



## Angles

### ANGLE Topics

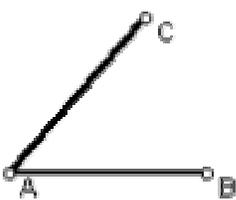
- **Coterminal Angles**
- **Defintion of an angle**
- **Decimal degrees to degrees, minutes, seconds  
by hand  
using the TI-82 or TI-83 Plus**
- **Degrees, seconds, minutes changed to decimal degree  
by hand  
using the TI-82 or TI-83 Plus**
- **Standard position of an angle**
- **Positive and Negative angles**

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### Definition: Angle

*An angle is created when a half-ray (the initial side of the angle) is drawn out of a single point (the vertex of the angle) and the ray is rotated around the point to another location (becoming the terminal side of the angle).*

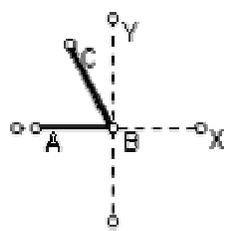
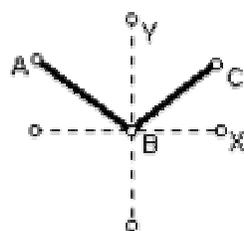
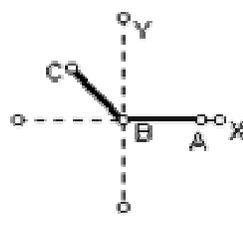
An angle is created when a half-ray (initial side of angle)	 A: vertex point of angle
is drawn out of a single point (vertex)	 AB: Initial side of angle.
and the ray is rotated around the point to another location (becoming the terminal	AC: Terminal side of angle

side of the angle).	
Hence angle A is created (also called angle BAC)	

### STANDARD POSITION

**An angle is in "standard position" when the vertex is at the origin and the initial side of the angle is along the *positive* x-axis.**

Recall: polynomials in algebra have a *standard form* (all the terms have to be listed with the term having the highest exponent first). In trigonometry, there is a *standard position* for angles. In this way, we are all talking about the same thing and are not trying to guess if your math solution and my math solution are the same.

		
Not standard position. Initial side not along positive x-axis.	Not standard position. Initial side along negative x-axis	This IS standard position. Initial side IS along the positive x-axis

## ANGLE MEASURE

**Angles are measured with two different units:  
They are measured in Degrees, minutes, and seconds or in Radians.**

**a). *Degrees, minutes, and seconds.***

For example,  $65^{\circ} 37' 15''$

### **Degrees, Seconds, Minutes changed to Decimal Degree**

To change minutes and seconds to a decimal:

There are 60 minutes in 1 degree, so divide minutes by 60.

There are 60 seconds in 1 minute (60 times 60 seconds in 1 degree),  
so divide seconds by 3600.

Add the results together to become the decimal part of the degrees.

For example,  
 $65^{\circ} 37' 15''$   
 $= 65^{\circ} + 37/60 + 15/3600$   
 $= 65^{\circ} + .616666... + .00416666...$   
 $= 65^{\circ} + .62083333...$   
 $= 65.62083333...^{\circ}$   
 $= 65.62083^{\circ}$  rounded to five decimal places.

*Calculator Steps to change minutes and seconds to a decimal:*

To do the same conversion on a ***TI-83 Plus***

Enter  $65^{\circ} 37' 15''$  as follows:

Type 65 and press the Yellow 2<sup>nd</sup>. Key and Apps/Angle; Select 1:  $^{\circ}$   
followed by 37 and the Yellow 2<sup>nd</sup>. Key and Apps/Angle; Select 2:  $'$   
followed by 15 and the **Green alpha key** and MEM/  $''$

Now press ENTER.

The result will be an un-rounded decimal: 65.62083333...

On a **TI-82**, to separate the degrees, minutes, and seconds as 65°37'15"  
use the *Blue 2<sup>nd</sup> Key* and Matrix/Angle Select 2: '

### **Decimal Degrees to Degrees, Minutes, Seconds**

To change any decimal degrees into degrees, minutes, seconds .

For example, change 37.25125° into degrees, minutes, and seconds

Set aside the digits to the left of the decimal;

these are the degrees: 37 in our example.

The decimal .25125 remains.

Multiply the resulting decimal by 60 and again set aside the digits to the left of the decimal;

these are the minutes:

in our example,  $.25125 * 60 = 15.075$

15 minutes is set aside, and the decimal .075 remains.

Multiply the remaining decimal again by 60.

The result will be the number of seconds.

in our example,  $.075 * 60 = 4.5$

so we have 4.5 seconds.

Thus, 37.25125° is the same as 37° 15' 4.5"

*Calculator Steps to change decimal degrees into degrees, minutes, seconds using the TI-82 or the TI-83 plus:*

First type the decimal expression, but do not use the degree symbol.

For example, 37.25125

Next press the 2<sup>nd</sup> Key (blue on TI-82 and yellow on TI-83)

followed by the Angle button (MATRIX/Angle on the TI-82 or APPS/Angle on the TI-83)

And choose 4:DMS (the same on both calculators).

The screen should read 37.25125>DMS

Now press ENTER.

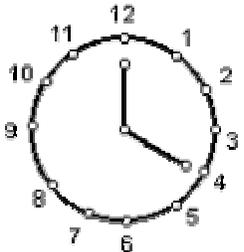
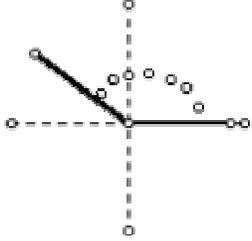
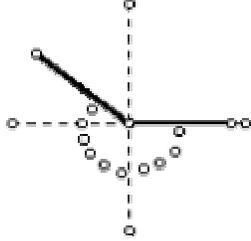
The result will be displayed in degrees, minutes, seconds.

For our example,  $37^{\circ}15'4.5''$  should be displayed on the screen.

### Positive and Negative Angles

*When a ray is rotated from the initial side in a counter-clockwise direction, the angle's measure is positive.*

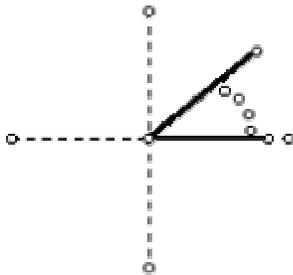
*When a ray is rotated in a clockwise direction from the initial side, the angle's measure is negative.*

		
<p>Clockwise direction is the direction that the hands of a clock move. Clockwise movement of a ray means an angle measure is negative.</p>	<p><i>Counter-clockwise</i> movement means the measure of the angle is <i>positive</i>. Start at positive x-axis.</p>	<p><i>Clock-wise</i> movement means the measure of the angle is <i>negative</i>. Again, start at positive x-axis</p>

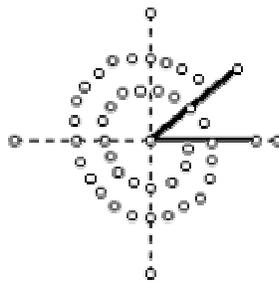
## Coterminal Angles

Two angles that have the same initial side and share the same terminal side are called coterminal angles. The idea is that you start at the same initial side and end at the same terminal side, but the ray creating the angle may rotate once or even several times either in a positive or a negative direction.

A 45 degree angle and a -675 degree angle are coterminal angles.

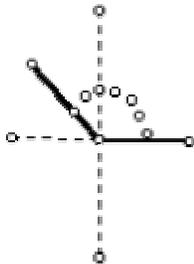


45 degree angle

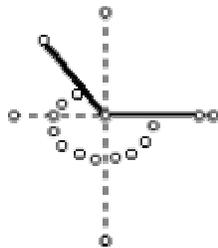


-675 degree angle

A 150 degree angle and a -210 degree angle are coterminal angles.



150 degree angle



-210 degree angle