancel{h}}$$

$$= \lim_{h \rightarrow 0} 4.9 \{ h + 4 \}$$

$$= 4.9 \times 4$$

$$= 19.6 \text{ m/s}$$