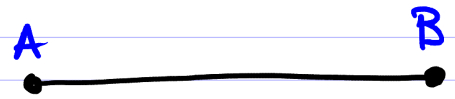
Basic Terminology

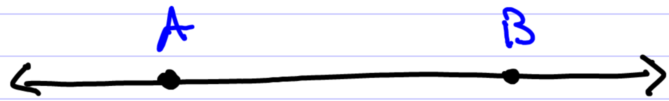
Line Segment:



Written: $\boxed{\overline{AB}}$

finite line from A to B

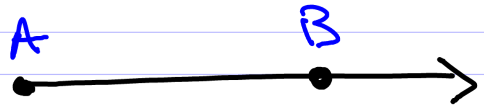
Line:



Written: $\boxed{\overleftrightarrow{AB}}$

Never ending line thru A and B

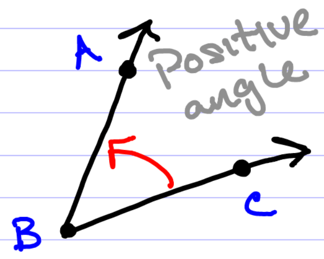
Ray:

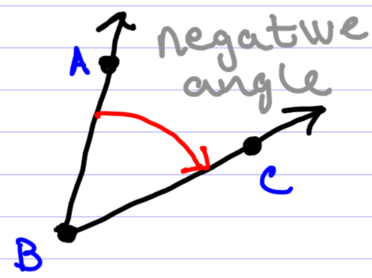


Written: $\boxed{\overrightarrow{AB}}$

Line never ending on one-side

Angles: CCW angles are positive +
CW angles are negative −

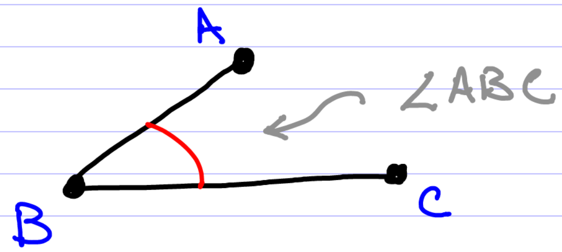




We denote these angles by: $\angle ABC$.
or $\angle CBA$

The middle letter is the vertex of the angle.

⚠ When we write $\angle ABC$ for

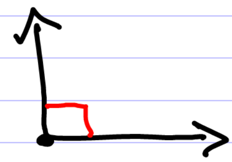


we **always** mean the **CCW** angle unless stated otherwise. That means the angle will be **positive**.

Degrees

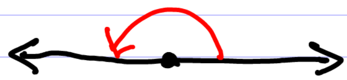
1 degree, $1^\circ = \frac{1}{360}$ of a circle.

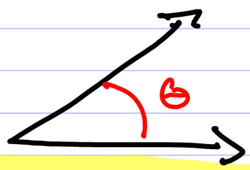
$90^\circ = \frac{90}{360} = \frac{1}{4}$ a circle:



We call this a right angle.

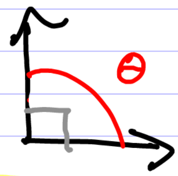
$180^\circ = \frac{180}{360} = \frac{1}{2}$ a circle:





Acute Angle

$0^\circ < \theta < 90^\circ$



Right Angle

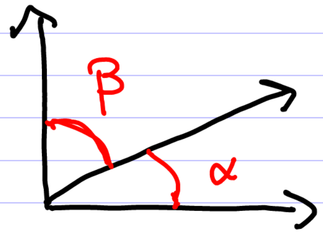
90°

Obtuse Ang

$90^\circ < \theta < 180^\circ$

Complementary Angles

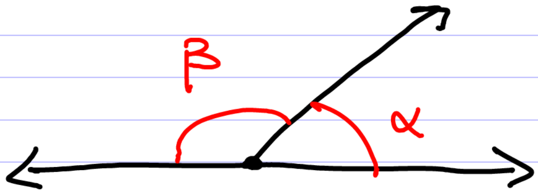
Two angles that add to $\underline{90°}$.



Here α and β are complementary angles.

Supplementary Angles

Two angles that add to $\underline{180°}$.



Here α and β are supplementary angles.

Examples

- $30°$ and $60°$ are <u>complementary</u> since $30° + 60° = 90°$
- $45°$ and $45°$ are <u>complementary</u> since $45° + 45° = 90°$.
- $100°$ and $80°$ are <u>supplementary</u> since $100° + 80° = 180°$

Ex Find complementary and supplementary angles for $55°$:

A To find complementary angle, we need to find θ so:

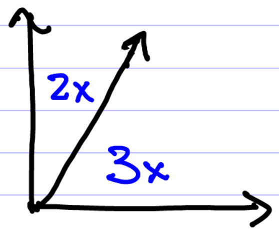
$$55° + \theta = 90° \Rightarrow \theta = 90° - 55° = \boxed{35°}.$$

(B) To find supplementary angle, we need to find θ so:

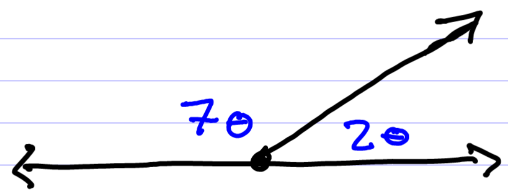
$$55^\circ + \theta = 180^\circ \Rightarrow \theta = 180^\circ - 55^\circ = \boxed{125^\circ}.$$

Ex Determine the angles of the following supp and compl angles:

A



B



(A) Need to find x so:

$$2x + 3x = 90^\circ$$
$$5x = 90^\circ$$
$$x = \frac{90^\circ}{5} = 18^\circ$$

Now substitute x back in!

$$2x = \boxed{36^\circ} \qquad 3x = \boxed{54^\circ}$$

(B) Need to find θ so:

$$2\theta + 7\theta = 180^\circ$$
$$9\theta = 180^\circ$$
$$\theta = 20^\circ$$

Sub back in: $2\theta = \boxed{40^\circ}$, $7\theta = \boxed{140^\circ}$.

Degrees, Minutes, Seconds (DMS)

degree 1° – $\frac{1}{360}$ of circle.

minute $1'$ – $\frac{1}{60}$ of a degree

second $1''$ – $\frac{1}{60}$ of a minute

Used in GPS coordinate systems and other navigational systems.

Converting DMS to Decimal Degree (DD)

Helpful:

$$1'' = \left(\frac{1}{60}\right)' = \left(\frac{1/60}{60}\right)^\circ = \frac{1}{60\cdot 60}^\circ = \frac{1}{3600}^\circ$$

Ex Convert $74^\circ 08' 14''$ to DD. to nearest thousandth.

$$74^\circ 08' 14'' = 74^\circ + \frac{8}{60}^\circ + \frac{14}{3600}^\circ$$

I list 4 digits to account for rounding. →

$$\approx 74^\circ + 0.1333^\circ + 0.0039^\circ$$

$$\approx \boxed{74.137^\circ}$$

Converting DD to DMS

Ex $34.817^\circ = 34^\circ + 0.817^\circ$

$1^\circ = 60'$ $\quad = 34^\circ + 0.817\cdot(60')$

$1' = 60''$ $\quad = 34^\circ + 49.02'$

$= 34^\circ + 49' + 0.02\cdot 60''$

$= 34^\circ + 49' + 1.2''$

$$\boxed{34^\circ 49' 1.2''}$$

Adding DMS Angles

Just like long division, but have 60s instead of 10s.

Ex

$$\begin{array}{r} 57^\circ 37' 52'' \\ +\ 32^\circ 25' 18'' \\ \hline 89^\circ 62' 70'' \end{array}$$

$70'' = 60'' + 10'' = 1' + 10''$

$\Rightarrow\ 89^\circ 63' 10''$

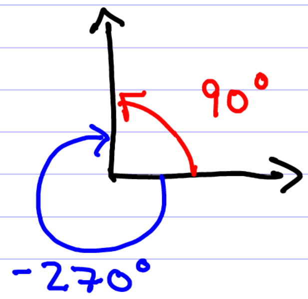
$63' = 60' + 3' = 1^\circ + 3'$

$\Rightarrow\ \boxed{90^\circ 03' 10''}$

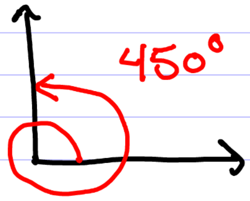
Coterminal Angles

Observation: different degrees can give the "same" angle!

Ex



90° and -270° give same angle.



450° gives same angle too.

This is because going in multiples of 360° will bring you back to where you started.

Coterminal Angles { Angles that differ by 360°.

Angles Coterminal w/ 60°

$$60° - 360° = -300°$$
$$60° + 360° = 420°$$
$$60° + 720° = 780°$$

Sometimes it's convenient to find a "simplest" value for an angle. Usually we prefer a value of $0° \le \theta < 360°$.

Ex Find angles of least possible measure that are coterminal to:

A $1106°$ B $-603°$

Idea: Add or subtract $360°$ until you get a number: $0 \le \theta < 360$

A $1106° - 360° = 746°$

$\ldots - 360° = 386°$

$\ldots - 360° = \boxed{26°}$