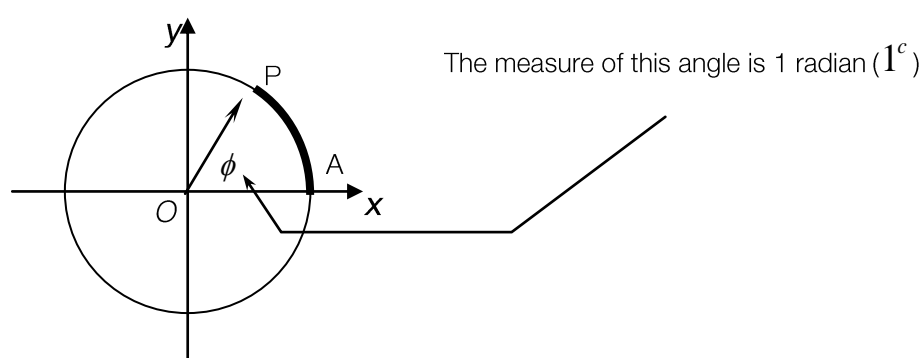**RMIT UNIVERSITY**

TR1.5: ANGULAR MEASUREMENT

Definition of a radian

So far all angles have been given in degrees. Another common unit of angular measurement is the **radian.**

If we move around the edge of a circle of radius = 1 (unit circle), a distance of 1 unit from *A* to *P*, in an anti-clockwise direction, then the angle *AOP* is formed.

The measure of this angle is 1 radian (1^c)

Converting between radians and degrees

The circumference of a circle is: $2 \times \pi \times \text{radius}$ units

Circumference of the unit (radius=1) circle is: $2 \times \pi \times 1 = 2\pi$ units.

Moving around the edge of the unit circle a distance of 2π units from *A* forms a complete circle.

The angle, in **radians**, formed by one full revolution of a circle is $2\pi^c$.

The angle, in **degrees**, of a circle is 360º.

$$\therefore \quad 2\pi^{c} = 360^{o}$$

$$\pi^{c} = 180^{o}$$

Rearranging the above statements gives:

$$1^{c} = \frac{180^{o}}{\pi} \quad \text{and} \quad 1^{o} = \frac{\pi^{c}}{180}$$

These two equations are used to convert between radians and degrees.

Examples

1. Convert 60° to radians.

$$1^o = \frac{\pi^c}{180}$$

$$60^o = \frac{\pi}{\cancel{180}_{3}} \times \cancel{60}^{c}$$

$$60^o = \frac{\pi^c}{3}$$

Using $\pi \approx 3.142$, $60^o \approx 1.05^c$

2. Convert 250° to radians.

$$1^o = \frac{\pi^c}{180}$$

$$250^o = \frac{\pi}{\cancel{180}_{18}} \times \cancel{250}_{25}^{c}$$

$$250^o = \frac{25\pi^c}{18}$$

Using $\pi \approx 3.142$, $250^o \approx 4.36^c$

See Exercise 1

3. Convert $\frac{\pi^c}{4}$ to degrees

$$1^c = \frac{180^o}{\pi}$$

$$\frac{\pi^c}{4} = \frac{\cancel{180}^{45}}{\cancel{\pi}} \times \frac{\cancel{\pi}}{\cancel{4}}^{o}$$

$$\frac{\pi^c}{4} = 45^o$$

4. 'Convert 6.5^c to degrees

$$1^c = \frac{180^o}{\pi}$$

$$6.5^c = \frac{180}{\pi} \times 6.5$$

$$6.5^c = \frac{1170^o}{\pi}$$

Using $\pi \approx 3.142$, $6.5^c \approx 372.4^o$

See Exercise 2

Note: The symbol for radian, ^{c} , is often omitted.

Exercise

1. Convert the following degrees to radians

1. 30°	2. 270°	3. 20°
4. 450°	5. 135°	6. 57.3°

2. Convert the following radians to degrees

1. $\frac{\pi}{2}$	2. $\frac{5\pi}{4}$	3. $\frac{11\pi}{6}$
4. 3.5π	5. π	6. 1

Answers

1. Degrees to radians

1. $\frac{\pi}{6}$	2. $\frac{3\pi}{2}$	3. $\frac{\pi}{9}$
4. $\frac{5\pi}{2}$	5. $\frac{3\pi}{4}$	6. 1

2. Radians to degrees

1. 90˚	2. 225˚	3. 330˚
4. 630˚	5. 180˚	6. 57.3˚