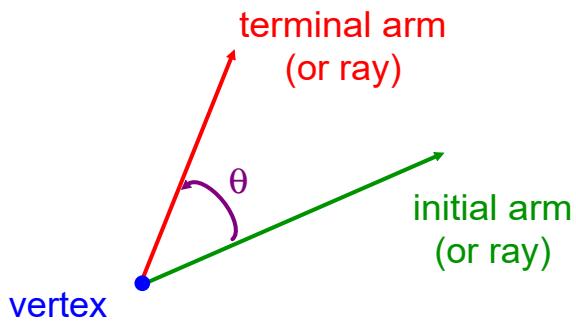


Angles in the Cartesian (x-y) Plane

Terminology:



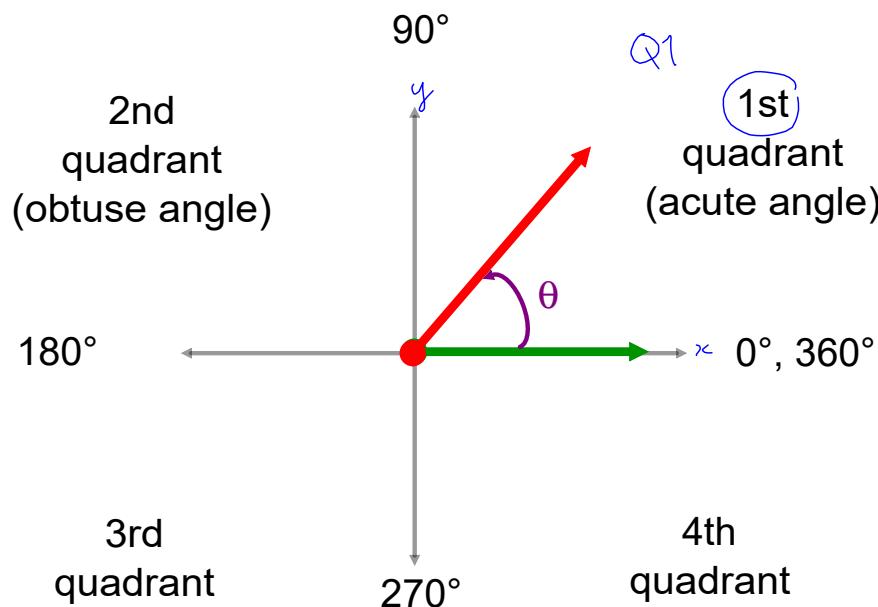
- an angle is positive if measured counter clockwise, and negative if measured clockwise.



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Definitions:

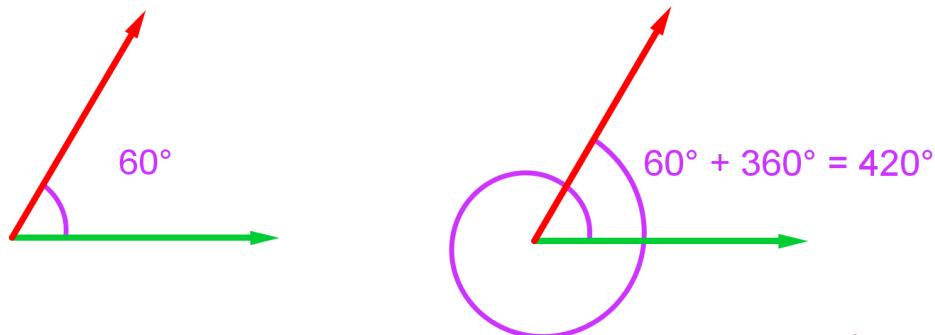
1. Standard Position - the vertex is at the origin and the initial arm is on the positive x-axis.



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2. Principal Angle - an angle between 0° and 360° .

3. Coterminal Angle(s) - angles that share the same initial and terminal arm.



4. Related Acute Angle / Reference Angle

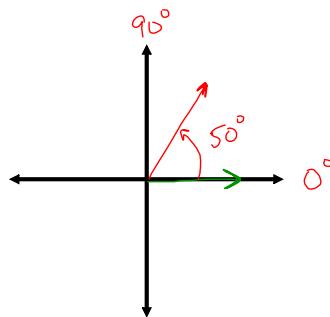
(RAA / RA)

- * - an angle formed between the terminal arm and the (closest part of the) x-axis.
- always positive
- always acute, $0^\circ < \theta < 90^\circ$

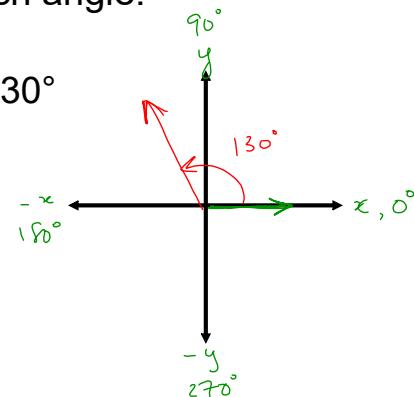
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Ex.1 Show the terminal arm for each angle:

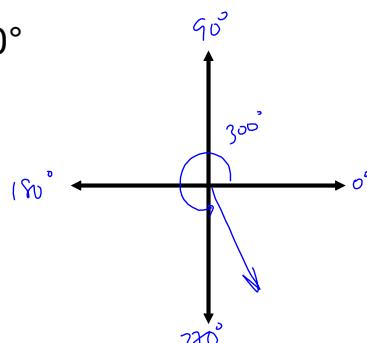
(a) 50°



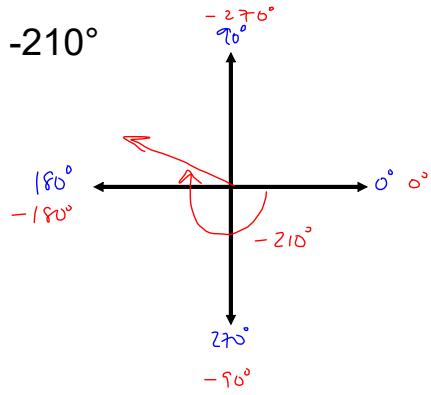
(b) 130°



(c) 300°



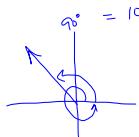
(d) -210°



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Ex.2 State the principal angle of:

$$(a) 463^\circ - 360^\circ$$



$$PA = 103^\circ$$

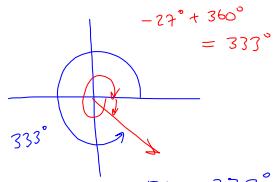
$$(b) 940^\circ - 360^\circ$$

$$\begin{aligned} &= 580^\circ \\ &= 220^\circ \end{aligned}$$

$$PA = 220^\circ$$

between 0° and 360°
 $[0^\circ, 360^\circ)$

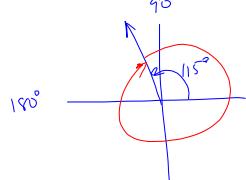
$$(c) -387^\circ + 360^\circ = -27^\circ$$



$$PA = 333^\circ$$

Ex.3 State a positive and negative coterminal angle:

$$(a) 115^\circ$$



$$\begin{aligned} CT_1 &= 115^\circ + 360^\circ \\ &= 475^\circ \end{aligned}$$

$$\begin{aligned} CT_2 &= 115^\circ - 360^\circ \\ &= -245^\circ \end{aligned}$$

$$(b) 28^\circ$$

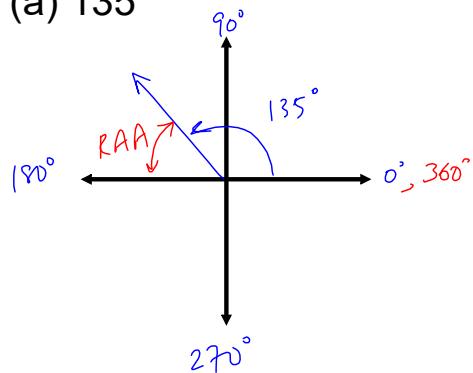
$$\begin{aligned} CT_1 &= 28^\circ + 360^\circ \\ &= 388^\circ \end{aligned}$$

$$\begin{aligned} CT_2 &= 28^\circ - 360^\circ \\ &= -332^\circ \end{aligned}$$

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Ex.4 Determine the reference angle (RAA) for:

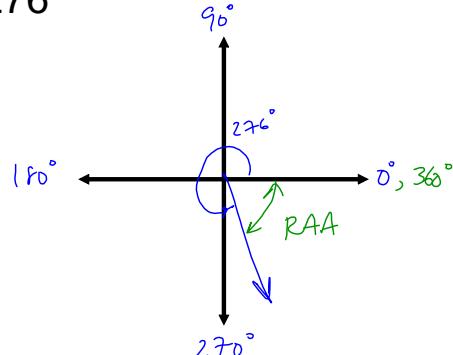
$$(a) 135^\circ$$



$$RAA + 135^\circ = 180^\circ$$

$$\begin{aligned} RAA &= 180^\circ - 135^\circ \\ &= 45^\circ \end{aligned}$$

$$(b) 276^\circ$$



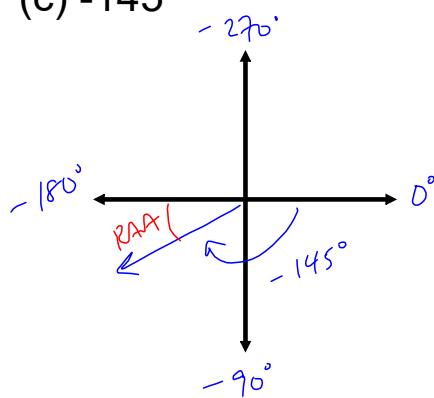
$$RAA + 276^\circ = 360^\circ$$

$$\begin{aligned} RAA &= 360^\circ - 276^\circ \\ &= 84^\circ \end{aligned}$$

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Ex.4 Determine the reference angle (RAA) for:

(c) -145°



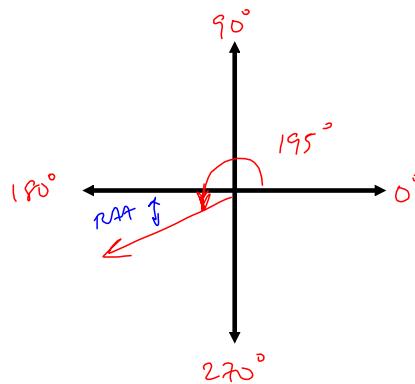
$$\text{RAA} + (-145^\circ) = -180^\circ$$

$$\text{RAA} = -180^\circ + 145^\circ$$

$$\text{RAA} = -35^\circ$$

but $\text{RAA} \geq 0$, $\text{RAA} = 35^\circ$

(b) 195°



$$\text{RAA} + 180^\circ = 195^\circ$$

$$\begin{aligned}\text{RAA} &= 195^\circ - 180^\circ \\ &= 15^\circ\end{aligned}$$

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Assigned Work:

(Handout)

10.

$$\begin{array}{r} 11, 12 \quad 10. \quad -244^\circ \quad -244^\circ \quad -244^\circ \\ 16 \quad \quad \quad +360^\circ \quad \quad \quad -360^\circ \\ 22 \quad \quad \quad \underline{116^\circ} \quad \quad \quad \underline{-604^\circ} \\ 20. \end{array}$$

$$\begin{array}{r} 11. \quad 650^\circ \quad 650^\circ \\ \quad \quad \quad -360^\circ \\ \quad \quad \quad \underline{290^\circ} \\ \quad \quad \quad -360^\circ \\ \quad \quad \quad \underline{-70^\circ} \end{array}$$

$$\begin{array}{r} 360010^\circ \\ -1000 \times 360^\circ \\ \hline 10^\circ \end{array}$$

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16. 12. 20

$2 \times 360^\circ = 720^\circ$

Full angle

$720^\circ + 360^\circ - 48^\circ$
 $= 1032^\circ$

20.

$PA = 51^\circ$

22.

$PA = 180^\circ + 74^\circ$
 $= 254^\circ$

May 2-2:18 PM