MCR3U
Ms. Kueh

Angles between 0° and 90° in X-Y plane

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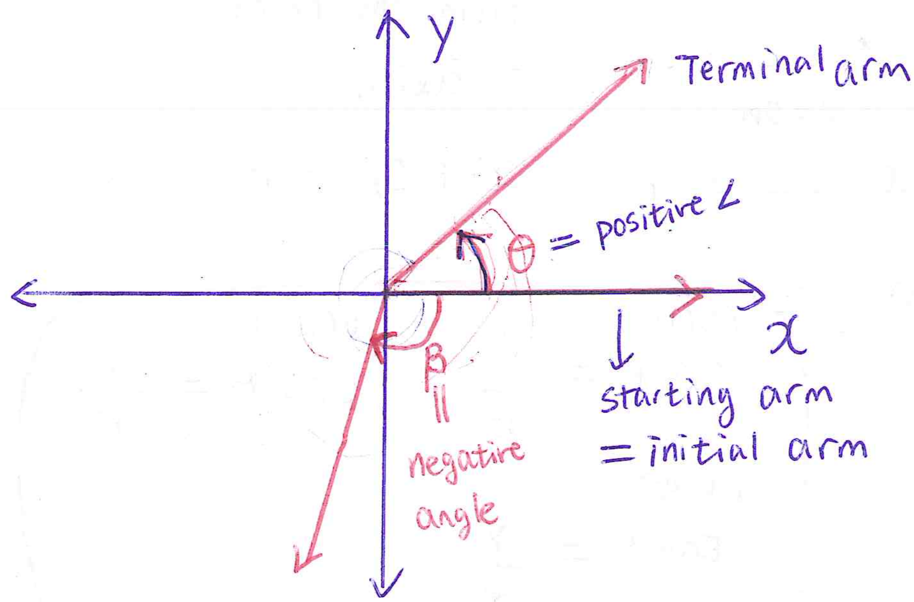
April 30

Unit 4 Trig Ratios

Angles are often labelled with Greek letters, such as θ "theta", α "alpha", and β "beta".

An angle in **standard position** has:

a. its vertex at the origin.
b. its initial (starting) arm on the positive x-axis.

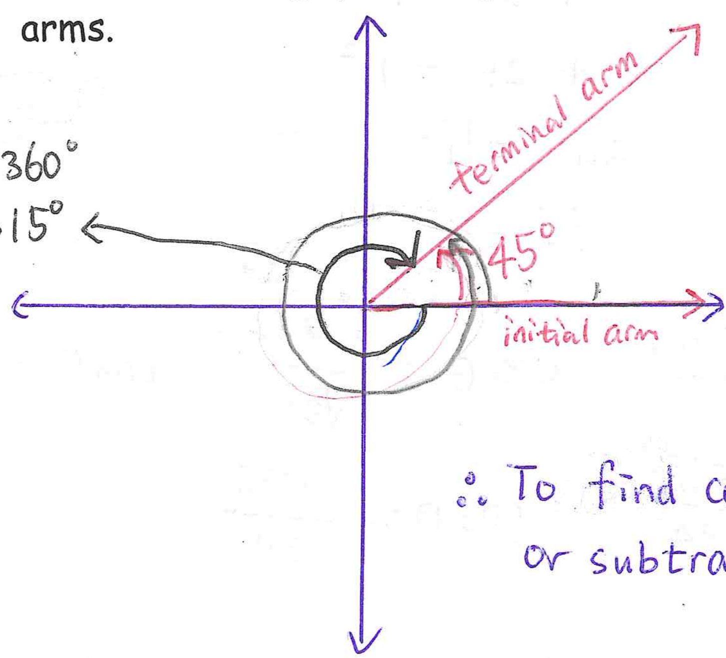


A **positive angle** is formed by a counterclockwise rotation of the terminal arm.
↳ (left)

A **negative angle** is formed by a clockwise rotation of the terminal arm.
↳ (right)

Co-terminal angles are angles that have the same initial and terminal arms.

$45° - 360°$
$= -315°$



* 45°∠ and −315°∠ are co-terminal angles.

* $360° + 45° = 405°$

* 45°∠, 405°∠ and −315°∠ are co-terminal angles.

∴ To find co-terminal ∠s, you either add or subtract 360°

MCR3U **Angles between 0° and 90° in X-Y plane**
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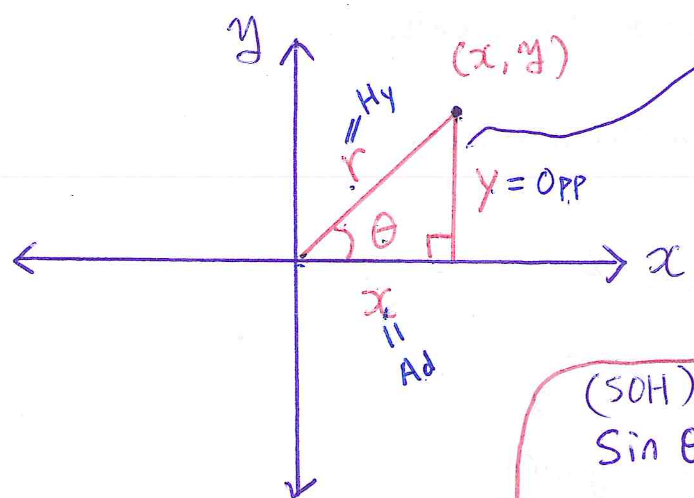
Let P(x, y) be any point on the terminal arm of an angle, in standard position. Since P can be anywhere in the x-y plane, the angle can terminate anywhere in the x-y plane.

Angles in terms of x, y, and r.



Draw a vertical line from the point to the x axis.

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

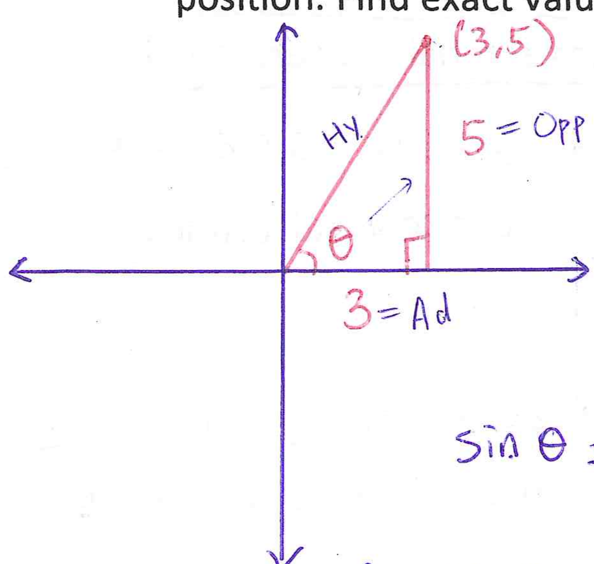
(SOH)
$\sin\theta = \frac{y}{r}$

(CAH)
$\cos\theta = \frac{x}{r}$

(TOA)
$\tan\theta = \frac{y}{x}$

Memorize !

Example 1
The point (3, 5) is on the terminal arm of an angle, θ, in standard position. Find exact values of the primary trig ratios of θ.



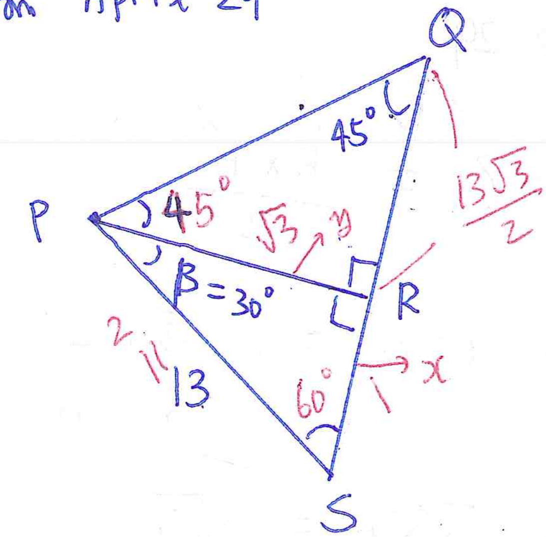
$$3^2 + 5^2 = r^2$$
$$9 + 25 = r^2$$
$$\sqrt{34} = \sqrt{r^2}$$
$$\sqrt{34} = r$$

$\sin\theta = \frac{5 \times \sqrt{34}}{\sqrt{34} \times \sqrt{34}}$ $\cos\theta = \frac{3 \times \sqrt{34}}{\sqrt{34} \times \sqrt{34}}$ $\tan\theta = \frac{5}{3}$

$\therefore \sin\theta = \frac{5\sqrt{34}}{34}$ $\therefore \cos\theta = \frac{3\sqrt{34}}{34}$

HW from April 29

11 b)



$\cos\beta = \frac{\sqrt{3}}{2}$ Area = ?

$\beta = 30°$

$60°\Delta = 1 : \sqrt{3} : 2$

$x : y : 13$

$x = 13 \div 2 = 6.5$

$y = 6.5 \times \sqrt{3}$

$= 6.5\sqrt{3}$

$= \frac{13}{2}\sqrt{3}$

$y : 13 = \sqrt{3} : 2$

$\frac{y}{13} = \frac{\sqrt{3}}{2}$

$2y = 13\sqrt{3}$

$y = \frac{13\sqrt{3}}{2}$

$$\text{Area} = \frac{B \times H}{2}$$

$$= \frac{\left(\frac{13\sqrt{3}}{2} + \frac{13}{2}\right) \times \frac{13\sqrt{3}}{2}}{2}$$

$$= \frac{\frac{(169 \cdot 3)}{4} + \frac{169\sqrt{3}}{4}}{2}$$

$$= \frac{\frac{507 + 169\sqrt{3}}{4}}{2}$$

$$= \frac{507 + 169\sqrt{3}}{4} \div 2$$

$$= \frac{507 + 169\sqrt{3}}{4} \times \frac{1}{2}$$

$$= \frac{507 + 169\sqrt{3}}{8} = \frac{169(3 + \sqrt{3})}{8}$$

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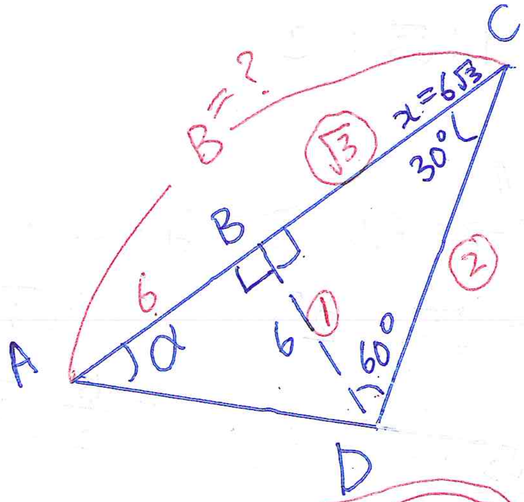
11. a) $\tan \alpha = 1$

$$\text{Area} = ? = \frac{\overset{?}{B} \times \overset{6}{H}}{2}$$

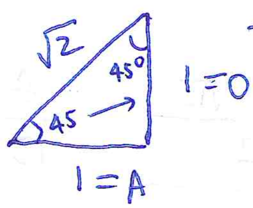


Ratio of 60° Δ = $1 : \sqrt{3} : 2$

$\times 6 \downarrow \quad \downarrow \times 6$

$6 : x : H$

$x = \sqrt{3} \times 6 = 6\sqrt{3}$



$TOA = \tan 45 = \frac{1}{1} = 1$

$\therefore \alpha = 45°$

$\therefore \text{Base} = 6 + 6\sqrt{3}$

$$\text{Area} = \frac{(6 + 6\sqrt{3}) \times \cancel{6}\,3}{\cancel{2}\,1}$$

$= 18 + 18\sqrt{3}$

$= 18(1 + \sqrt{3})$

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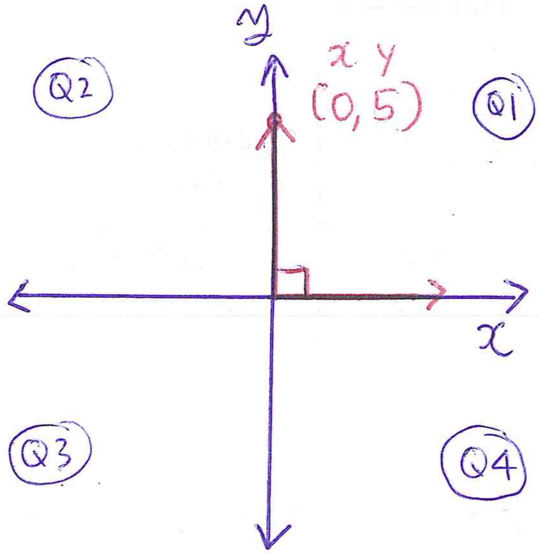
Unit 4 Trig Ratios

Example 2

Determine the primary trig ratios of 90°.



$y = 5 = \text{Opp}$, $x = 0 = \text{Adjacent}$ (zero)

$\text{radius} = 5 = \text{Hyp}$

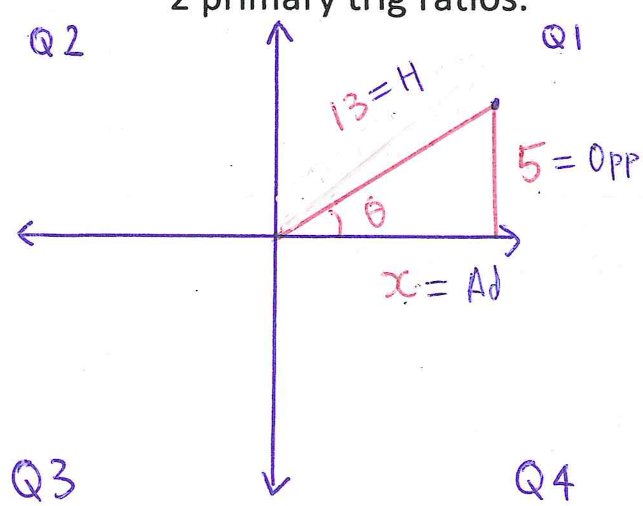
$\sin\theta = \frac{y}{r} = \frac{5}{5} = 1$

$\cos\theta = \frac{x}{r} = \frac{0}{5} = 0$

$\tan\theta = \frac{y}{x} = \frac{5}{0} = \text{undefined}$

Example 3 — S $\frac{O}{H}$

If $\sin\theta = \frac{5}{13}$ and the terminal arm is in quadrant 1, determine the other 2 primary trig ratios.



$x^2 + 5^2 = 13^2$

$x^2 + 25 = 169$

$\sqrt{x^2} = \sqrt{144}$

$x = 12$ — positive number because of position on x axis

$\therefore \cos\theta = \frac{A}{H} = \frac{12}{13}$

$\therefore \tan\theta = \frac{O}{A} = \frac{5}{12}$

Homework: Pg 237 # C3, C4, 1ad, 2e, 3af, 5, ~~20*~~, ~~21~~, ~~22~~ — optional

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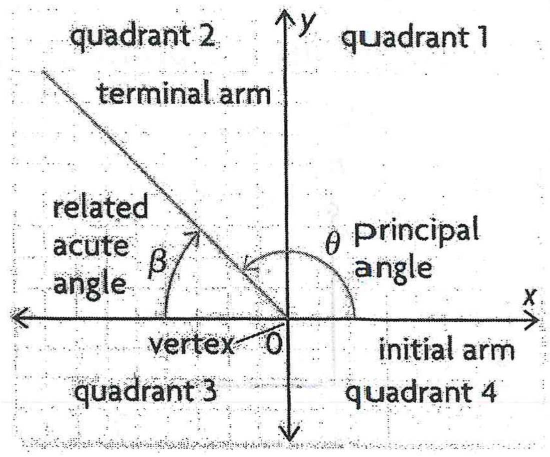
Angles between $90°$ and $360°$

Principal Angle

- In Standard position
- Initial arm on positive x - axis
- In between $0°$ to $360°$



Related Acute Angle/ Reference Angle:

- Positive acute angle made by the terminal arm of the angle and x -axis

How to find Reference angle in four quadrants:

First Quadrant	**Second Quadrant** Example – Principal Angle of $155°$
Third Quadrant Example – Principal Angle of $204°$	**Fourth Quadrant** Example – Principal Angle of $298°$