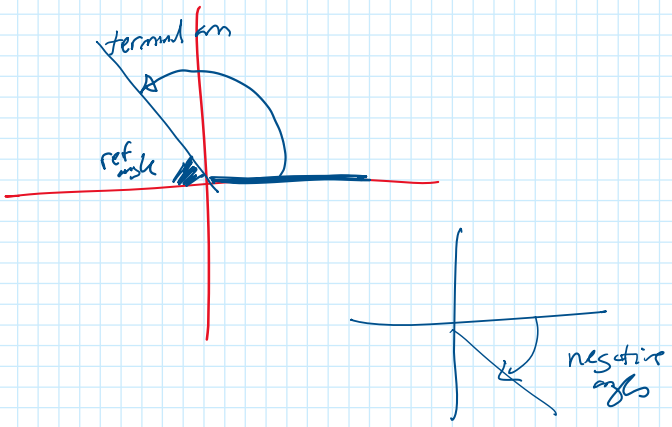
Class_16 Mar 2 - Angles in all quadrants

Tuesday, February 28, 2023 9:30 PM

Tonight's Class:

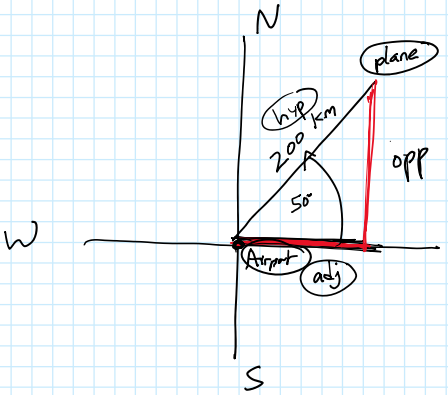
- **Unit 2 Test**
- **Working through section 5.2**
  - **Standard position angles in all quadrants**



From Section 5.1
WT page 407:

Example 2 **Solving a Problem Using Trigonometric Ratios**

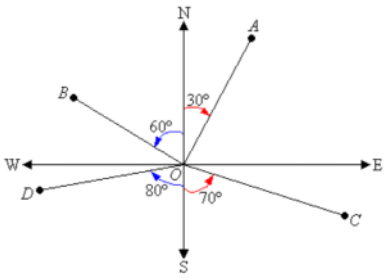
An aircraft made an emergency landing 200 km from an airport. Its heading from the airport was E50°N. The land-based rescue team has to travel east then north to get to the aircraft. To the nearest kilometre, how far should the team travel in each direction?



$\cos\theta = \frac{A}{H}$

$200 \cdot \cos 50^\circ = \frac{A}{200} \cdot 200$

For example, the direction of A from O is N30°E.
B is N60°W from O.
C is S70°E from O.
D is S80°W from O.



$\sin\theta = \frac{opp}{hyp}$

$\cos\theta = \frac{adj}{hyp}$

$\sin 50^\circ = \frac{opp}{200}$

$200 \cdot \cos 50^\circ = \frac{A}{200} \cdot 200$

$A = 200 \cos 50^\circ$

east direction: $A = 129$ km

$\sin 50^\circ = \frac{Opp}{200}$

$Opp = 200 \sin 50^\circ$

north direction: opp. $\doteq$ 153 km north direction

5.2 Standard Position Angles in All Quadrants

Focus: Use angles in standard position to determine the trigonometric ratios of angles from 0 to 360 degrees

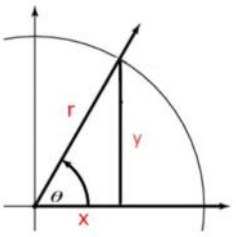
WT page 421

Example 1 **Determining the Trigonometric Ratios of an Angle Given a Terminal Point**

The point P(2, −5) lies on the terminal arm of an angle θ in standard position.

a) Determine the primary trigonometric ratios of θ. ($\sin\theta$, $\cos\theta$, $\tan\theta$)

b) Determine the measure of θ to the nearest degree.



Step 1: Plot the point (x, y)

Step 2: Find the value of r $r = \sqrt{x^2 + y^2}$

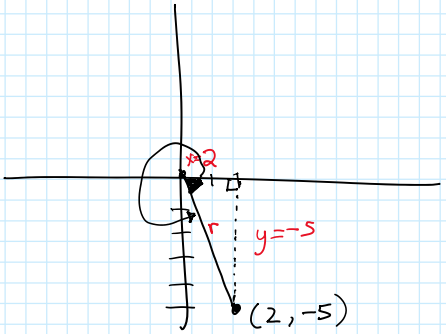
Step 3: Write the trig ratios

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

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

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

start by drawing a diagram



1) plot point
2) connect it to (0,0)
3) connect it to the x-axis

make a △

Find r, $x^2 + y^2 = r^2$

$(2)^2 + (-5)^2 = r^2$

$4 + 25 = r^2$

$29 = r^2$

$\sqrt{29} = r$

r is ALWAYS positive!

a) $\sin\theta = \frac{y}{r} = \frac{-5}{\sqrt{29}}$

$\cos\theta = \frac{ADJ}{HYP} = \frac{x}{r} = \frac{2}{\sqrt{29}}$

$\tan\theta = \frac{OPP}{ADJ} = \frac{y}{x} = \frac{-5}{2}$

$\tan\theta = -\frac{5}{2}$

$\theta_R = \tan^{-1}\left(\frac{+5}{2}\right)$

$\theta_R = 68^\circ$

Actual angle:

$360^\circ - \theta_R$

$= 360^\circ - 68^\circ$

$= 292^\circ$

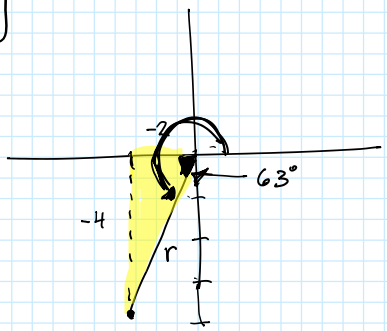
p421, CYU

p421, CYU

$= \boxed{292°}$

$(-2, -4)$

x, y



Find r: $(-2)^2 + (-4)^2 = r^2$

$4 + 16 = r^2$

$20 = r^2$

$\sqrt{20} = r$

$\sqrt{4 \cdot 5} = r$

$\boxed{2\sqrt{5} = r}$

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

$= \frac{-4}{2\sqrt{5}}$

$= \frac{-2}{\sqrt{5}}$

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

$= \frac{-2}{2\sqrt{5}}$

$= \frac{-1}{\sqrt{5}}$

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

$= \frac{-4}{-2}$

$= 2$

$\tan\theta = 2$

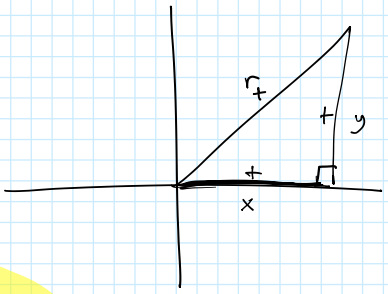
$\theta = \tan^{-1}(2)$

$\theta_R = 63°$ (ref angle)

$\theta = 180° + 63°$

$= \boxed{243°}$

Signs of Trigonometric Ratios



Q1

$\sin\theta = \frac{+}{+} = +$

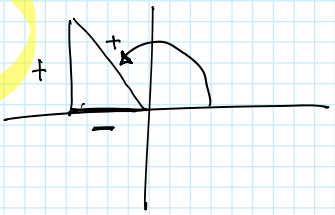
$\cos\theta = \frac{+}{+} = +$

$\tan\theta = \frac{+}{+} = +$

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

$= \frac{+}{+}$

$= +$



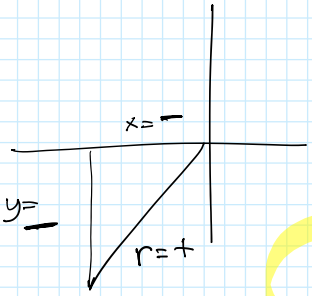
$\cos\theta = \frac{-}{+}$

$= -$

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

$= \frac{+}{-}$

$= -$



$\sin\theta = \frac{y}{r} = \frac{-}{+}$

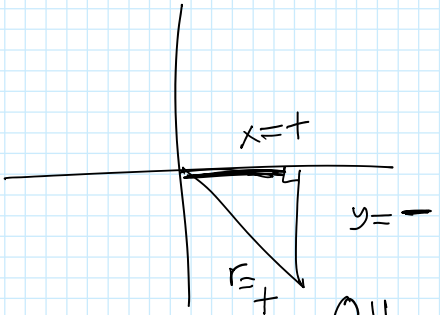
$= -$

$\cos\theta = \frac{x}{r} = \frac{-}{+}$

$= -$

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

$= +$



Q4

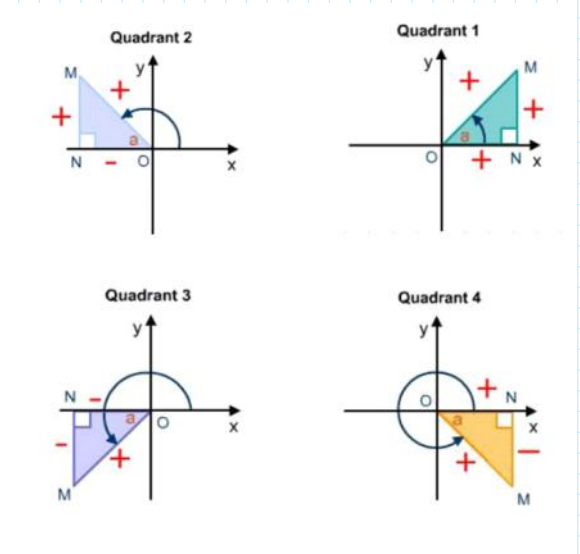
$\sin\theta = \frac{-}{+} = -$

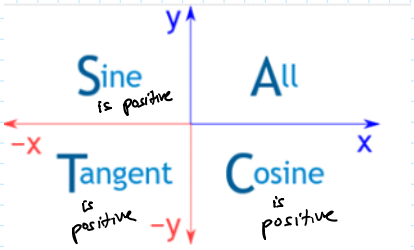
$\cos\theta = \frac{+}{+} = +$

$\tan\theta = \frac{-}{+} = -$

Q4

$\tan\theta = \frac{-}{+} = -$





S | A

T | C

WT, page 424

Example 3 **Solving a Trigonometric Equation**

To the nearest degree, which values of θ satisfy the equation $\cos\theta = -\frac{3}{4}$ for $0° \le \theta \le 360°$?

(usually there are 2 answers)

1) in which quadrants is it possible, for $\cos\theta = -\frac{3}{4}$?

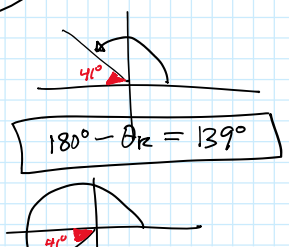
cosine is negative!

Q2 and Q3

② S | A ①

③ T | C ④

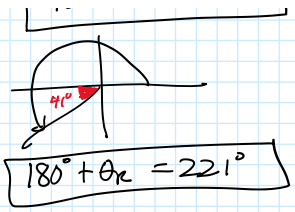
Where is cosine positive? Q1, Q4



Find reference angle:

$\theta_R = \cos^{-1}\left(+\frac{3}{4}\right)$

$\approx 41°$



For next class

- **Work on the worktext questions for 5.1-5.2**
- **For 5.2, these are good to try, so do the ones that match what we talked about, from this list: #3-7, 9-11, 14-16**
- **If you want to do the Unit 2 rewrite, prepare for it**