

## Vectors:

Quantities can either be scalar or vector

Size only  
mass  
time  
speed

Size and direction  
force  
velocity  
acceleration

Vector quantities can be represented by an arrow called a *vector*. The vector has a **tail** and a head. The **head** of the vector shows direction. (tail marks origin)



The length of the vector shows the size of the quantity. A scale is used to draw size/length. *Example:* if the vector is to represent a 60 N force you could make it 6.0 cm long. The scale would be 1cm = 20 N

## Rules for Vector Addition

- Draw the first vector (scale and direction)
- Start the second vector at the head of the first and draw it. (repeat if more than two)
- Start the resultant at the tail of the first and end it at the head of the second (last). Measure its direction for the tails of the first and resultant.

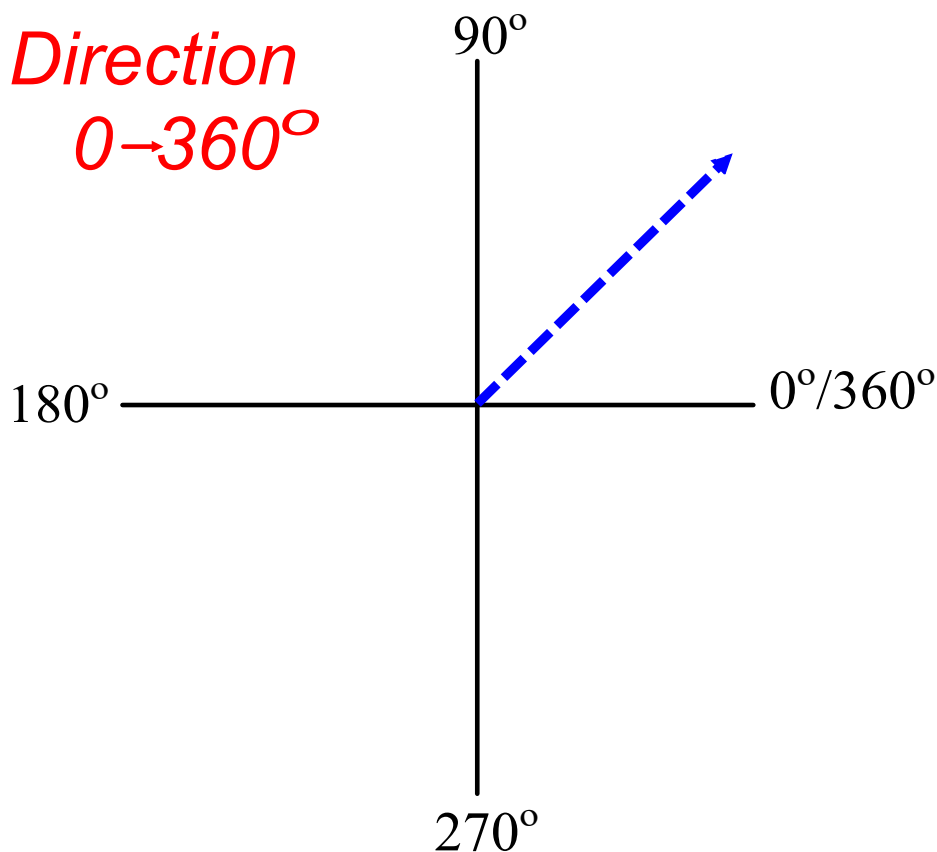
## Types of vectors:

Components = vectors that act on an object

Resultant = a single vector that is the vector sum of components that are acting

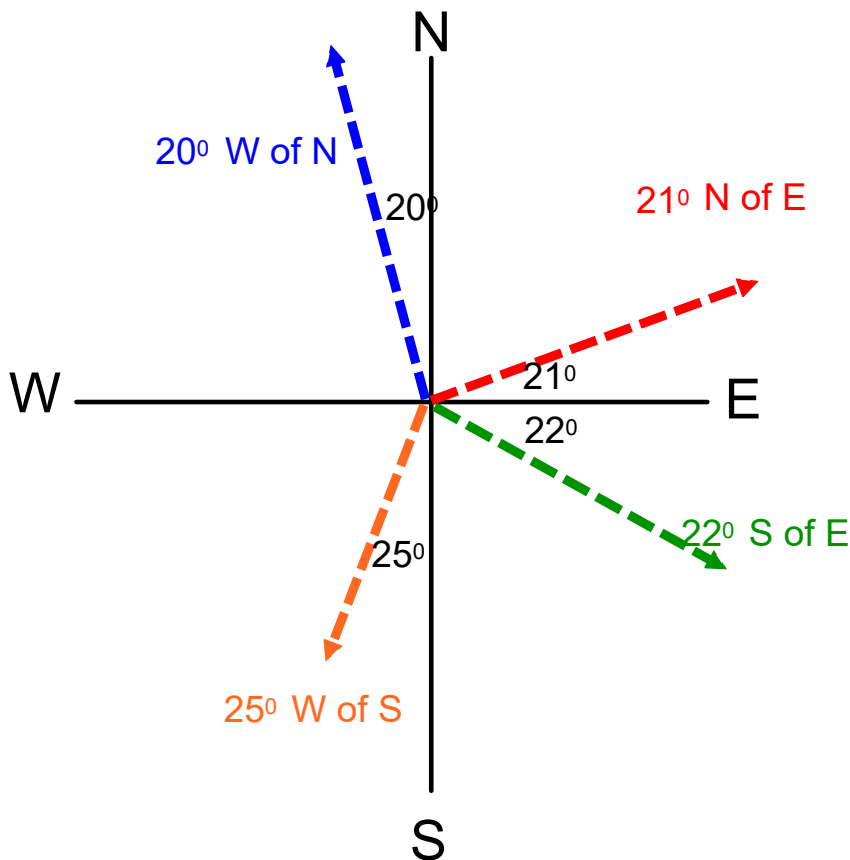
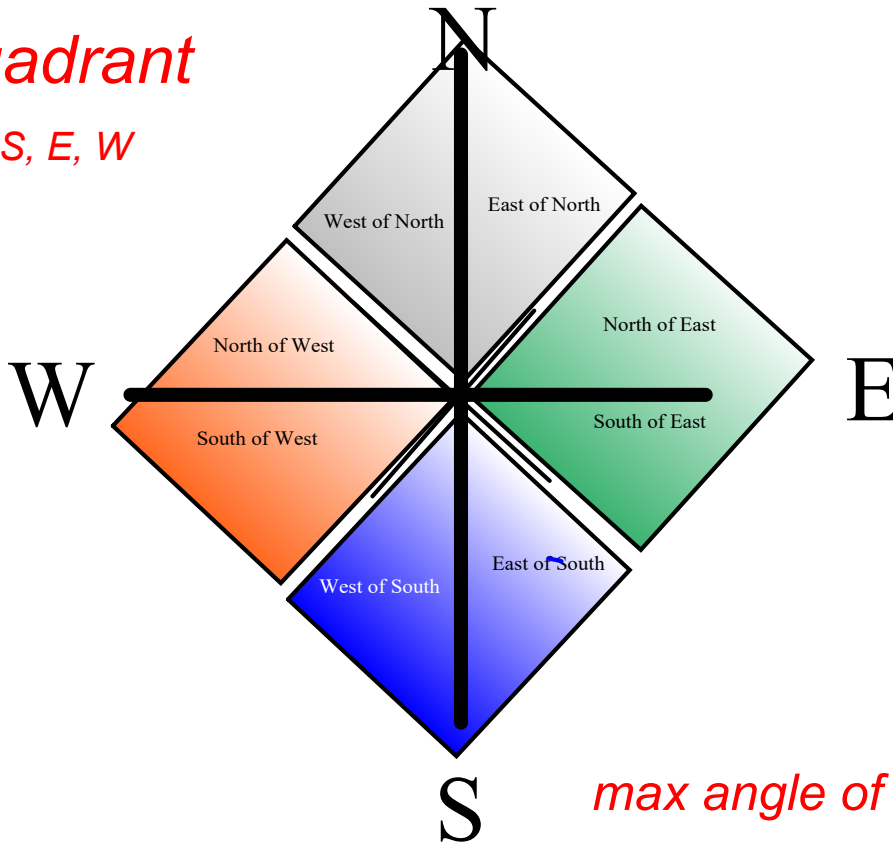
Equilibrant = equal and opposite to a resultant  
equal in size and opposite in  
direction

$$E = -R$$



# Quadrant

*N, S, E, W*

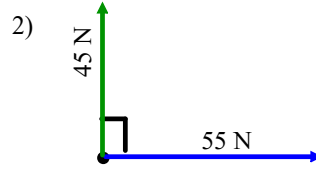
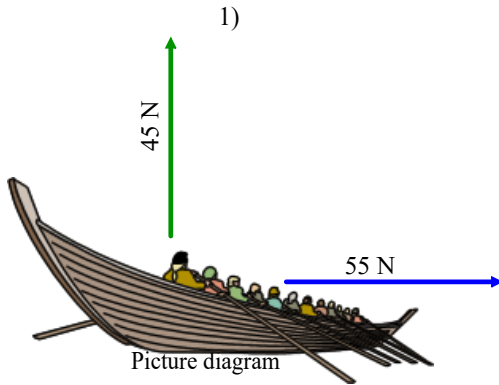


$$F_1 = 55 \text{ N at } 0.0^\circ$$

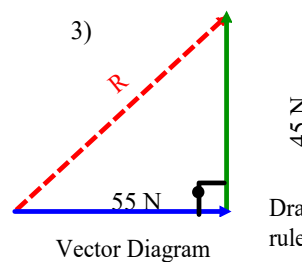
$$F_2 = 45 \text{ N at } 90.0^\circ$$

$$R = ?$$

Two forces act on an object.  
 One force is 55 N acting at  $0.0^\circ$ ,  
 and the second is 45 N acting at  $90.0^\circ$   
 What is the *resulting force*?



Point diagram: all components drawn from a single point



Drawn according to the rules of vector addition!

## Steps for solving vector problems using

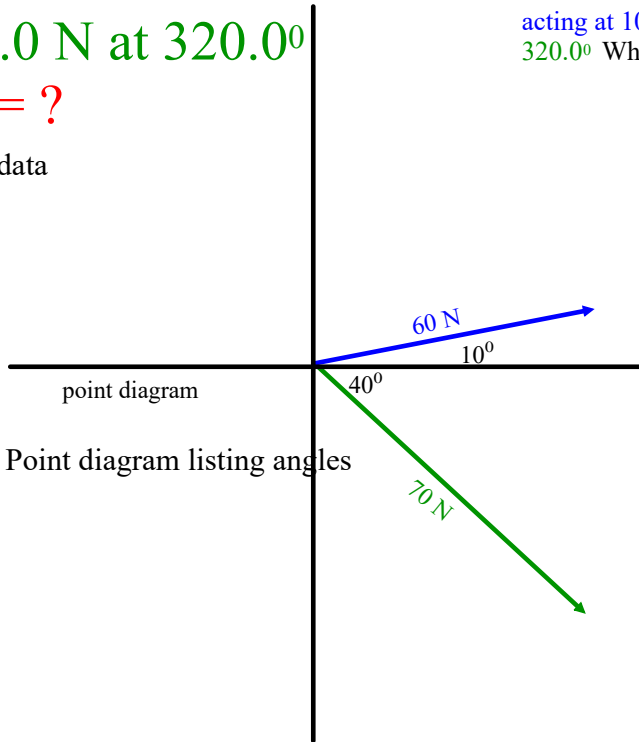
### "Graphical Analysis"

- 1) List data
- 2) draw Point diagram listing angles  
*freehand*
- 3) draw "x" and "y" axis at head of  $c_1$  (from point diagram)
- 4) draw in all angles...use alternate interior/exterior and complimentary/supplementary angles
- 5) move tail of  $c_2$  to head of  $c_1$  at angle  $c_2$  is from axis
- 6) calculate angle between  $q$  and  $c_2$  (happy angle) 😊
- 7) draw vector diagram to scale

$F_1 = 60.0 \text{ N at } 10.0^\circ$   
 $F_2 = 70.0 \text{ N at } 320.0^\circ$   
 $R = ?$

Two forces act on an object. One force is 60.0 N acting at 10.0°, and the second is 70.0 N acting at 320.0°. What is the *resulting force*?

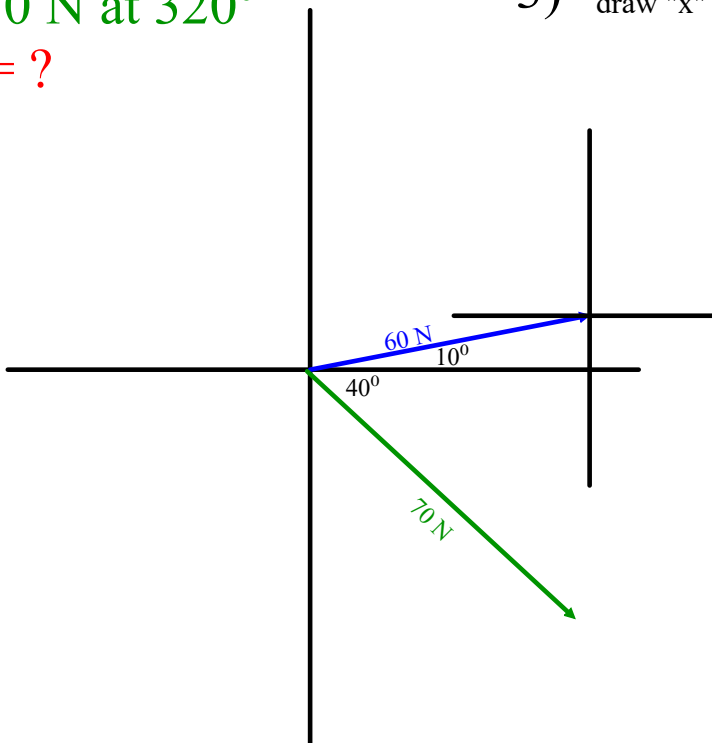
1) List data



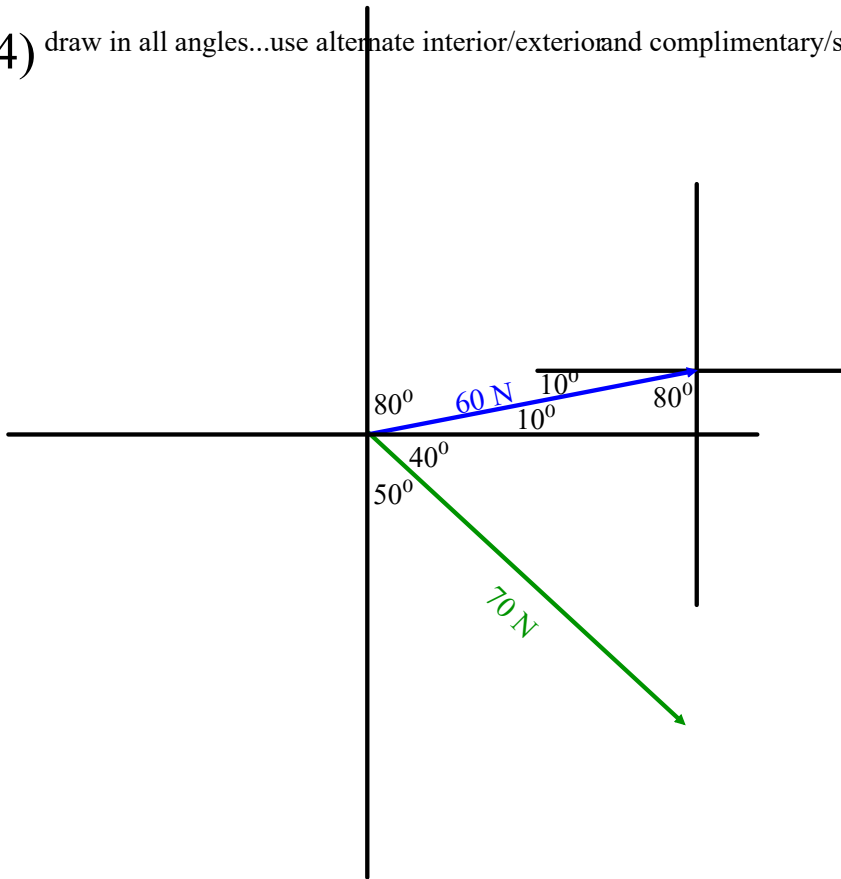
2) draw Point diagram listing angles

$60.0 \text{ N at } 10.0^\circ$   
 $70.0 \text{ N at } 320^\circ$   
 $R = ?$

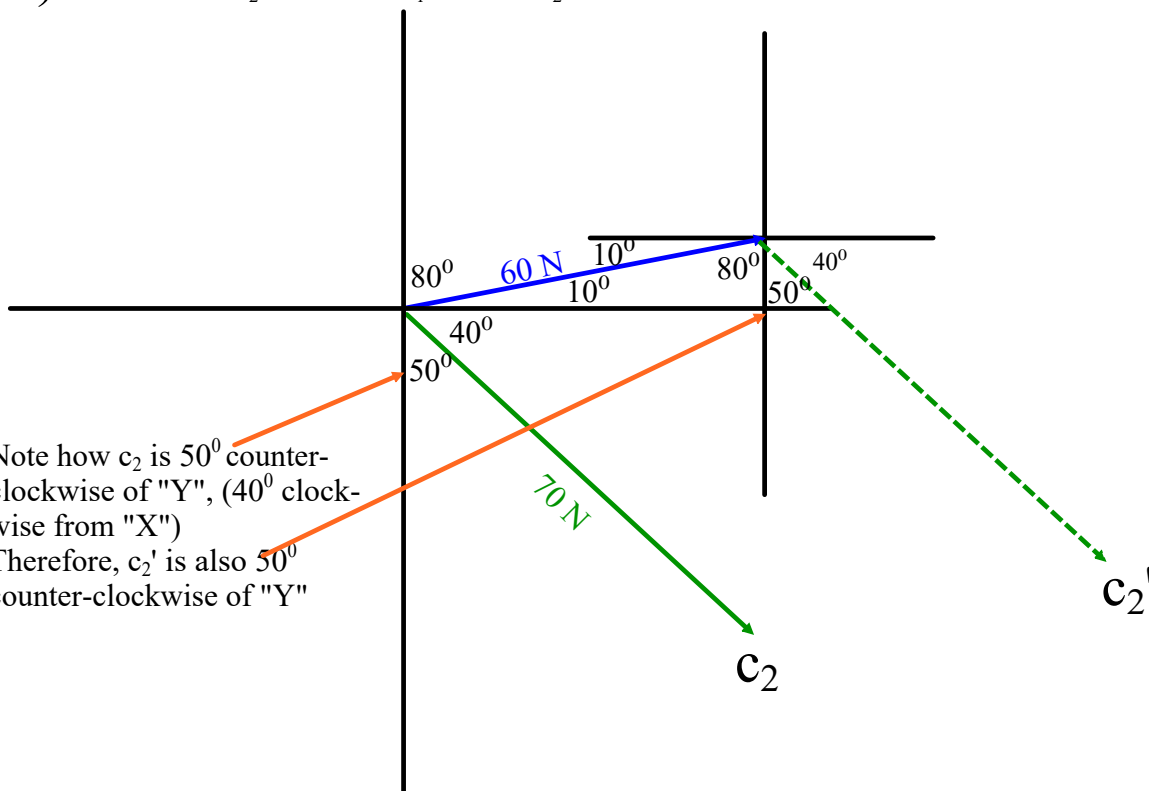
3) draw "x" and "y" axis at head of  $c_1$



4) draw in all angles...use alternate interior/exterior and complimentary/supplementary angles

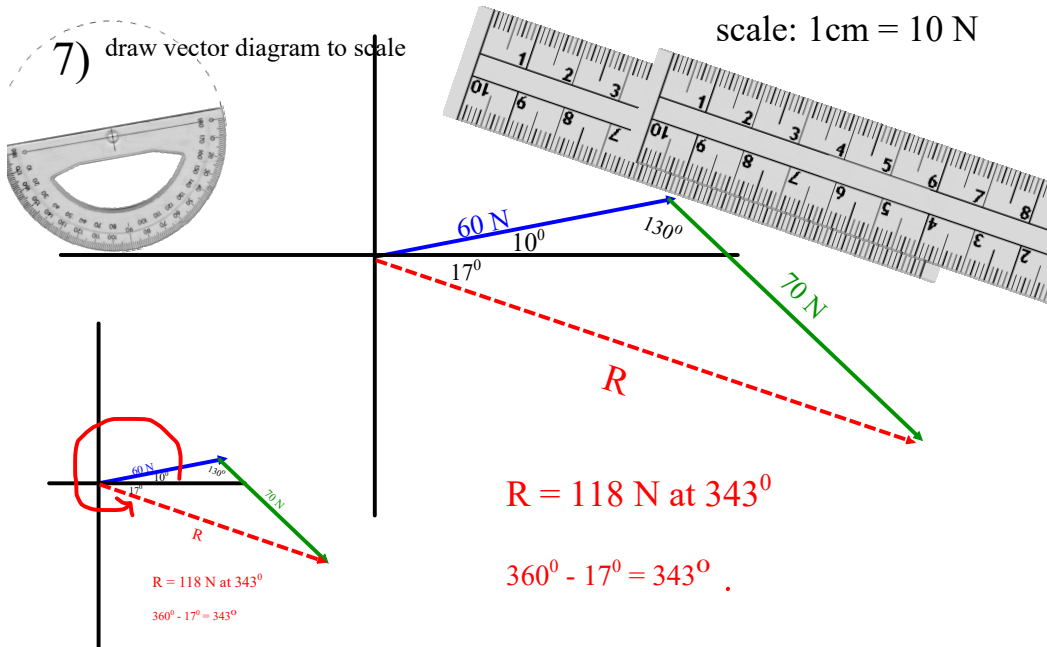
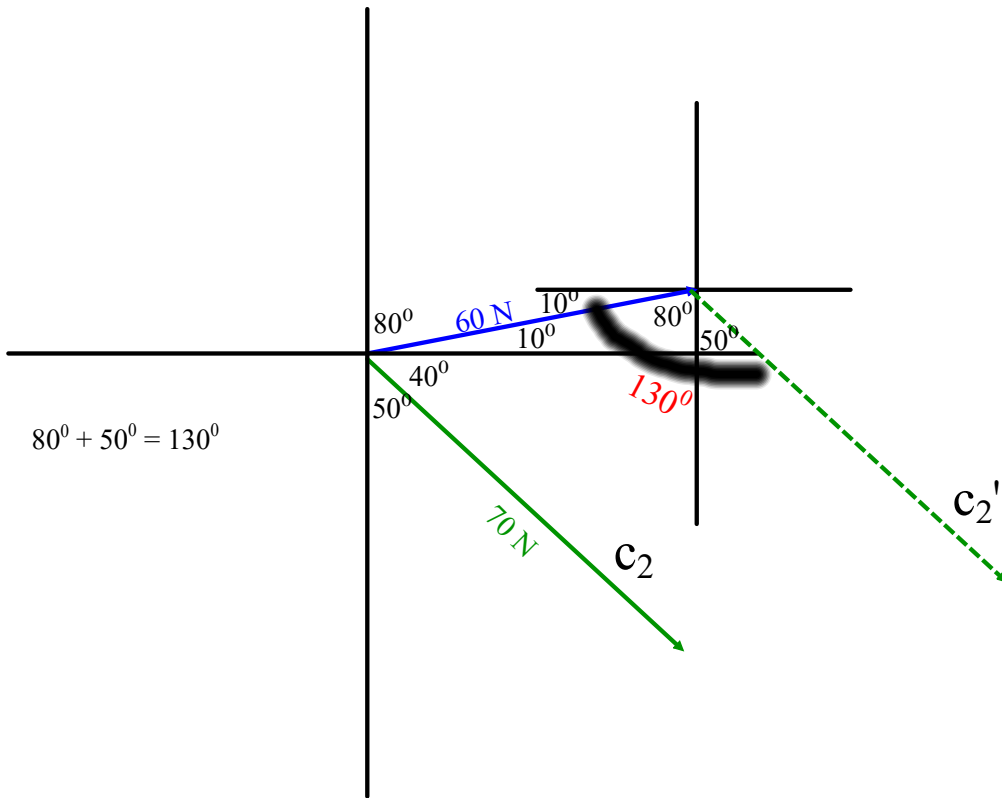


5) move tail of  $c_2$  to head of  $c_1$  at angle  $c_2$  is from axis



Note how  $c_2$  is  $50^\circ$  counter-clockwise of "Y", ( $40^\circ$  clockwise from "X")  
Therefore,  $c_2'$  is also  $50^\circ$  counter-clockwise of "Y"

6) calculate angle between  $c_1$  and  $c_2$

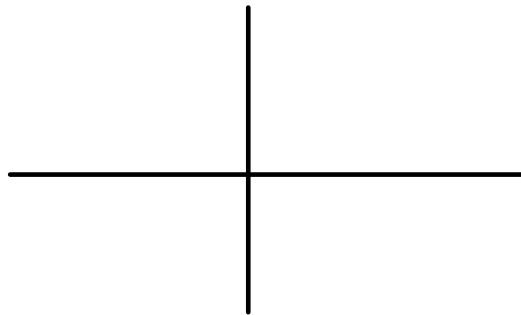


Remember, all directions are listed from  $0^\circ$  to the tail of the vector (in this case the resultant)

"Graphical Analysis" problem

1) Data

Two forces act on an object.  
One force is 85 N at  $112^\circ$  and  
the other is 77 N at  $12^\circ$ . What  
is the resultant?



"Graphical Analysis" problem

1) Data

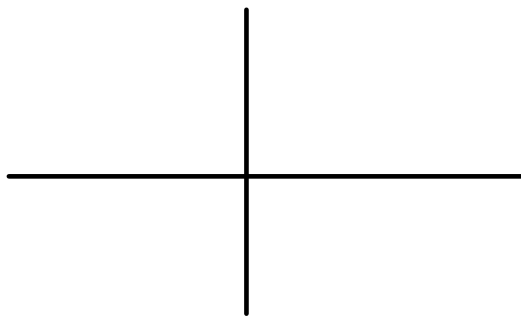
$$F_1 = 85 \text{ N at } 112^\circ$$

$$F_2 = 77 \text{ N at } 12^\circ$$

$R = ?$

Two forces act on an object.  
One force is 85 N at  $112^\circ$  and  
the other is 77 N at  $12^\circ$ . What  
is the resultant?

2) Draw a point diagram





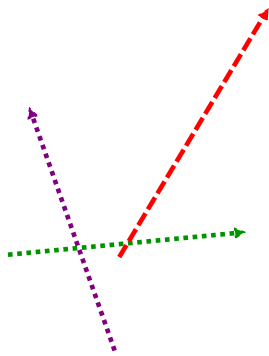
1) Data

Example:

$$F_1 = 85 \text{ N at } 112^\circ$$

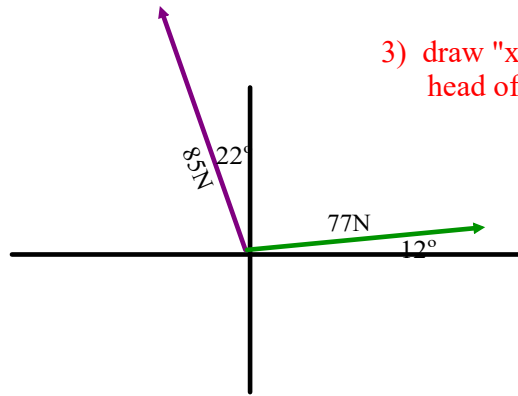
$$F_2 = 77 \text{ N at } 12^\circ$$

$$R = ?$$



"Graphical Analysis" problem

2) Draw a *point diagram*



3) draw "x" and "y" axis at head of  $c_1$

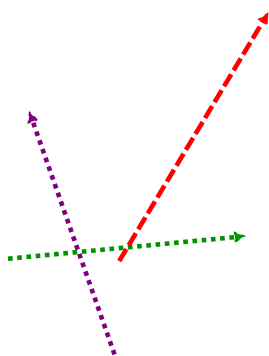
1) Data

Example:

$$F_1 = 85 \text{ N at } 112^\circ$$

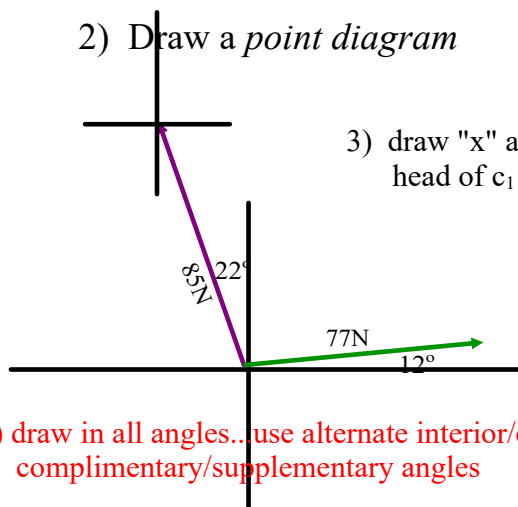
$$F_2 = 77 \text{ N at } 12^\circ$$

$$R = ?$$



"Graphical Analysis" problem

2) Draw a *point diagram*



3) draw "x" and "y" axis at head of  $c_1$

4) draw in all angles...use alternate interior/exterior and complimentary/supplementary angles

1) Data

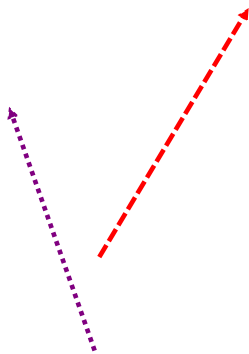
Example:

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$R = ?$

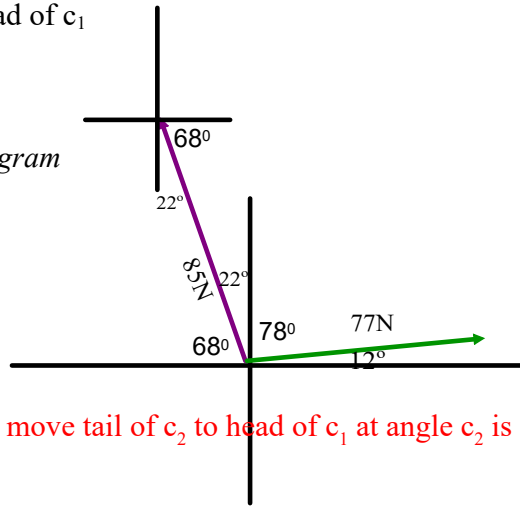
2) Draw a *point diagram*



"Graphical Analysis" problem

3) draw "x" and "y" axis at head of  $c_1$

4) draw in all angles...use alternate interior/exterior and complimentary and supplementary angles



5) move tail of  $c_2$  to head of  $c_1$  at angle  $c_2$  is from axis

1) Data

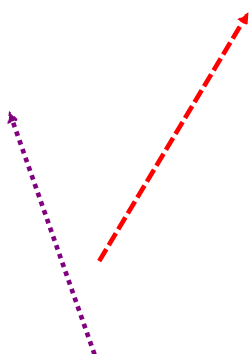
Example:

$F_1 = 85 \text{ N at } 112^\circ$

$F_2 = 77 \text{ N at } 12^\circ$

$R = ?$

2) Draw a *point diagram*

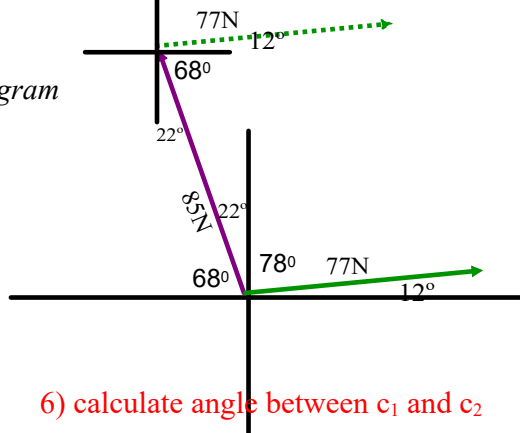


"Graphical Analysis" problem

3) draw "x" and "y" axis at head of  $c_1$

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6) calculate angle between  $c_1$  and  $c_2$

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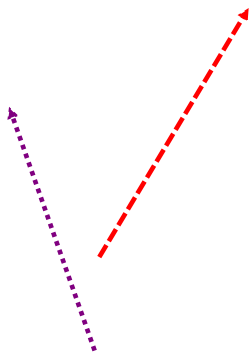
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$R = ?$

2) Draw a *point diagram*



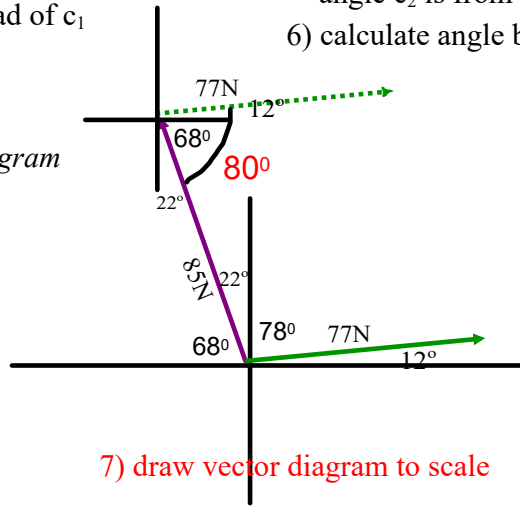
"Graphical Analysis" problem

4) draw in all angles...use alternate interior/exterior and complimentary and supplementary angles

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5) move tail of  $c_2$  to head of  $c_1$  at angle  $c_2$  is from axis

6) calculate angle between  $c_1$  and  $c_2$



7) draw vector diagram to scale

1) Data

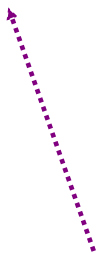
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2) Draw a *point diagram*



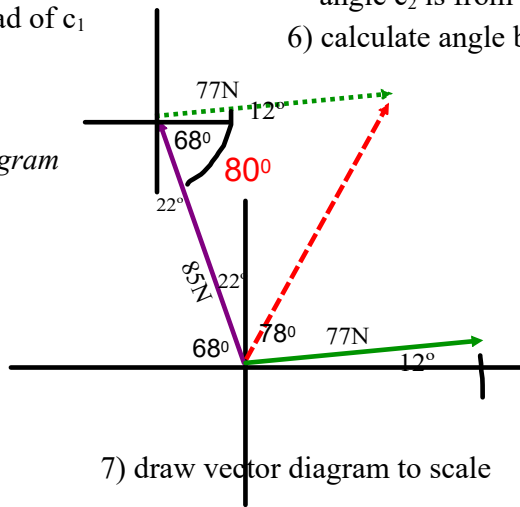
"Graphical Analysis" problem

4) draw in all angles...use alternate interior/exterior and complimentary and supplementary angles

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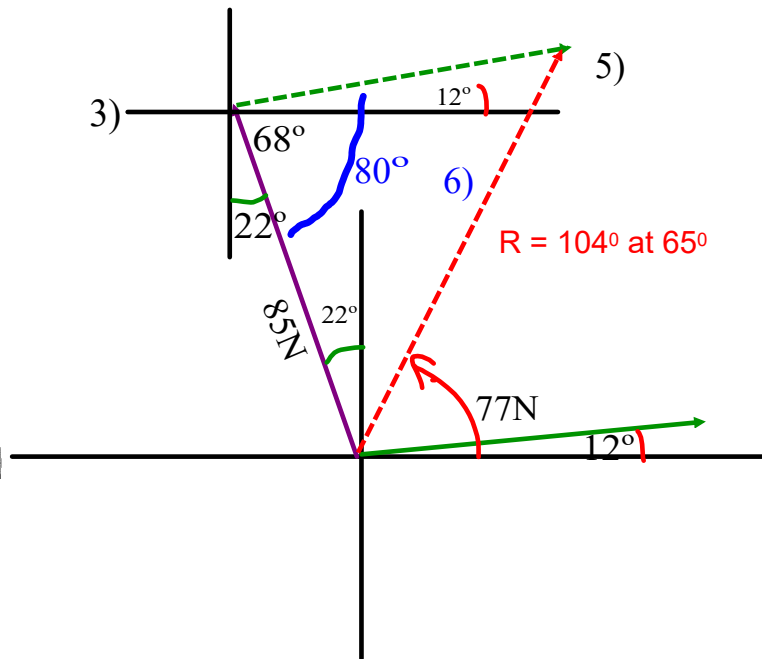
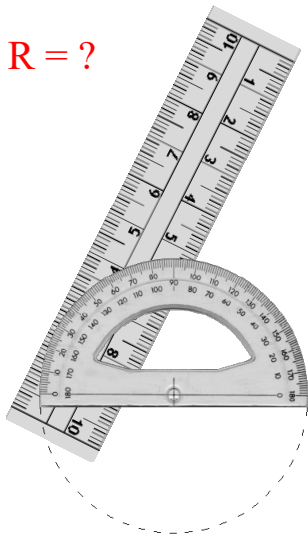


7) draw vector diagram to scale

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7)

