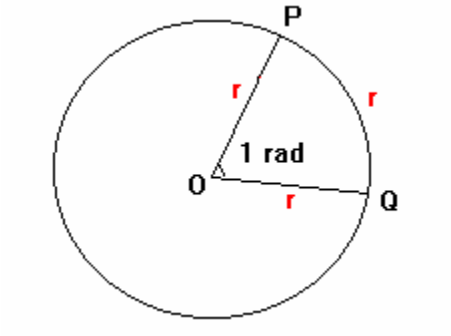
Why Use Radian Measure?

What is the point of using radians for measuring angles? Why not simply stick with degrees? One can answer all the questions perfectly well by converting the radians into degrees, working out the answer, and converting back into radians at the end if necessary. So why bother with radians in the first place?

Let us first remind ourselves of the definition of a radian:

In a circle with centre O and radius r, if points P and Q on the circumference of the circle are such that angle POQ is one radian, then the length of the arc PQ is equal to the radius of the circle.



This definition, based on a circle, makes it simple to carry out calculations on circles. Forexample, if an angle at the centre of 1 radian makes an arc of length 1 radius, then:

- an angle 2 radians makes an arc length 2 × radius
- an angle 3 radians makes an arc length 3 × radius
- an angle 4 radians makes an arc lenght 4 × radius
- etc.

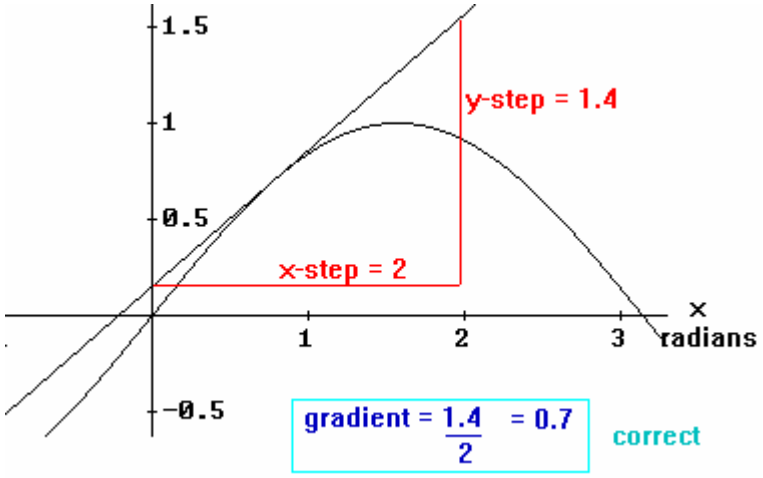
So, in a circle radius r, $arc\ length = r\theta$ where θ is in radians

Admittedly, you could also work out arc lengths if the angle is measured in degrees, using $arc\ length = \frac{\theta}{360} \cdot 2\pi r$ but you must agree that the radian form is neater, don't you?

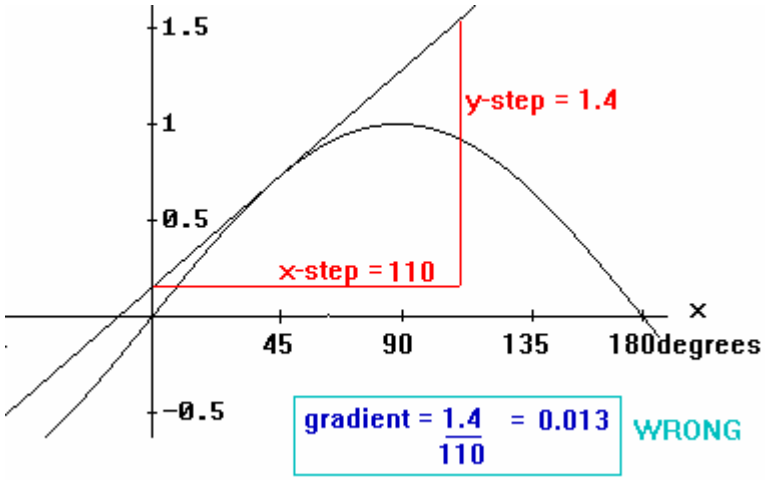
However, there is one area of maths where it is **essential** to express the angles in radians. It is the area of Calculus (which includes techniques known as Differentiation and Integration). Perhaps you have not gotten that far in your course yet, so please take our word for it!

As an example, suppose you wanted to find the gradient of the curve $y = \sin(x)$ at the point where $x = \pi/4$ radians (or 45 degrees).

Using the Calculus technique of Differentiation, the answer can be shown to be **gradient=0.707** (to 3 d.p.). If we check this by drawing a tangent on the graph where x is in radians, the answer seems right:



But if we use a graph where the angle is in degrees, it is hopelessly wrong:



Similarly, if we use the Calculus technique of Integration to find the area bounded by the graph of a trig function and check by drawing a graph, we will also find that the result is only sensible if we use radians.

So please believe us - as your math course gets more advanced, you will have to use radians rather than degrees most of the time!
