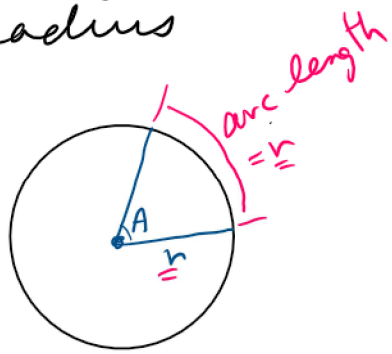
8.3 Radian Measures

There is a relationship between degree + radian measures of angles.

RADIANS is another unit of measuring angles

A radian is a measure of the angle that creates an arc length that is equal to the radius



$\angle A = 1$ radian

$180^\circ \sim 3.14$ radian $\sim \pi$

$2\pi \sim 360^\circ = 1$ rotation

$$\boxed{\frac{\text{degrees}}{180} = \frac{\text{radians}}{\pi}}$$

ex. 1 convert to radians (3 dec) ⊛ calc in "R" "RAD"

a) 57° $\quad \frac{57}{180} = \frac{r}{\pi}$ $\quad r = \frac{57 \times \pi}{180} = 0.995$

b) 500° $\quad r = \boxed{\frac{500 \times \pi}{180}} = 8.727$

exact value → lowest terms $\frac{25\pi}{9}$

2. Convert to degrees (1 dec) ⊛ CALC in "D" DEG

a) $2r$ $\quad \frac{d}{180} = \frac{2}{\pi}$ $\quad d = \frac{180 \times 2}{\pi} = 114.6$

b) $1.2r$ $\quad d = \frac{180 \times 1.2}{\pi} = 68.8$

Coterminal Angles

degrees $\quad \theta \pm 360n$

n ↑ # of rotations

radians $\quad \theta \pm 2\pi n$

eg. coterminal $\frac{2\pi}{3}$ radians

$$\frac{2\pi}{3} + 2\pi = \frac{2\pi}{3} + \frac{6\pi}{3} = \frac{8\pi}{3} \ldots\ldots$$

$$\frac{2\pi}{3} - 2\pi = \frac{2\pi}{3} - \frac{6\pi}{3} = -\frac{4\pi}{3} \ldots\ldots$$

ex. 3 coterminal

a) $\theta = \frac{2\pi}{3}$ $\quad -2\pi \le \theta \le 2\pi$

$\frac{8\pi}{3}$ $\quad = \cancel{2\frac{2}{3}\pi}$ TO BIG

$-\frac{4\pi}{3}$ $\quad = -1\frac{1}{3}\pi$ ✓

b) $\theta = 3$ $\quad -2\pi \le \theta \le 2\pi$

-6.28 $\quad 6.28$

$3 + 2\pi = \cancel{9.28}$ calc.

$3 - 2\pi = -3.28$ ✓

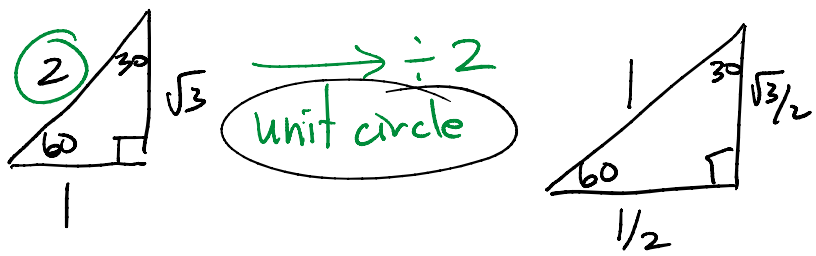
Trig ratios in radians/deg

$\tan 60$ in "D" $= \sqrt{3}$

$\tan\left(\frac{\pi}{4}\right)$ in "R"

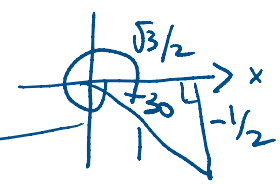
$\frac{180}{4}$

$\tan(45) = 1$



ex. 4 exact value of $\sin\left(-\frac{13\pi}{6}\right)$ in a unit circle

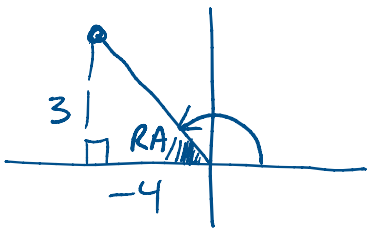
$$\sin\left(\frac{-13\pi}{6}\right) = \sin\left(\frac{-13(180)}{6}\right) = \sin(-390)$$



$$\sin(-30) = \frac{-\frac{1}{2}}{1} = -\frac{1}{2}$$

ex. 5 Find the angle given a point $P(-4, 3)$ to a tenth of a radian. $\left[-2\pi \le \theta \le 2\pi\right]$

-6.28 $\quad$ 6.28



$\tan(R.A.) = \frac{3}{-4} \Rightarrow R.A = -0.64$ ×

Angle $\theta = 180 - R.A.$

$\pi - 0.64 = 2.5$

coterminal

$2.5 + 2\pi =$ TOO BIG

$2.5 - 2\pi = -3.8$ ✓

$\boxed{\text{p552 \# 5, 6, 11(2), 13}}$