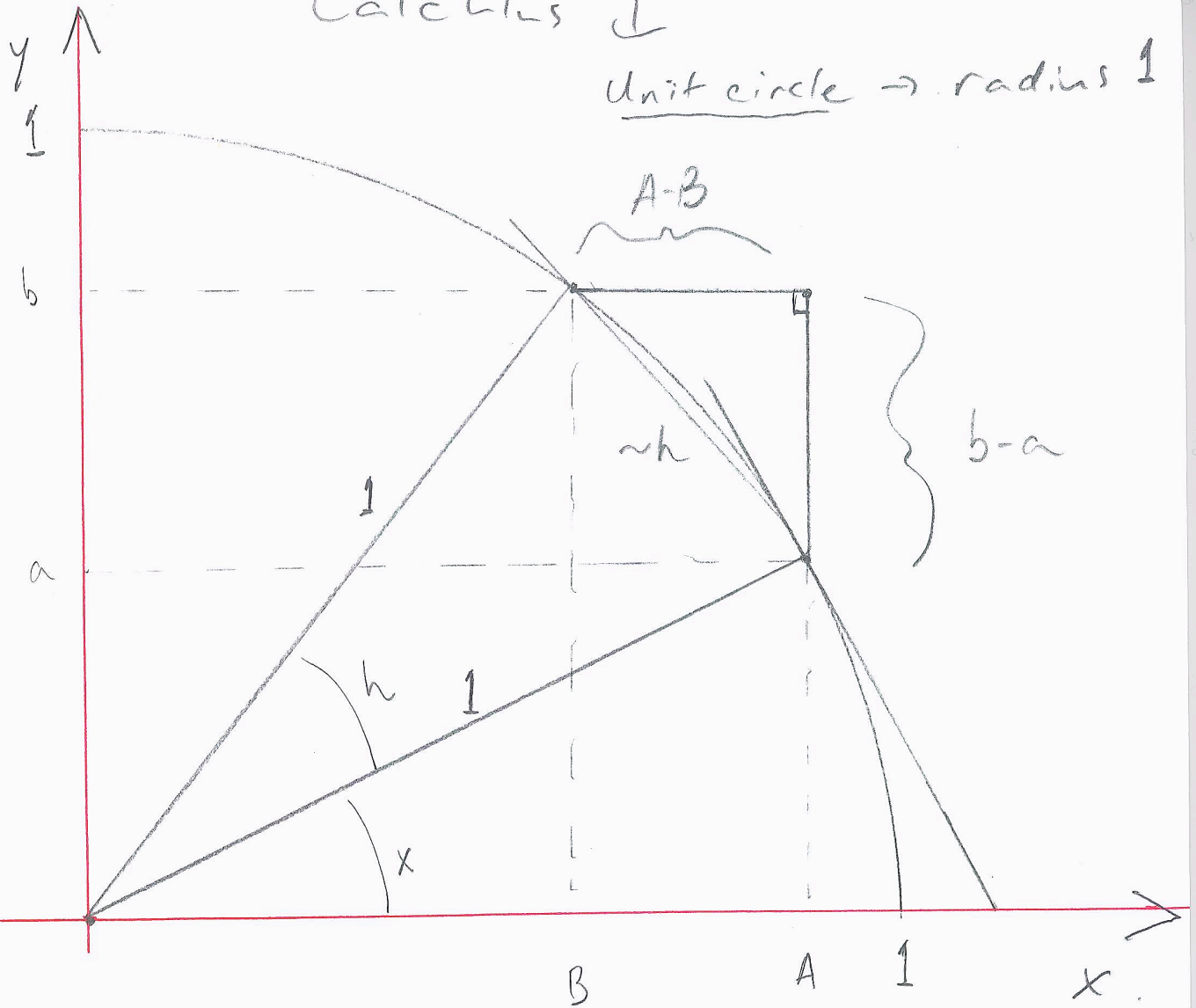


# Calculus I

Unit circle  $\rightarrow$  radius 1

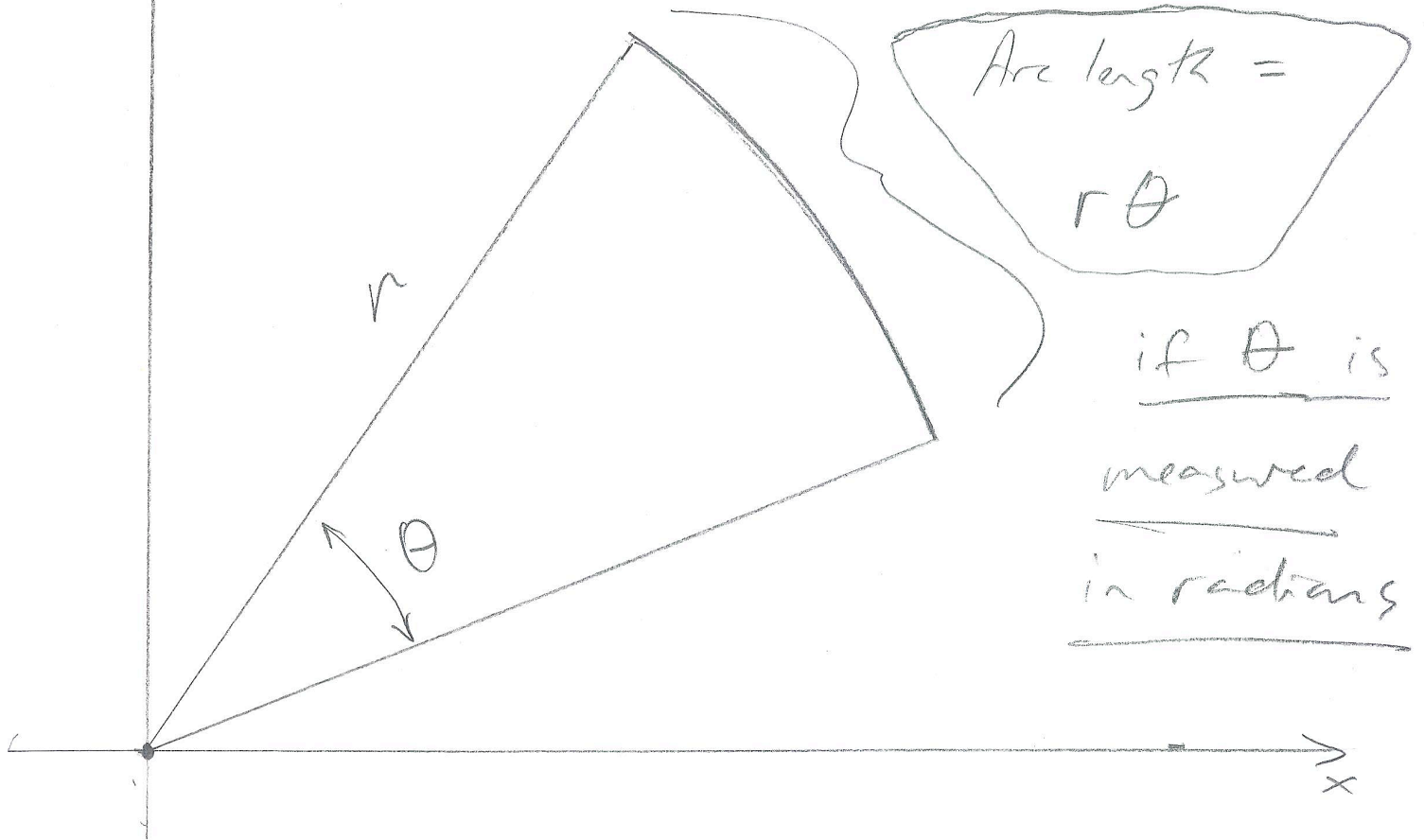


## Derivatives of trig functions

Objective: Given angle  $x$  -  
measured in radians -  
compute

$$\lim_{h \rightarrow 0} \frac{\sin(x+h) - \sin(x)}{h} = \frac{d}{dx} [\sin(x)]$$

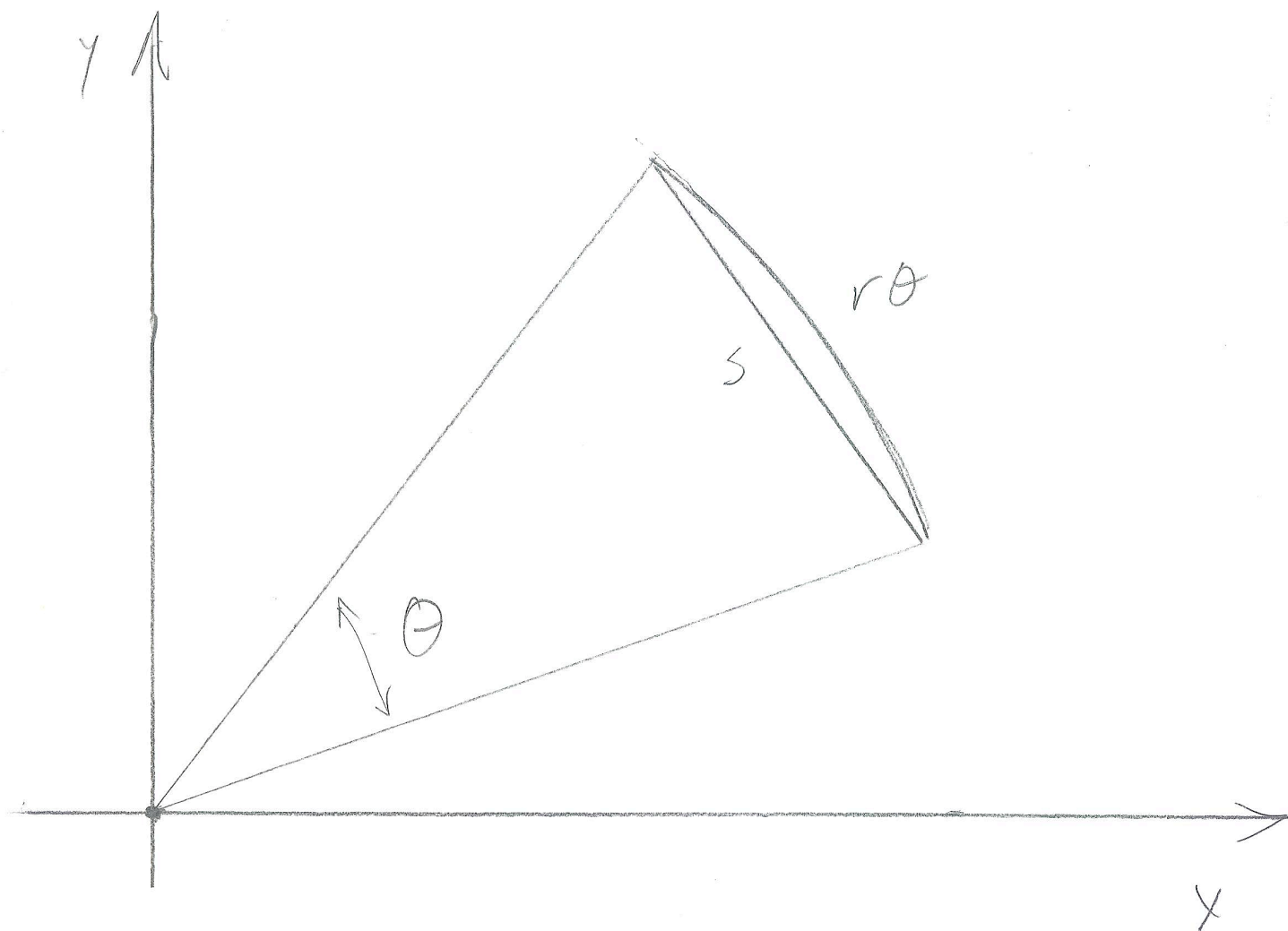
- One important fact about  
Arc length:



Note: There are  $2\pi$  radians in a complete circle.

Degrees  $D$  + radians  $R$  are related by the equation (linear!)

$$R = 2\pi \frac{D}{360}$$



An important fact<sup>\*</sup> needed for  
the calculation of the limit for  
 $\frac{d}{dx}(\sin(x))$ : as  $\theta \rightarrow 0$  (gets small)

$$s \approx r\theta$$

(in fact  $\lim_{\theta \rightarrow 0} \frac{s}{r\theta} = 1$ )

\* also a limit!

The secret: keep your eye on the right triangle at the upper right: its interior angles are tending toward the answer, as  $h \rightarrow 0$ .

So consider  $x$  fixed, & let  $h \rightarrow 0$  in the very first figure. What is  $b-a$ ?