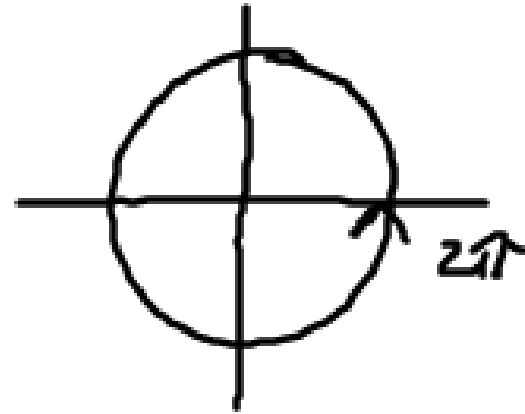


4.1 Angles, angle measure

unit circle $\rightarrow r = 1$ $C = 2\pi r$ $\therefore C = 2\pi$



radian measure: 1 rotation = 2π

degree measure: 1 rotation = 360°

degrees \times $\frac{\pi}{180^\circ}$

radian \times $\frac{180^\circ}{\pi}$

$$2\pi = 360^\circ$$
$$\pi = 180^\circ$$

↑ radians ↑ degrees

ex1 Convert to radians $^{\circ} \times \frac{\pi}{180^{\circ}}$

$$a) \boxed{30^{\circ}} \times \frac{\pi}{180^{\circ}} = \frac{30\pi}{180} = \boxed{\frac{\pi}{6}}$$

$$b) 45^{\circ} \times \frac{\pi}{180^{\circ}} = \frac{45\pi}{180} = \boxed{\frac{\pi}{4}}$$

$$c) \boxed{60^{\circ}} \times \frac{\pi}{180^{\circ}} = \frac{60\pi}{180} = \boxed{\frac{\pi}{3}}$$

$$d) 90^{\circ} \times \frac{\pi}{180^{\circ}} = \frac{90\pi}{180} = \boxed{\frac{\pi}{2}}$$

$$e) 225^{\circ} \times \frac{\pi}{180^{\circ}} = \frac{225\pi}{180} = \boxed{\frac{5\pi}{4}}$$

$$f) 17^{\circ} \times \frac{\pi}{180^{\circ}} = \boxed{\frac{17\pi}{180}}$$

0, 30, 45, 60...

ex 2 convert to degrees $\times \frac{180^\circ}{\pi}$

$$a) \boxed{\pi/4} \times \frac{180^\circ}{\pi} = \frac{180^\circ}{4} = \boxed{45^\circ}$$

$$b) \pi/3 \times \frac{180^\circ}{\pi} = \frac{180^\circ}{3} = \boxed{60^\circ}$$

$$c) \pi/2 \times \frac{180^\circ}{\pi} = \frac{180^\circ}{2} = \boxed{90^\circ}$$

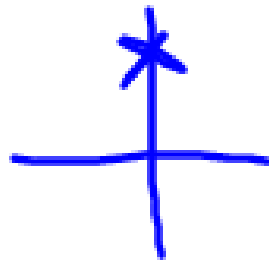
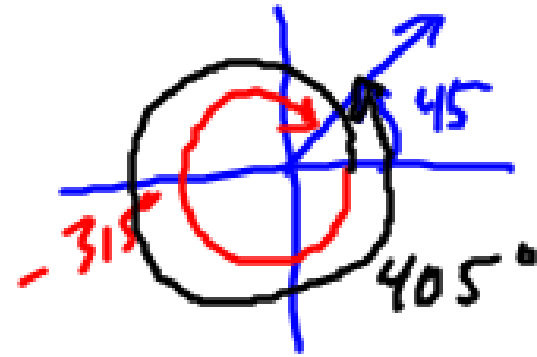
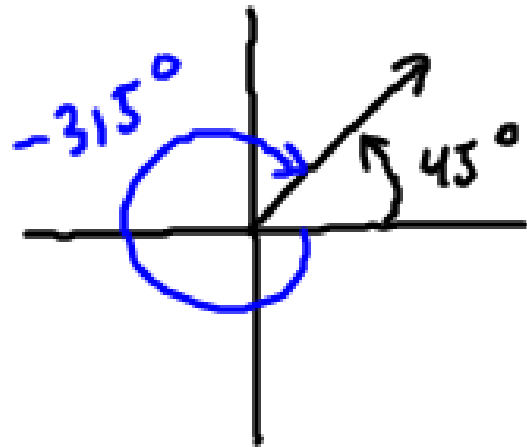
$$d) 5\pi/6 \times \frac{180^\circ}{\pi} = \frac{900^\circ}{6} = \boxed{150^\circ}$$

$$e) 7\pi \times \frac{180^\circ}{\pi} = 1260^\circ$$


$$f) 50 \times \frac{180^\circ}{\pi} = \frac{9000^\circ}{\pi}$$

$$30^\circ = \pi/6$$

coterminal angles



ex3: give 3 angles coterminal to 90°

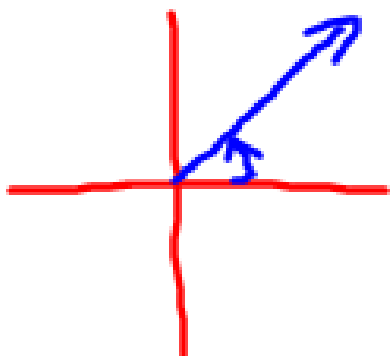
 $90^\circ \rightarrow \pm 360^\circ$ $450^\circ, 810^\circ, 1170^\circ \dots$
 $-270^\circ, -630^\circ \dots$

ex4: give 3 angles coterminal to $\pi/3$

$\frac{\pi}{3} \rightarrow \pm 2\pi \left(\begin{matrix} +6\pi \\ -3 \end{matrix} \right)$ $\frac{7\pi}{3}$ $\frac{13\pi}{3}$ $\frac{19\pi}{3} \dots$ $-\frac{5\pi}{3}$ $-\frac{11\pi}{3} \dots$

general term:

ex5: give all angles coterminal to 45°

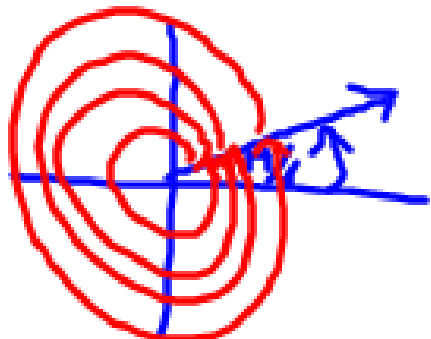


$$45^\circ + 360^\circ K, K \in \mathbb{I}$$

~~$45^\circ + 360^\circ n, n \in \mathbb{N}$~~

~~$45^\circ - 360^\circ n$~~

ex6: give all angles coterminal to $\pi/6$



$$\frac{\pi}{6} + 2\pi K, K \in \mathbb{I}$$

arc length



θ (in radians)

$$\theta = \frac{l}{r}$$

r : radius
 l : arc length

ex 7. find the missing measure

a) $\theta = \frac{2\pi}{3}$ $l = 2$ $r = ?$

$$\frac{2\pi}{3} = \frac{2}{r} \quad 2\pi r = 6 \quad r = \frac{6}{2\pi} = \frac{3}{\pi}$$

b) $\theta = \frac{5\pi}{6}$, $r = 4$, $l = ?$

$$\frac{5\pi}{6} = \frac{l}{4} \quad \frac{20\pi}{6} = l = \frac{10\pi}{3}$$

c) $r = 2$ $l = \frac{4\pi}{3}$ $\theta = ?$

$$\theta = \frac{l}{r} = \frac{\frac{4\pi}{3}}{2} = \frac{2\pi}{3}$$

d) $\theta = 60^\circ$ $l = 5$ $r = ?$

$$\frac{\pi}{3} = \frac{5}{r} \quad r\pi = 15 \quad r = \frac{15}{\pi}$$

today: 1-7 pgs 175-176

next: 8-14, 17, 19
pgs 176-177