

Geometry

Monday 11-19-12

Class Notes

$y = \sin(x)$ or $y = \sin(\theta)$ is
theta

A function. But so far we have
only looked at angles between
 0° and 90° $0 \leq \theta \leq 90$

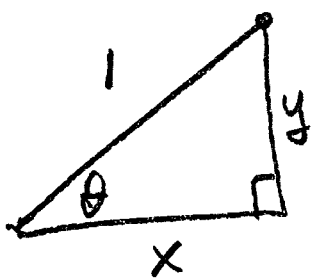
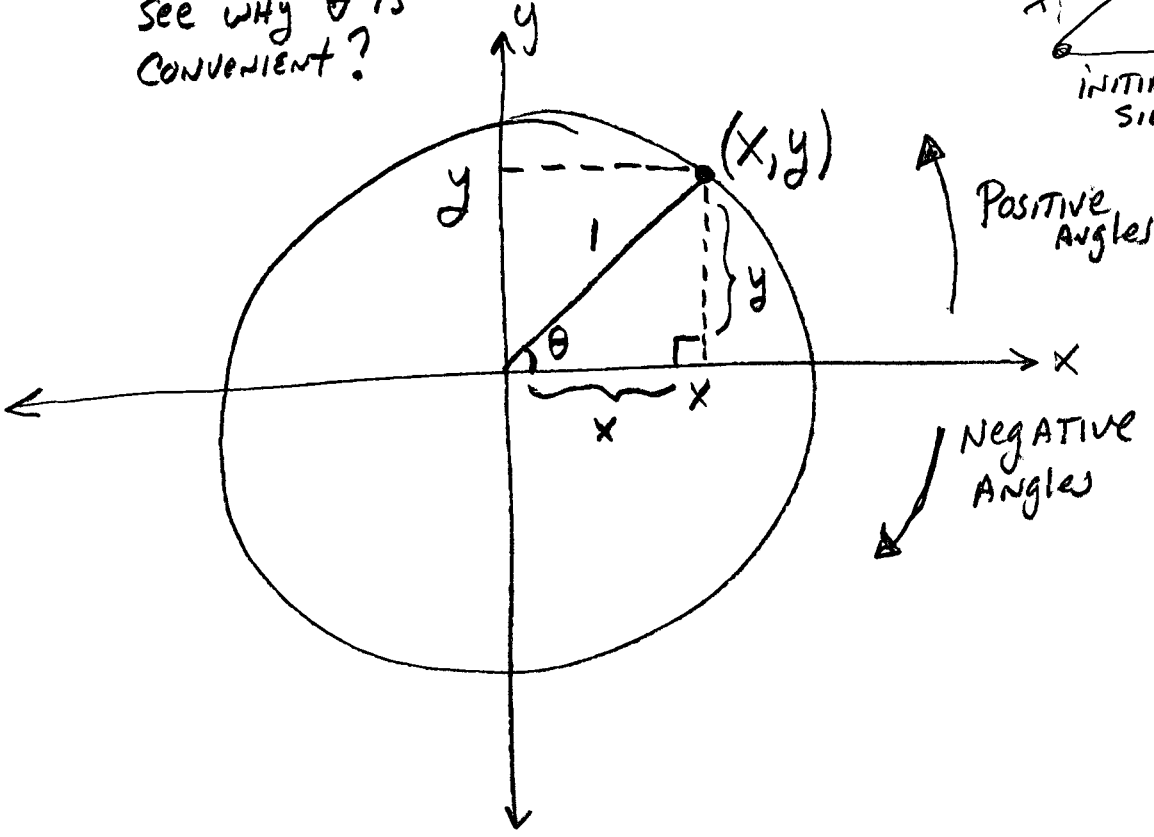
How do you find $\sin(105^\circ)$
or the $\cos(280^\circ)$?

We use a very powerful tool
called the unit circle, a
ONE = unity
circle with a radius of 1.

And we learn a new memory aid
to go with SOH CAH TOA

A S T C
A SMART TRIG CLASS

DRAW AND label A unit circle,
see why θ is
CONVENIENT?



$$\sin \theta = \frac{y}{1} = y$$

$$\cos \theta = \frac{x}{1} = x$$

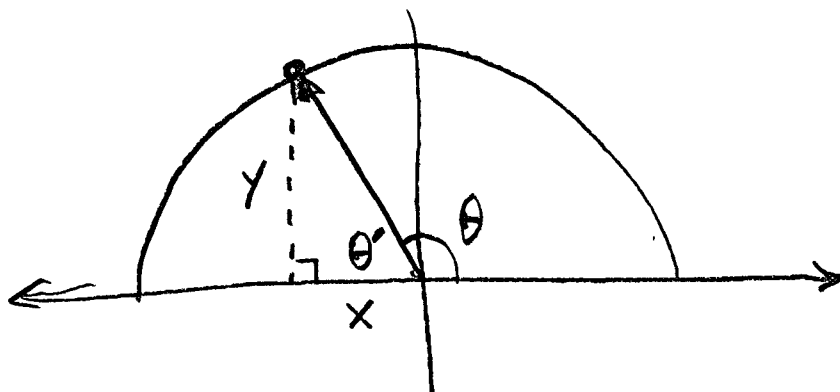
$$\tan \theta = \frac{y}{x}$$

QUADRANT I, $x \oplus y \oplus$
 \Downarrow
 0° to 90°

\therefore All
 \Downarrow
sin, cos, tan \oplus

NO NEGATIVES
ON TRIG table!

LOOK AT AN ANGLE IN QUADRANT II



θ' = theta prime = reference angle, Always \oplus
Always "back to X-axis"

In Quadrant II θ' is the angle you get by subtracting $180 - \theta$

Quadrant II is $(-, +)$ so

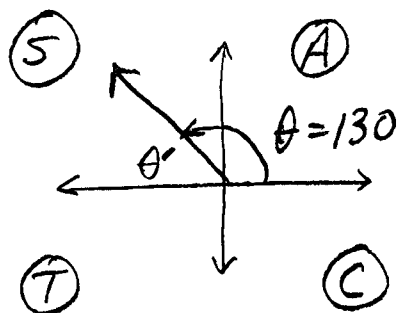
$$\left. \begin{array}{l} \sin \theta = y = \oplus \\ \cos \theta = x = \ominus \\ \tan \theta = \frac{y}{x} = \ominus \end{array} \right\} \begin{array}{l} 90^\circ \text{ to } 180^\circ \text{ only} \\ \underline{\text{Sine is Positive}} \end{array}$$

$$* \sin \theta = \oplus \sin \theta'$$

$$\cos \theta = \ominus \cos \theta'$$

$$\tan \theta = \ominus \tan \theta'$$

EX SIN, COS, TAN OF 130°



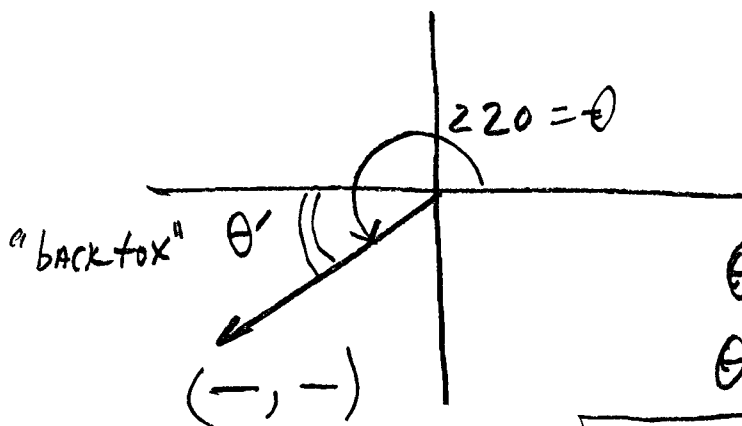
$$\theta' = 180 - 130 = 50^\circ$$

$$\sin 130 = \sin 50 = .7660$$

$$\cos 130 = -\cos 50 = -.6428$$

$$\tan 130 = -\tan 50 = -1.1918$$

QUADRANT III, SAY 220° , FIND SIN, COS, TAN



$$\theta' = 220 - 180$$

$$\theta' = 40^\circ$$

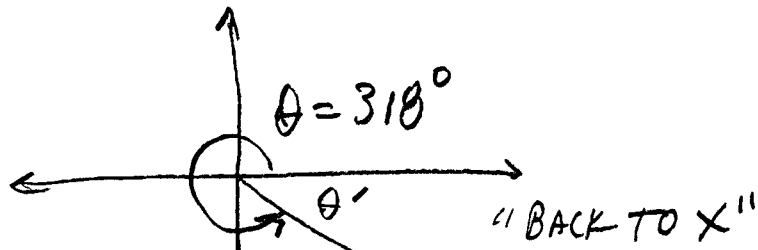
$$\begin{aligned} X &= \ominus & \therefore \cos \ominus \\ Y &= \ominus & \therefore \sin \ominus \\ \frac{Y}{X} &= \frac{\ominus}{\ominus} & \therefore \tan \oplus \\ & & = \end{aligned}$$

$$\sin 220 = -\sin 40 = -.6427$$

$$\cos 220 = -\cos 40 = -.7660$$

$$\tan 220 = +\tan 40 = .8391$$

Quadrant IV, say 318°



$$\theta' = 360 - 318$$

$$\theta' = 42^\circ$$

$$\tan \frac{\ominus}{\oplus} = -$$

ONLY COS is \oplus

S	A
T	C

All, SIN, TAN, COS
 \oplus \oplus \oplus \oplus

"A SMART TRIG CLASS"

QUADRANTAL
Angles

TIP

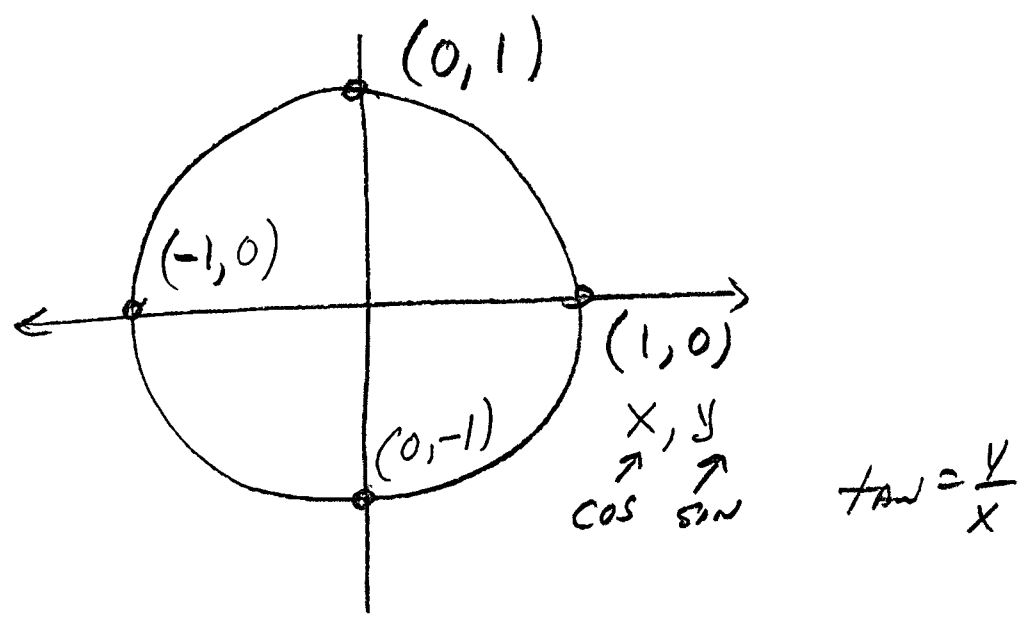
SIN, COS, TAN
will be 0, 1,
or -1, or
UNDEFINED

Angles whose terminal
side is on a
QUADRANT boundary

EX $0^\circ, 90^\circ, 180^\circ, 270^\circ, \dots$
 $360^\circ, 450^\circ, 540^\circ, 630^\circ, \dots$
 $720^\circ, \dots$

To find sin, cos, tan of
 QUADRANTAL Angles, label
 A UNIT circle's coordinates,

remember (x, y) $\tan = \frac{y}{x}$
 $\uparrow \quad \uparrow$
 cos sin

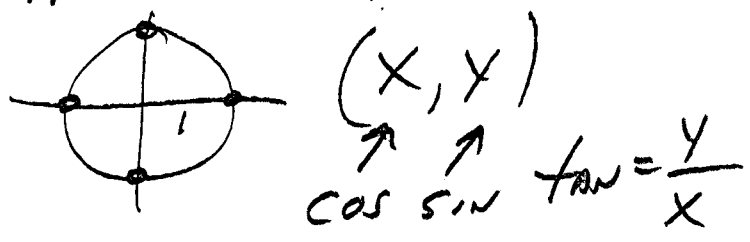


(EX) $\sin 0^\circ = 0$
 $\cos 0^\circ = 1$
 $\tan 0^\circ = \frac{0}{1} = 0$

(EX) $\sin 270^\circ = -1$
 $\cos 270^\circ = 0$
 $\tan 270^\circ = \frac{-1}{0} = \text{UNDEFINED}$

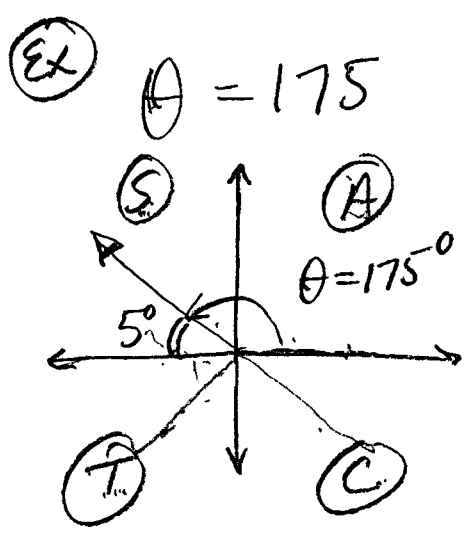
Summary: to find sin, cos, tan of any angle:

- ① draw θ on x, y axis
- ② find θ' , go "back to x"
- ③ find \oplus or \ominus using A, S, T, C
- ④ use trig table to get number which is same as θ' number
- ⑤ IF QUADRANTAL, draw and label UNIT CIRCLE POINTS



Homework: find sin, cos, tan

- for: $105^\circ, 120^\circ, 210^\circ, 260^\circ,$
 $305^\circ, 359^\circ, 180^\circ$



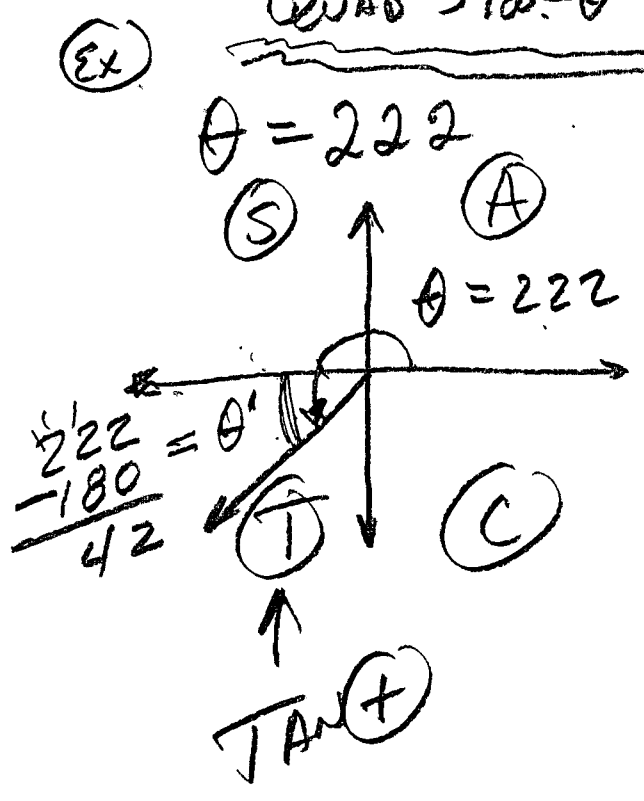
$$\sin 175^\circ = +\sin 5^\circ = .0872$$

$$\cos 175^\circ \Rightarrow -\cos 5^\circ = -.9962$$

$$\tan 175^\circ \Rightarrow -\tan 5^\circ = -.0875$$

DEF **QUADRANTAL Angle** Angle that has a terminal side on the x or y axis

QUAD 3 $180 < \theta < 270$



$\theta' = 42^\circ$

$$\sin 222 = -\sin 42 = -.6691$$

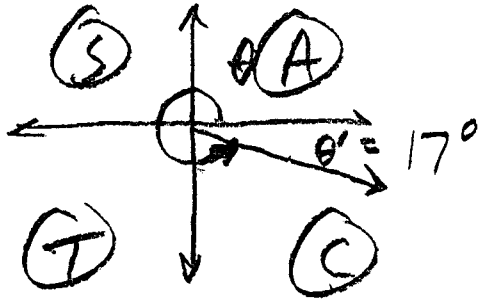
$$\cos 222 = -\cos 42 = -.7431$$

$$\tan 222 = +\tan 42 = .9004$$

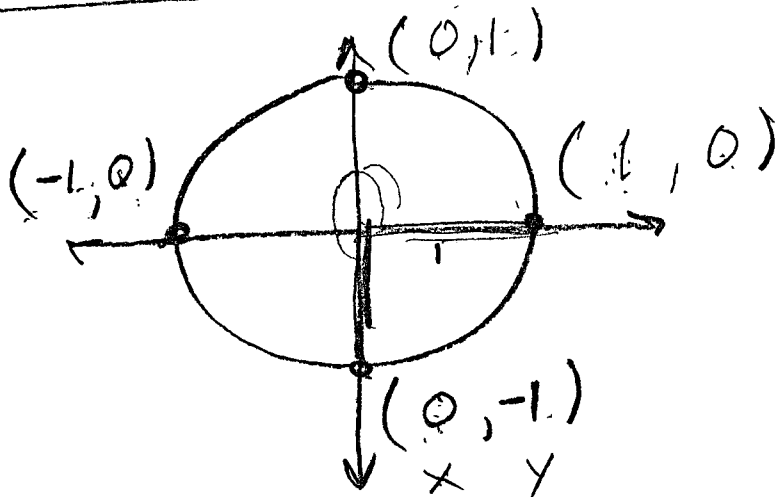
(E)

$$\theta = 34.3$$

$$270 < \theta < 360$$



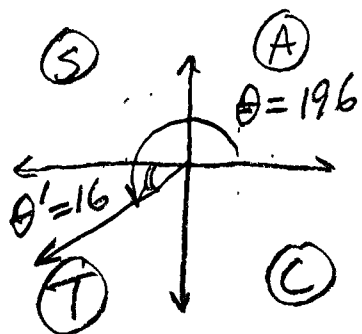
$$\begin{aligned} \sin 34.3 &= -\sin 17 = -0.2924 \\ \cos 34.3 &= +\cos 17 = 0.9563 \\ \tan 34.3 &= -\tan 17 = -0.3057 \end{aligned}$$



$$\begin{array}{ccc} \uparrow & \uparrow & \tan = \frac{y}{x} \\ \cos & \sin & \end{array}$$

Quadrantal Angles

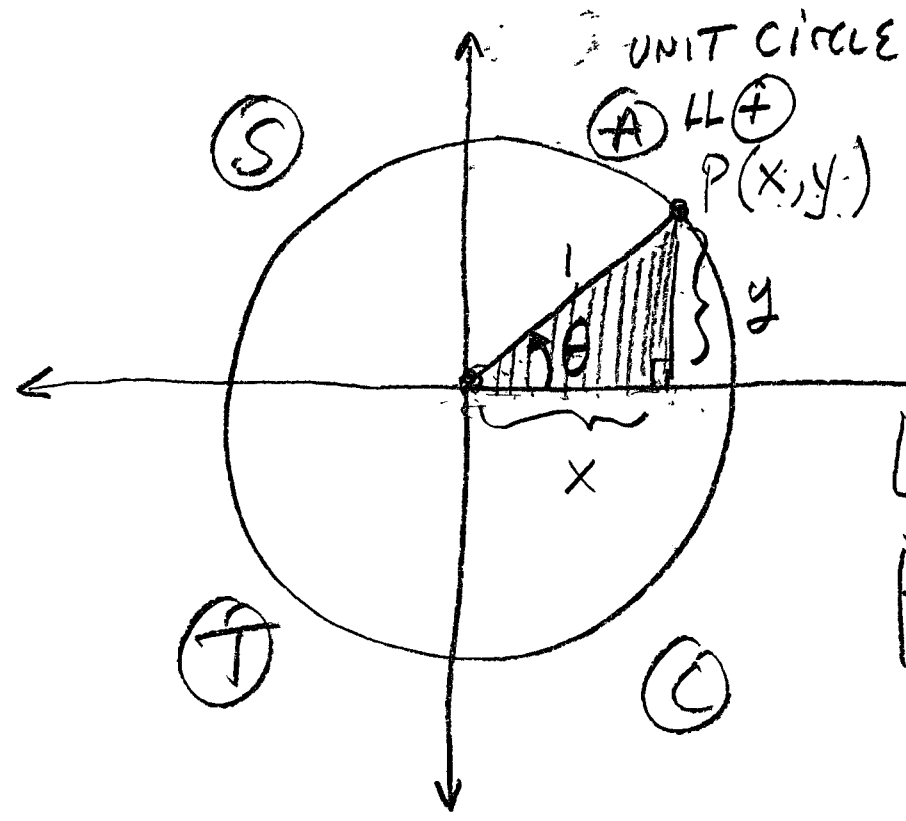
EX) \sin, \cos, \tan of $\theta = 196^\circ$



$$\sin 196^\circ = -\sin 16 = -.2756$$

$$\cos 196^\circ = -\cos 16 = -.9613$$

$$\tan 196 = \tan 16 = .2867$$

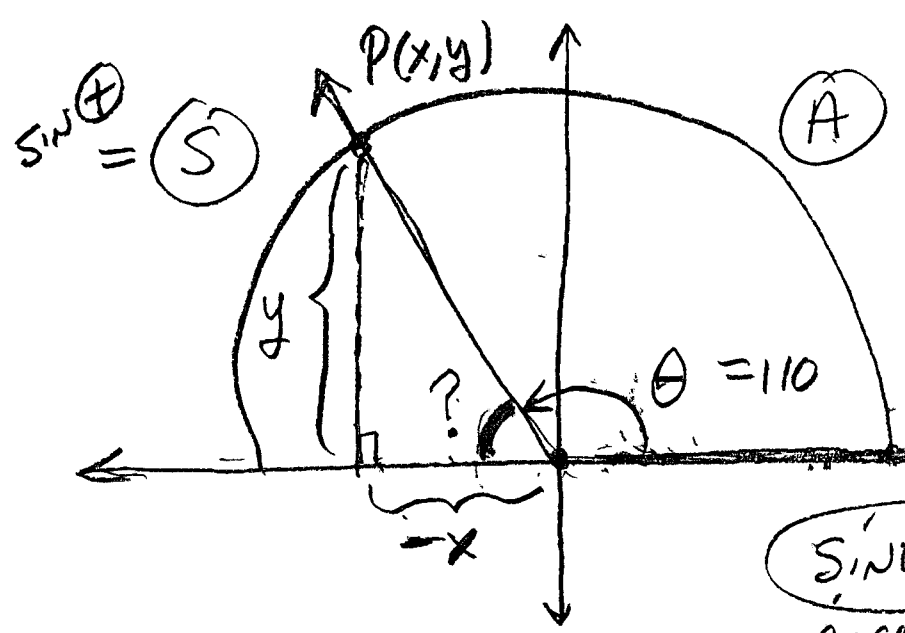


SOUTH CAH TOA.

$$\sin \theta = \frac{y}{1} = y$$

$$\cos \theta = \frac{x}{1} = x$$

$$\tan \theta = \frac{y}{x}$$



?
Reference angle
 $\theta' = \text{theta prime}$

$\theta = 110$
 $\theta' = 70^\circ$

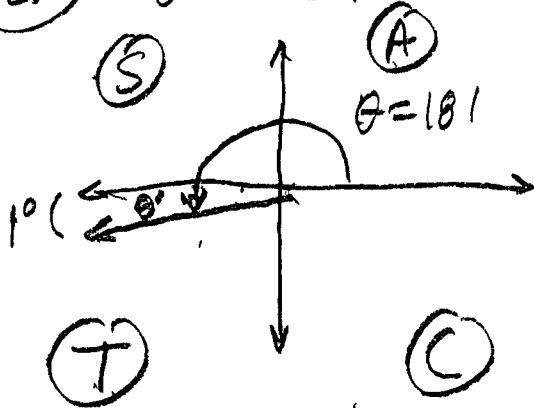
$$\sin \theta = y$$

$$\cos \theta = -x$$

$$\tan \theta = -\frac{y}{x}$$

(EX) $\sin 110^\circ = \sin 70$
 $= .9397$
 $\cos 110^\circ = -\cos 70$
 $= -.3420$
 $\tan 110 = -2.7475$

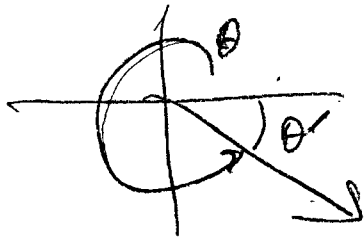
(EX) $\theta = 181^\circ$ $\theta' = 1^\circ$



$$\sin 181^\circ = -\sin 1^\circ = -.0175$$

$$\cos 181^\circ = -\cos 1^\circ = -.9998$$

$$\tan 181^\circ = +\tan 1^\circ = .0175$$



S, S'

Q, Q'

AARDVARD, AARDVARK'

QUADRANTAL ANGLE

AN ANGLE WHOSE TERMINAL SIDE IS ON THE X OR Y AXIS.

(EX) $0^\circ, 90^\circ, 180^\circ, 270^\circ, 360^\circ,$
 $-90^\circ, 450^\circ, 540^\circ; 630^\circ, 720^\circ, \dots$