Math 1149
Trigonometry

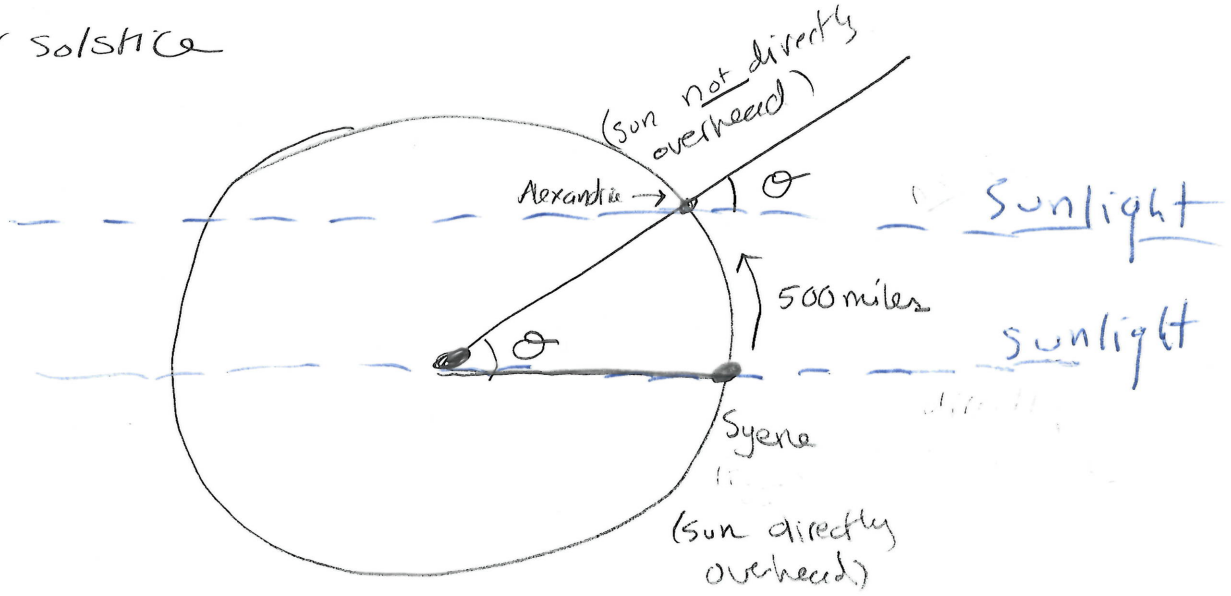
- Anyone know circumference of Earth? (25,000 miles)
- Guesses on when first calculated?
  - Before or after 1957 - first satellite into orbit?
  - Before or after Galileo (1500? AD)
  - Before or after 1st crusade? (~1100 AD)
  - Before or after Julius Ceaser (~44 BC)

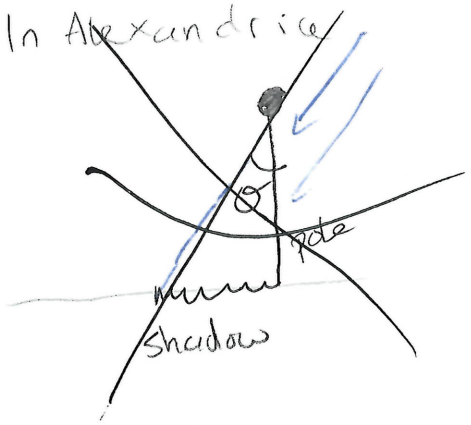
240 B.C. - Erathosthenes calculates circumference of Earth using trigonometry.

(1800 yrs before Galileo)

(250 yrs before Library of Alexandria was burned down for the first time...)

On Summer Solstice





$\theta \approx 7.2° \sim 1/50^{th}$ of a circle.

So 500 miles = $1/50^{th}$ of circumference

$\Rightarrow$ circumference of Earth $\approx$ 25,000 miles.

Within 10% of current accepted value.

Within a week or two, you'll have knowledge to redo this calculation if you like

6/5/18

Lecture

Today
- What is an angle?
- Degrees and radians
- Coterminal angles

Angles

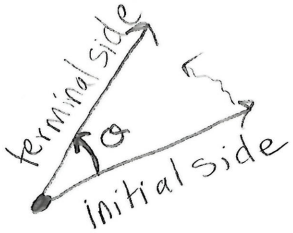
Intuitively, we know, e.g. what is 90° angle? ⇝

More formally...

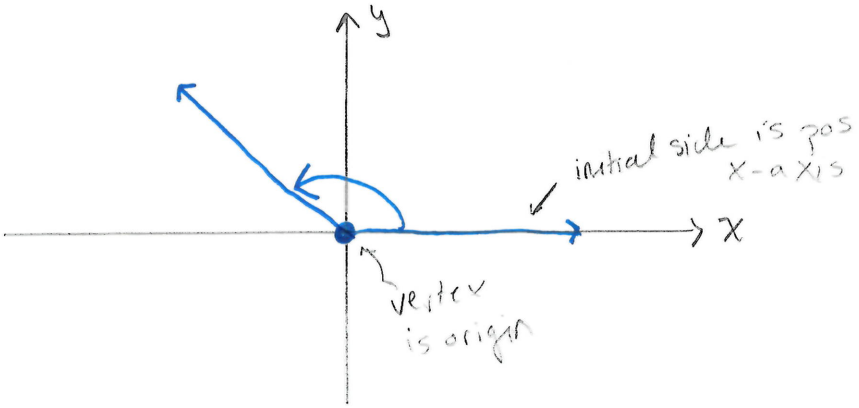
Def: A ray is "half of" a line, e.g. or

An angle is formed by rotating a ray.

rotate ⟹



almost always, our angles will be in standard position, i.e.



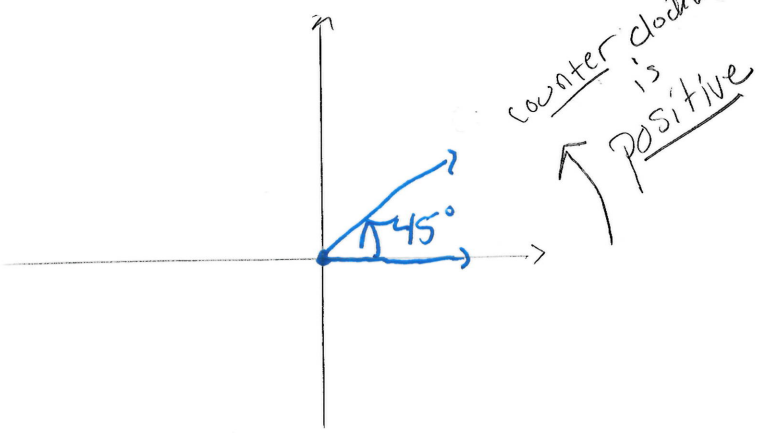
Degrees and radians

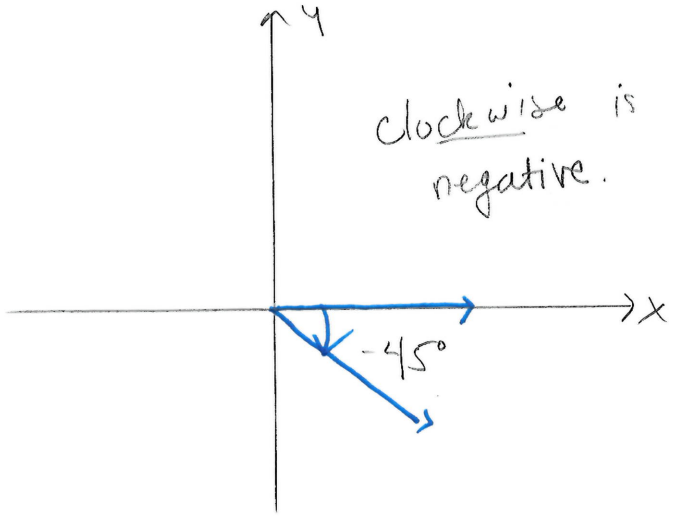
These are ways to measure an angle

Degrees

$360° \overset{?}{=}$ one full rotation

$\Rightarrow 1° = \frac{1}{360}^{th}$ of a rotation





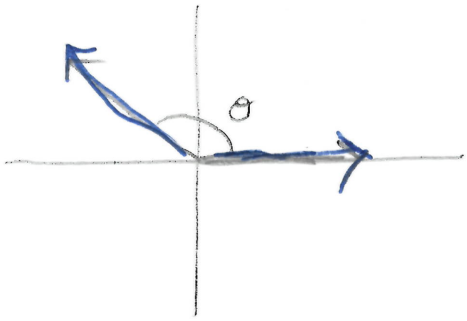
Radians We will use these!

One full rotation is $\underbrace{2\pi \text{ radians}}_{360°}$.

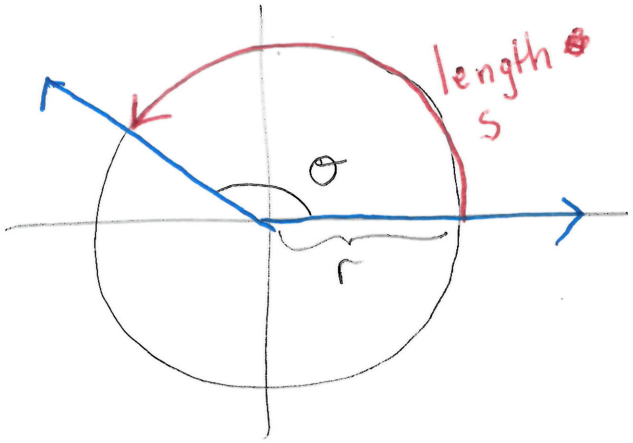
$\Rightarrow$ half of a rotation is $\underbrace{\pi \text{ radians}}_{180°}$ etc

How are they actually defined?

Imagine we have some angle



Draw a circle radius r



Def The measure of θ in radians is $\theta = \frac{s}{r}$

Why is a full rotation 2π?

For a full rotation, $s = \text{circum} = 2\pi r$.

$$\Rightarrow \theta = \frac{s}{r} = \frac{2\pi r}{r} = 2\pi$$

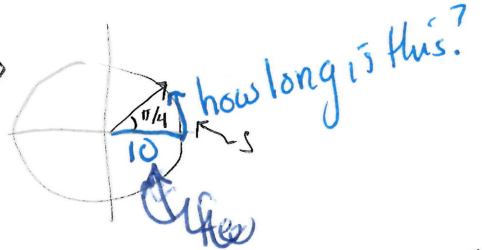
Note (arc length)

$\theta = \frac{s}{r} \Rightarrow s = r\theta$

Suppose we know θ and r. How long is s?

$s = r\theta = 10 \cdot \frac{\pi}{4}$

≈ 7.5

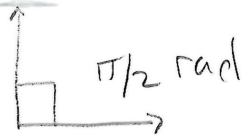


Converting

Know $180° = \pi$ rad.

- Degrees to radians $\Rightarrow$ mult. by $\frac{\pi \text{ rad}}{180°}$

$$90° \cdot \frac{\pi \text{ rad}}{180°} = \frac{\pi}{2} \text{ rad} \rightsquigarrow$$

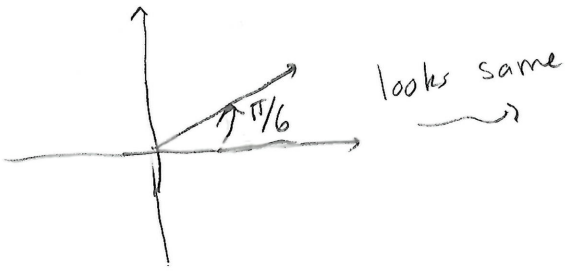


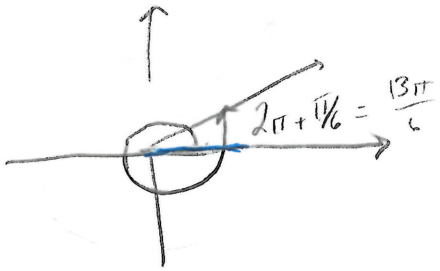
- Radians to degrees $\Rightarrow$ mult by $\frac{180°}{\pi \text{ rad}}$.

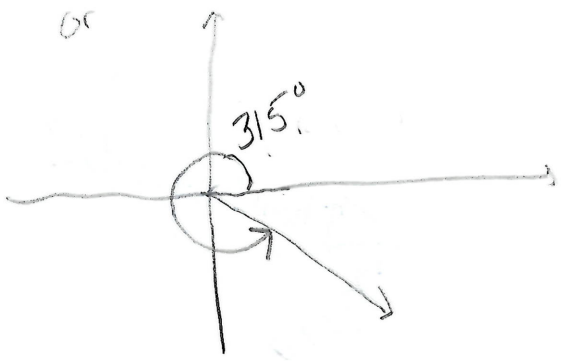
$$\frac{\pi}{2} \text{ rad} \cdot \frac{180°}{\pi \text{ rad}} = 90° \rightsquigarrow$$

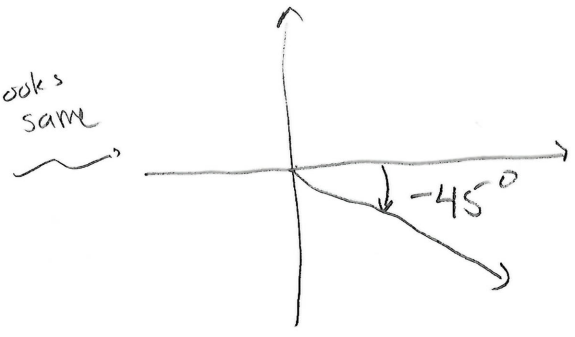
Coterminal angles

Idea: Different angles can look the same



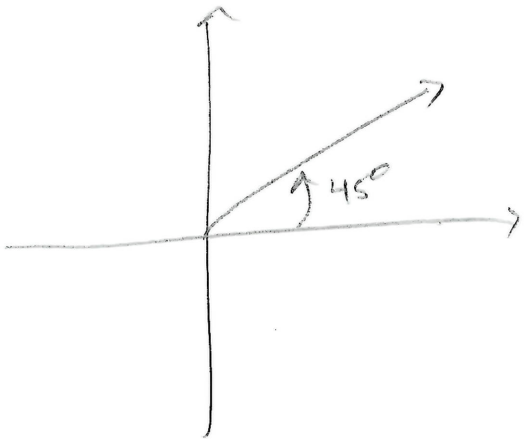




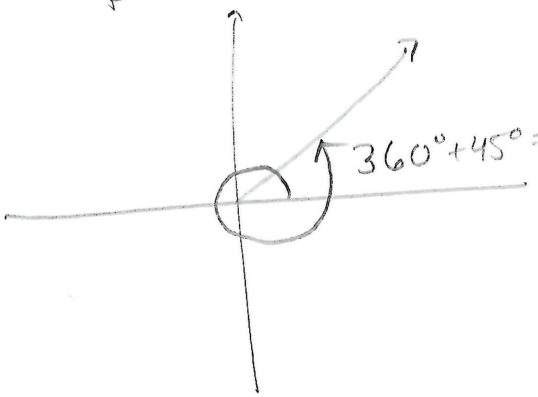


Def: These are called coterminal angles

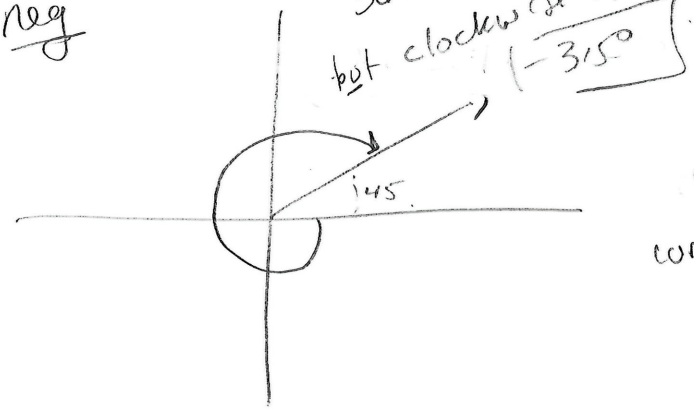
e.g. Find two angles (one pos. one neg) coterminal to 45°



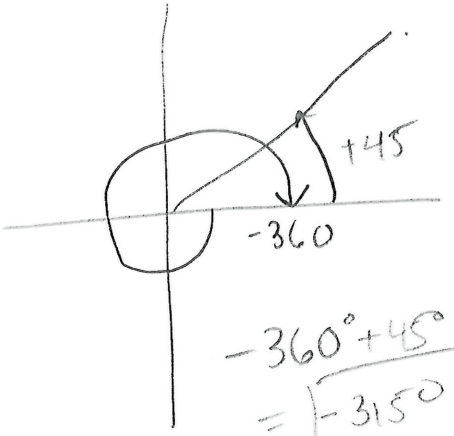
pos



neg



or continue



$-360° + 45° = -315°$