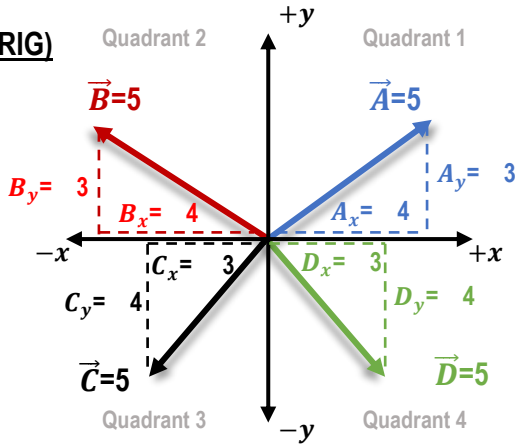
CONCEPT: DOING MATH WITH VECTORS IN ANY QUADRANT (MORE TRIG)



- You'll need to do math with vectors in *ALL* Quadrants, not just Quadrant 1.

Signs of Magnitudes & Components of Vectors:

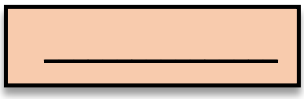
- Magnitudes → *Always* positive, but Components *may* be + **or** −
  - Positive Components = pointing **[UP | DOWN]** or **[RIGHT | LEFT]**
  - Negative Components = pointing **[UP | DOWN]** or **[RIGHT | LEFT]**

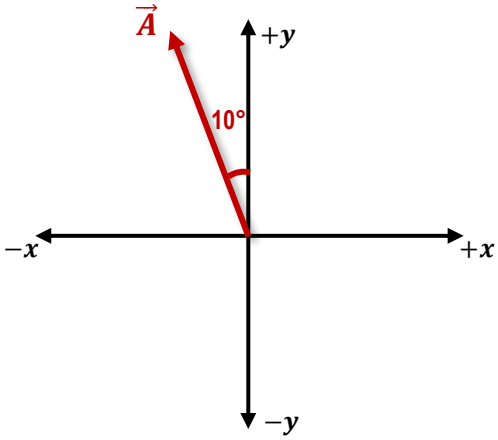
When given a Non-Reference Angle:

- Remember: We *always* use the Reference Angle $\boldsymbol{\theta_x}$ to calculate components:

$A_x = A\cos(\theta_x)$ $\qquad$ $A_y = A\sin(\theta_x)$

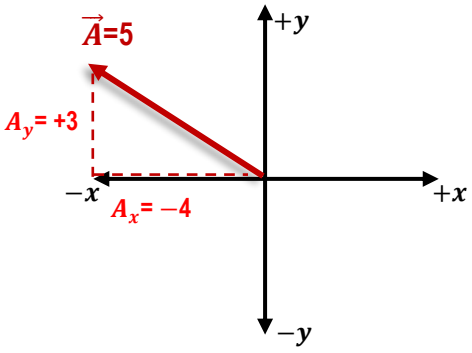
- All right angles add up to 90°, so we'll use this simple equation to get $\boldsymbol{\theta_x}$:



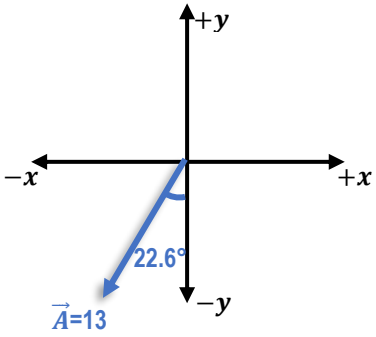


Calculating the Absolute Angle (Positive Angle from +x axis) from the Arctangent

- Taking arctan of components $\left[\theta_x = \tan^{-1}\left(\frac{|A_y|}{|A_x|}\right)\right]$ *always* gives **reference** angle $\boldsymbol{\theta_x}$.
  - Remember to always plug in positive value of components!
  - To find the **Absolute Angle**, work your way back to +x-axis (0°)



EXAMPLE: Calculate **a)** the components and **b)** the absolute angle for the given vector $\vec{A}$:



PRACTICE: FINDING VECTOR COMPONENTS

Vector **F** is 65 m long, directed 30.5° below the positive x-axis**. (a)** Find the x-component, F_x**. (b)** Find the y-component, F_y**.**

PRACTICE: VECTOR COMPOSITION IN ALL QUADRANTS

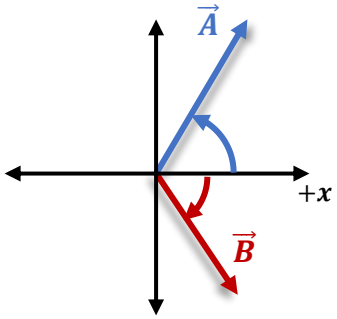
The vector **A** represented is by the pair of components A_x = -77 cm , A_y = 36 cm**. (a)** Find the magnitude of vector **A. (b)** Find the absolute angle of this vector**.**

CONCEPT: DESCRIBING DIRECTIONS VECTORS WITH WORDS (MORE TRIG)

- Many problems will use different words to describe the directions of vectors:

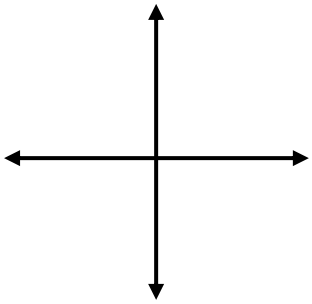
1) **Counterclockwise** angles are **[+ / −]**; **Clockwise** angles are **[+ / −]**

- However, reference angle θ_x for component equations is ***always*** a positive angle relative to nearest x-axis.

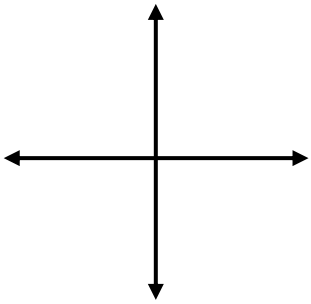


EXAMPLE: Draw each vector and calculate its components.

a) $\vec{A}$ = 5m @ +37° from -x axis



b) $\vec{B}$ = 5m 53° CW from +y axis



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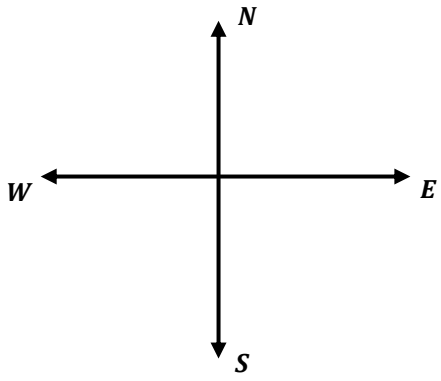
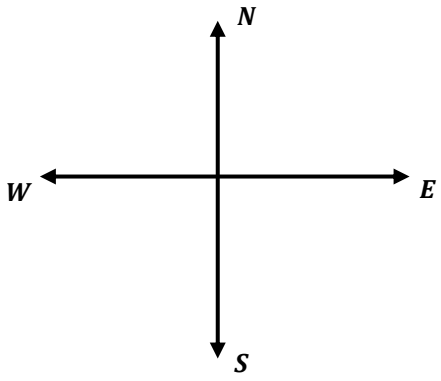
2) Angles **North/South/West/East** **(e.g. 30° north of east)**: Draw arrow in 2nd direction, curve towards 1st

EXAMPLE: Draw each vector and calculate the x-component

a) $\vec{A}$ = 6 @ 30° North of East



b) $\vec{B}$ = 10 @ 53° West of South



PRACTICE: HELICOPTER TRIP

A small helicopter travels 225 m across a city in a direction 53.1° south of east**.** What are the components of the helicopter's trip?