Moving from Degrees to Radians
Teacher Notes

Introduction

The primary aim of this activity is to develop an understanding of different ways of measuring the size of an angle using degrees and radians (both decimals and fractions of π). They are also exposed to revolutions, bearings and gradians.

Students will move a point on a circle's circumference and read off the size of the angle in a variety of units. They will then answer a single page of self-check true/false statements, construct their own labelled numberline and finally answer a single page of self-check true/false statements.

Resources

- Single tns file, called "Moving from Deg to Rad.v1NH.tns"
- Plain or squared paper.
- Ruler

Skills required

- Move from one page to the next
- Grab and drag a single point

The activity – suggestions for class use

Remind the class that they already know how to use degrees to measure angles.
The lesson will introduce them to other units of angle measurement, focussing in particular upon the unit called 'radians'.
They will explore how radians are linked to degrees, and the aim will be to know how to convert from one to the other.

See the Historial Note (later in these teacher notes) if you wish to set the scene on the different units at this stage.

Page 2.1
As students grab and drag the point on the sector's arc, the information on the right side of the screen is updated.
The point 'snaps' to the nearest degree, and the fractions of π are given in their simplest form.

Helpful tip: finer control of the point can be achieved by positioning the closed hand further outside the circle.

Ask the students to search for angles that generate 'nice' fractions of π.

Allow 10 mins for this, and note their discoveries on the board.

When it displays exactly 1 radian, further information is revealed on the diagram that 'defines' what a radian is.

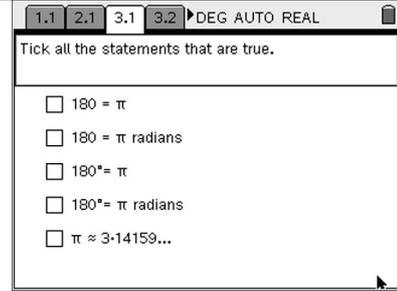# Moving from Degrees to Radians
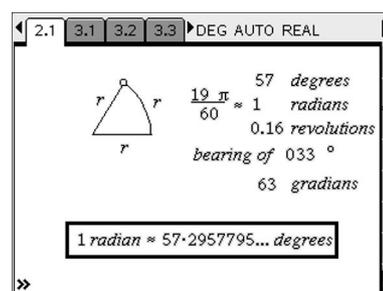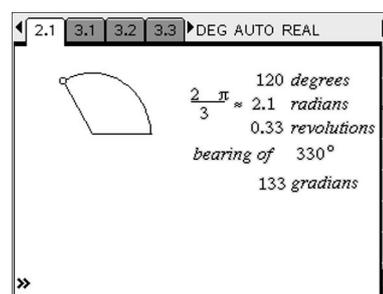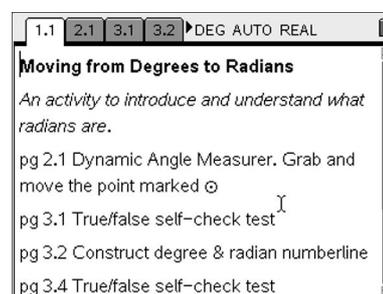
Page 3.1

This quick self-check test page highlights the importance of the language of units when making statements about angles.
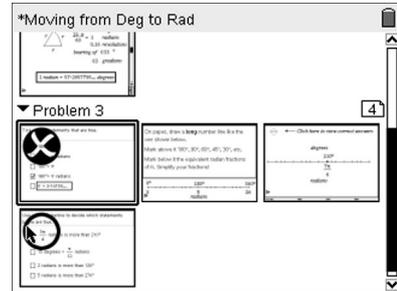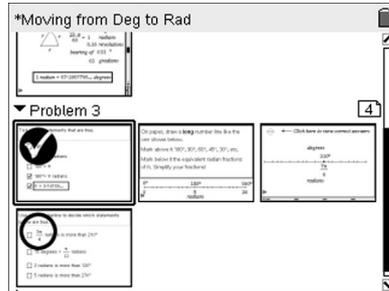
Students can check their answers by pressing ∕ then ` ©

The two screenshots below show the output for both 'right' and 'wrong' submissions.

To return to page 3.1, press either ✕ or · .

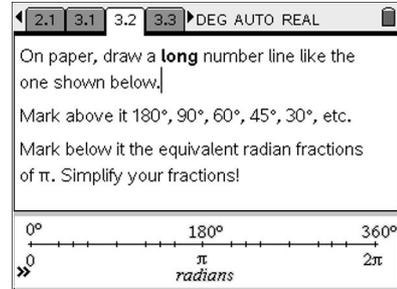*Students should not progress until they have a tick!*

Page 3.2

The skill of drawing a radian-number scale is required when drawing trigonometric graphs.
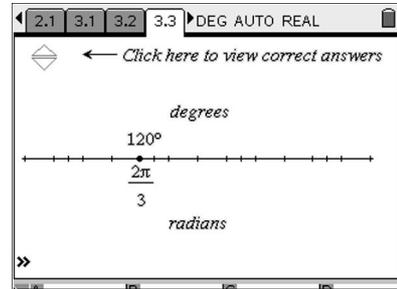
A long numberline is highly recommended.

You can expect students to use different strategies when positioning the notches, numbers and fractions of π upon the line.
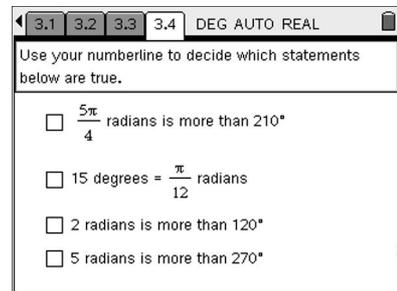
Page 3.3

Clicking on the slider arrows moves forward and back along the numberline, revealing the answers in turn, one at a time.

Page 3.4

This self-check test requires students to apply their understanding and possibly use their drawn numberline.

Again, students can check their answers by pressing ∕ then ` ©.

Suggested extension

For this lesson's activity, students had to accept that there are 2π radians in 1 revolution. Why is 2π used and not some other number?

We suggest that students refer back to page 2.1 and arrange the diagram to show an angle of 1 radian. This is when the arc length of the sector (*r*) is equal to the length of the radius (*r*). They also need to recall that C=2πr or C=πd.
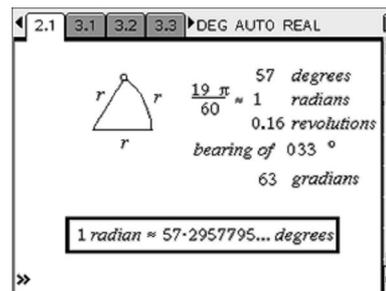
Interesting historial notes (sourced from Wikipedia)

Why 360 Degrees?

A quarter turn is 90 degrees. 90 is easier to do calculations with mentally as it can be factorised in many different ways: 2×45, 3×30, 5×18, 6×15, 10×9, 9×10, 15×6, 18×5, 30×3, 45×2. In times when people did calculations in their head, they liked the numbers 90 and 360 for this reason.

Why Radians?

The concept of radians should probably be credited to Roger Cotes in 1714 who recognised its 'naturalness' as a unit of angular measure.
The word 'radian' first appeared in print on 5 June 1873, in exam questions set by James Thomson at Queen's College, Belfast.
How many mathematical formulae do you know that have a π in them? And how many have '360' in them?

Why Gradians?

The gradian originated in France as the 'grade', along with the metric system. The French artillery has used the grade for decades. However, the unit was really only adopted in some countries and for specialised areas, like surveying. In the 1970s and 1980s most scientific calculators offered the grad as well as radians and degrees for their trigonometric functions, but in recent years some offer degrees and radians only.

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