Vector Addition: adding components using the rules of vector addition to find the resultant.

$$C_1 + C_2 = R$$

Vector Resolution: Breaking a vector (component) down into its parts

$$C_1 + C_2 = R$$

$$C_{x1} + C_{y1} \qquad C_{x2} + C_{y2}$$

$$R_x + R_y = R$$

Mathematical Analysis:

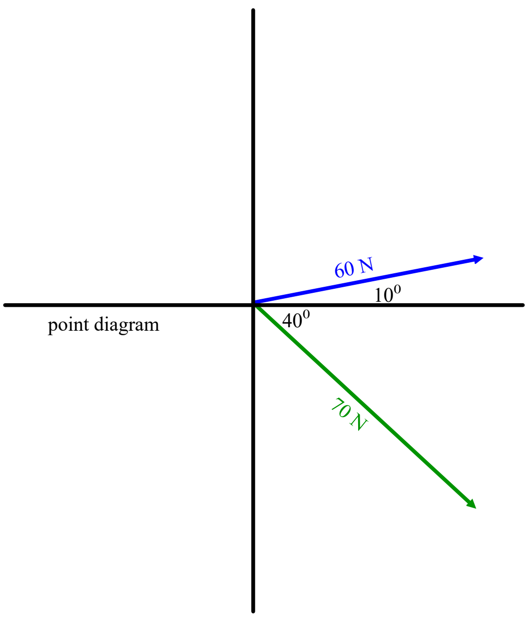
Sum of the "X" sum of the "Y"

60.0 N at 10.0^0

70.0 N at 320^0

R = ?

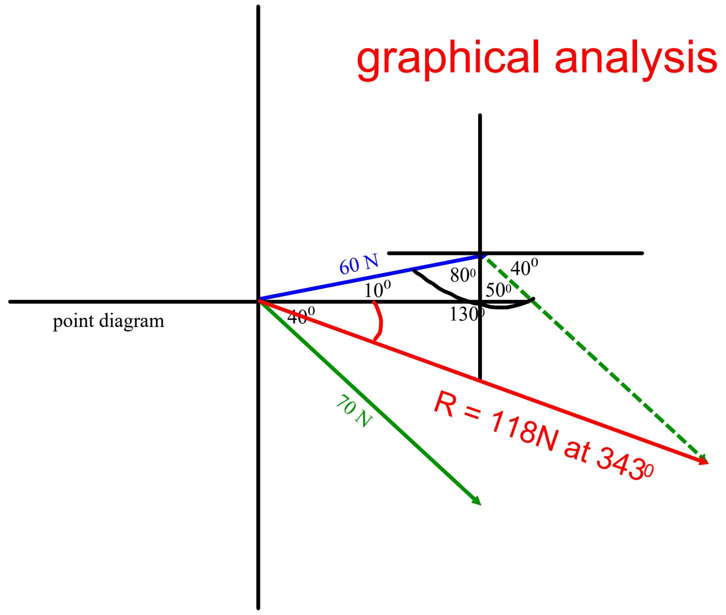
1) List data and draw point diagram



Mathematical Analysis:
Sum of the "X" sum of the "Y"

60.0 N at 10.0^0
70.0 N at 320^0
R = ?

1) List data and draw point diagram



2) Break each vector component into its "X" and "Y" components

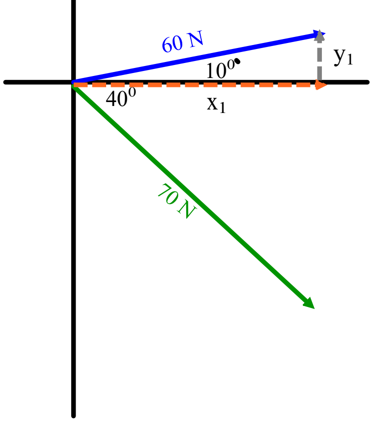
from slide #7

(Remember, right is "+", left is "-", up is "+", down is "-")

$\sin\theta_1 = y_1/60\text{ N}$ $\cos\theta_1 = x_1/60\text{ N}$

$y_1 = \sin 10^0(60\text{ N})$ $x_1 = \cos 10^0(60\text{ N})$

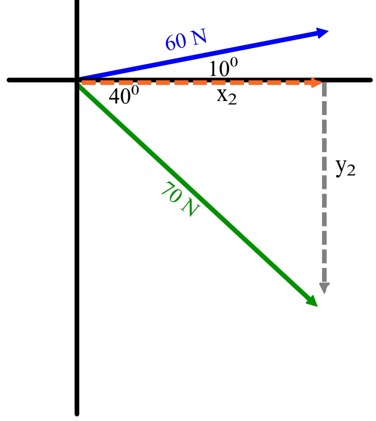
$y_1 = 10.\text{ N}$ $x_1 = 59\text{ N}$



$\sin\theta_2 = y_2/70\text{ N}$ $\cos\theta_2 = x_1/70\text{ N}$

$y_2 = \sin 40^0(70\text{ N})$ $x_2 = \cos 40^0(70\text{ N})$

$y_2 = -45\text{ N}$ $x_2 = 54\text{ N}$

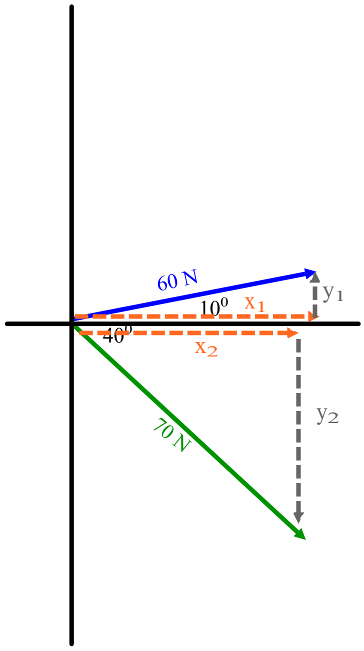


3) Add the "X" and "Y" components together

$\sin\theta_1 = y_1/60\ N$ $\cos\theta_1 = x_1/60\ N$ $\sin\theta_2 = y_2/70\ N$ $\cos\theta_2 = x_1/70\ N$

$y_1 = \sin 10^0(60\ N)$ $x_1 = \cos 10^0(60\ N)$ $y_2 = \sin 40^0(70\ N)$ $x_2 = \cos 40^0(70\ N)$

$y_1 = +10.\ N$ $x_1 = +59\ N$ $y_2 = -45\ N$ $x_2 = +54\ N$

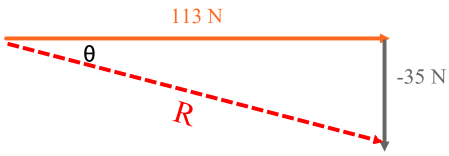


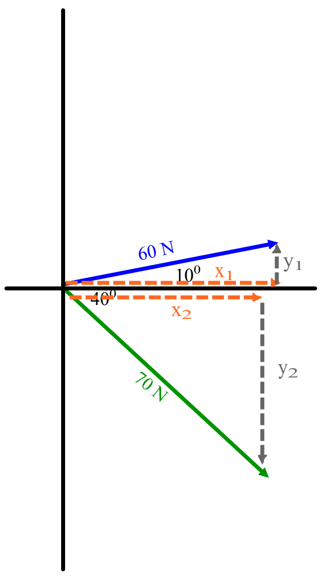
ΣX	ΣY
$x_1 = +59\ N$	$y_1 = +10.\ N$
+ $x_2 = +54\ N$	+ $y_2 = -45\ N$
$\Sigma X = +113\ N$	$\Sigma Y = -35\ N$

4) The ΣX's and ΣY's are the "X" and "Y" components of your *Resultant*

ΣX	ΣY
$x_1 = 59\ N$	$y_1 = 10.\ N$
+ $x_2 = 54\ N$	+ $y_2 = -45\ N$
$\Sigma X = +113\ N$	$\Sigma Y = -35\ N$

$\Sigma X = +113\ N$ $\Sigma Y = -35\ N$





5) Use Pythagorean Theorem to find magnitude of resultant

$R = \sqrt{(113\ N)^2 + (35\ N)^2}$

$R = 118\ N$

$R = 118\ N$ at 343^0

6) use Tangent function to find angle of resultant and then convert to a direction

$\tan\theta = 35\ N/113\ N$

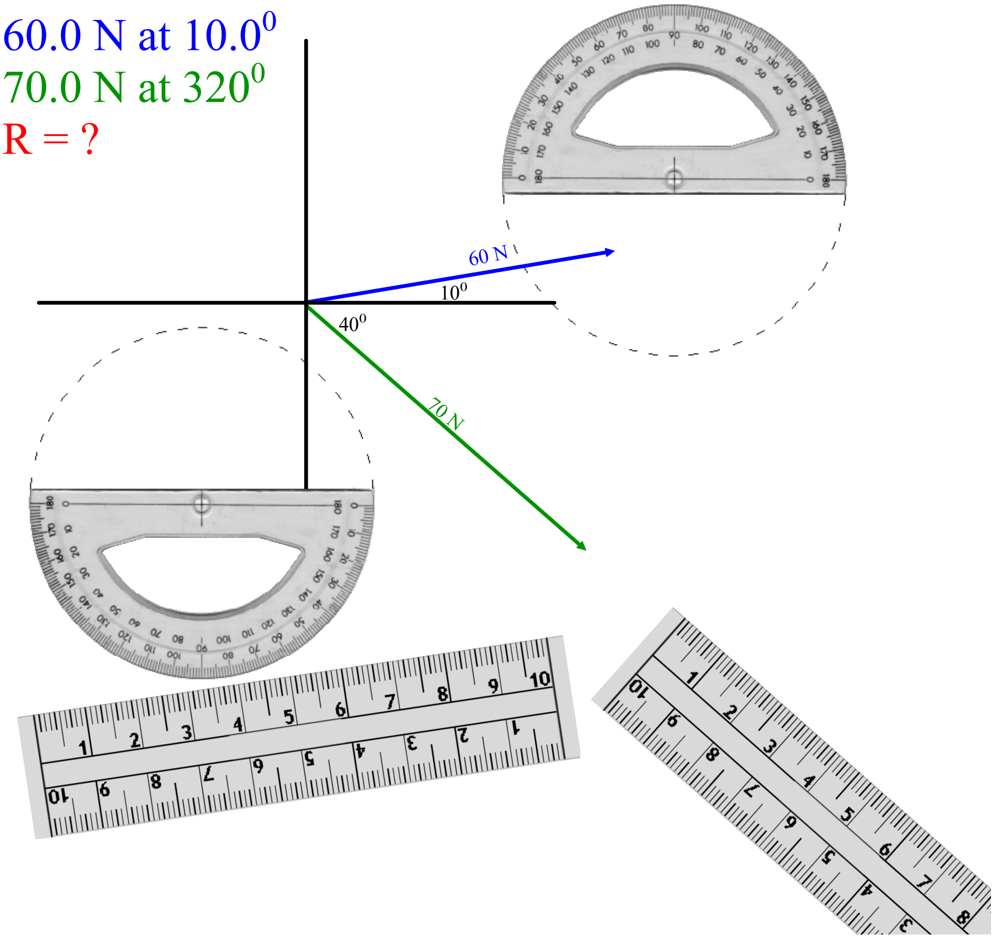
$\theta = 17^0$

The 17^0 is down (clockwise) from 0/360, therefore you would subtract the 17^0 from the 360^0 to get the direction of 343^0

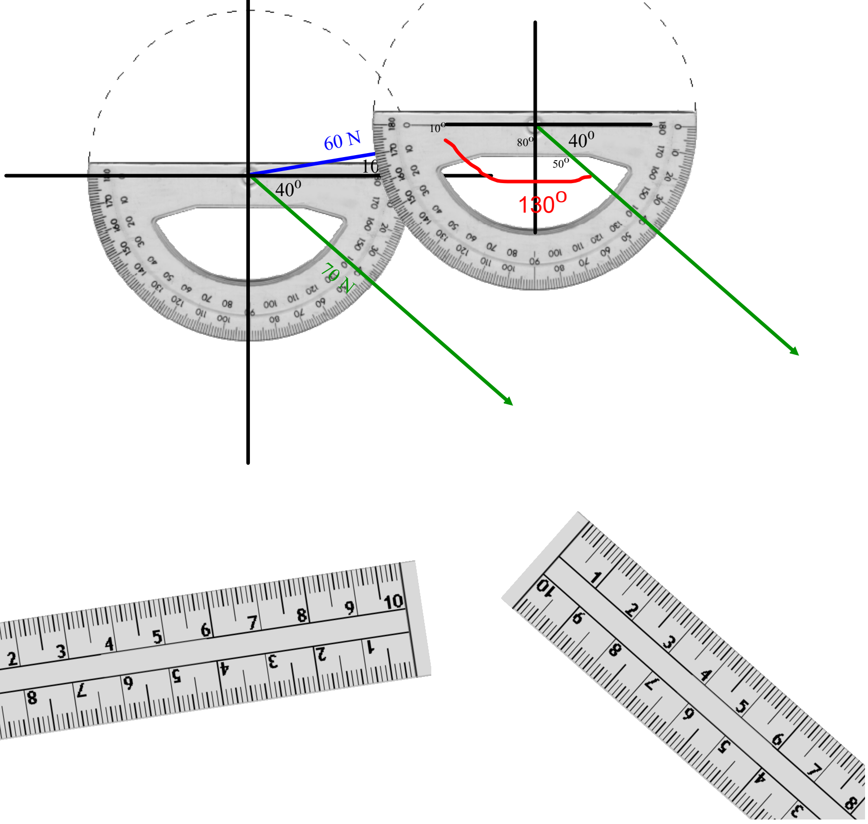
360
-17
343

Same problem done slightly differently

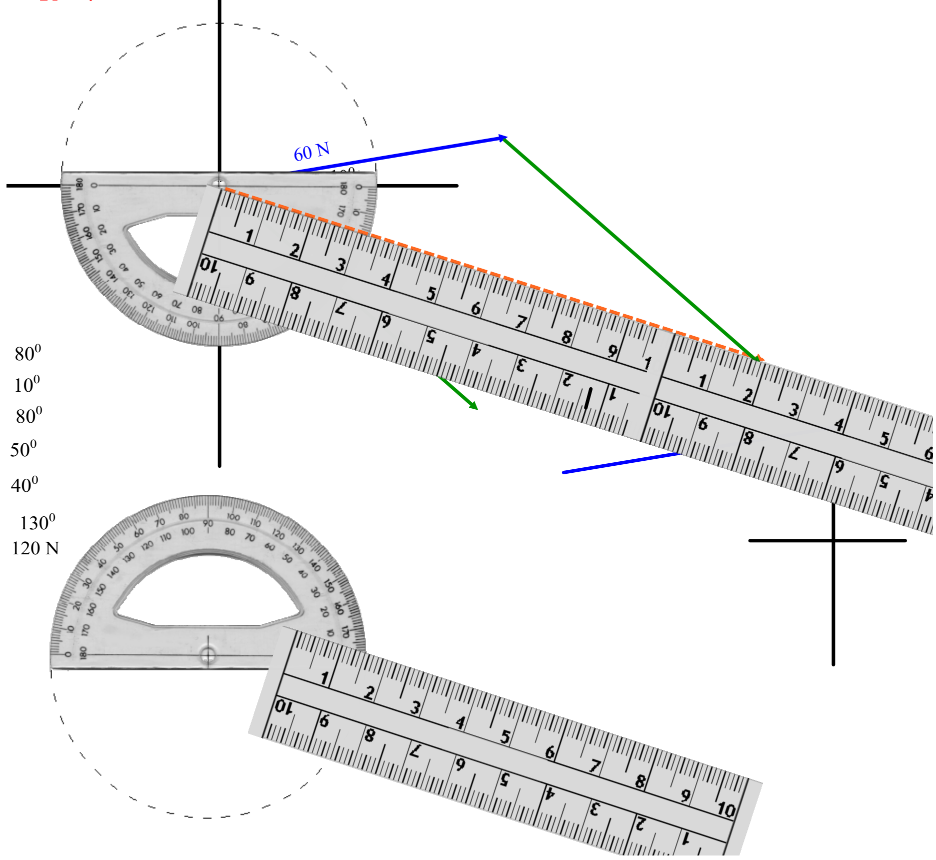
60.0 N at 10.0^0
70.0 N at 320^0
R = ?



60.0 N at 10.0^0
70.0 N at 320^0
R = ?



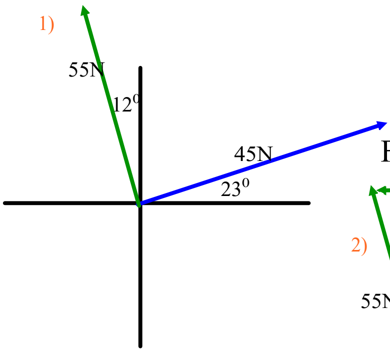
60.0 N at 10.0^0
70.0 N at 320^0
R = ?



Sum of the "X"s sum of the "Y"s

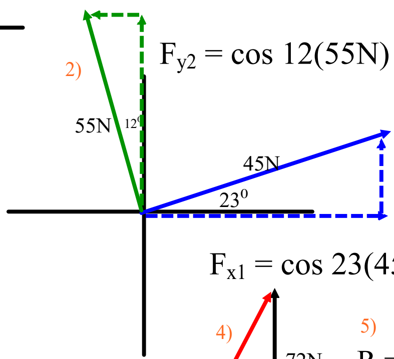
What is the resultant of 45 N at 23^0 and 55 N at 102^0
Use the sum of the "X"s and "Y"s to solve.

1)



F_{x2} = sin 12(55N) = -11N

2)



F_{y2} = cos 12(55N) = +54N

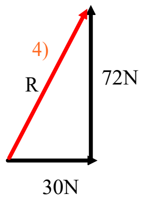
F_{y1} = sin 23(45N) = +18N

F_{x1} = cos 23(45N) = +41N

3)

ΣX	ΣY
+41N	+18N
-11N	+54N
+30.N	+72N

4)



5) $R = \sqrt{(30.N^2) + (72N)^2} = 78N$

6) Tan θ = 72N/30.N = 67^0

R = 78 N at 67^0

Three forces act on an object!

$F_1 = 45$ N at 345^0

$F_2 = 55$ N at 170^0

$F_3 = 50.$ N at $110.^0$

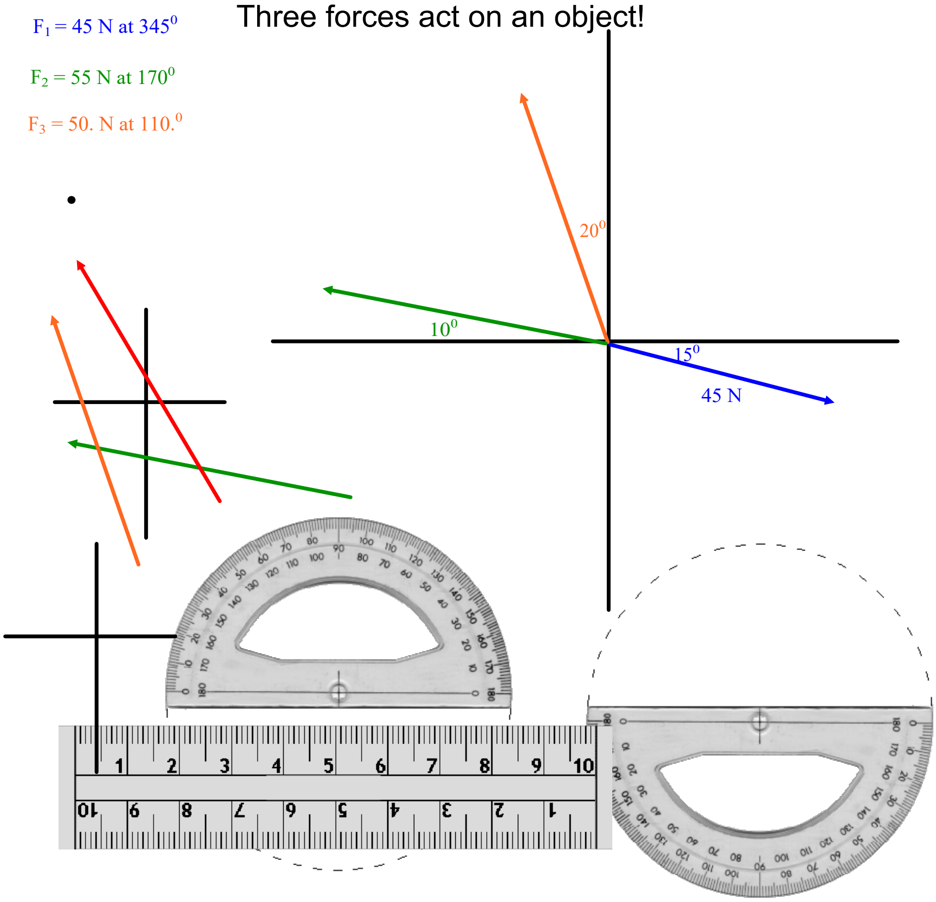
5^0

10^0

$20.^0$

$120.^0$

15^0



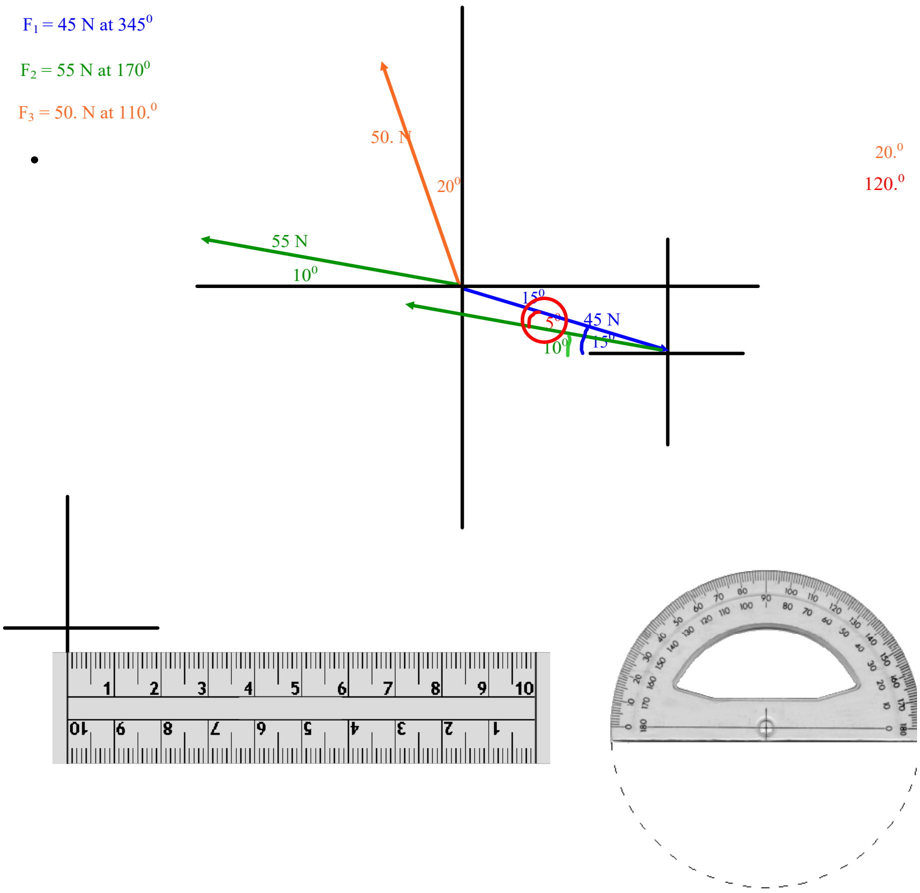
$F_1 = 45$ N at 345^0

$F_2 = 55$ N at 170^0

$F_3 = 50.$ N at $110.^0$

$20.^0$

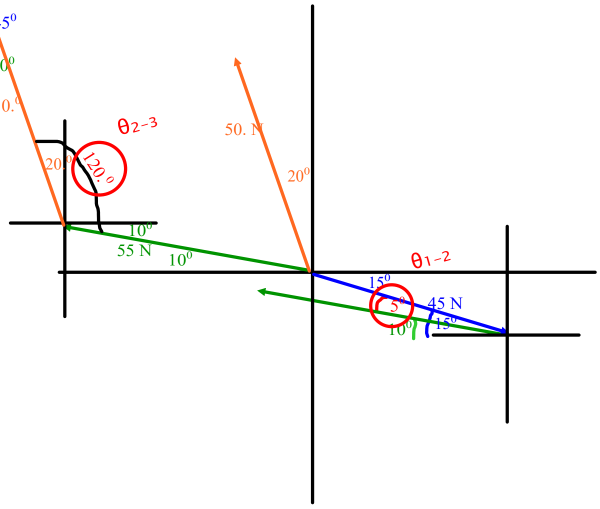
$120.^0$

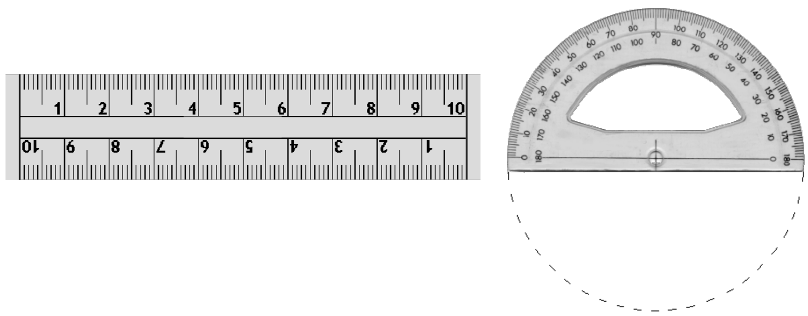


F_1 = 45 N at 345°

F_2 = 55 N at 170°

F_3 = 50. N at 110.°

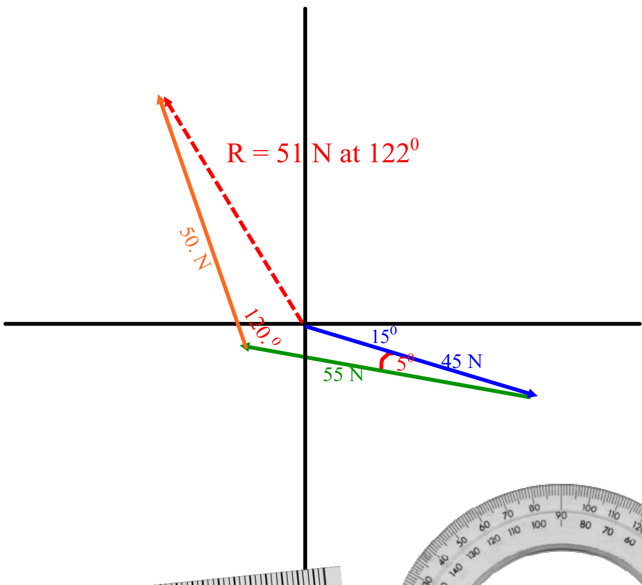


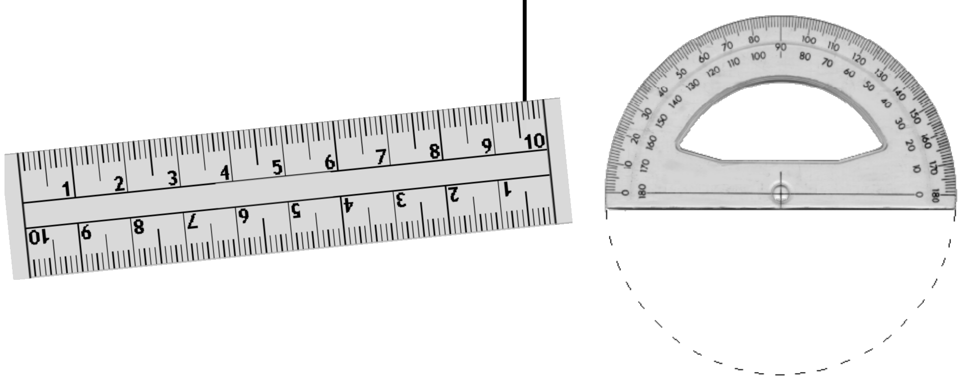


F_1 = 45 N at 345°

F_2 = 55 N at 170°

F_3 = 50. N at 110.°

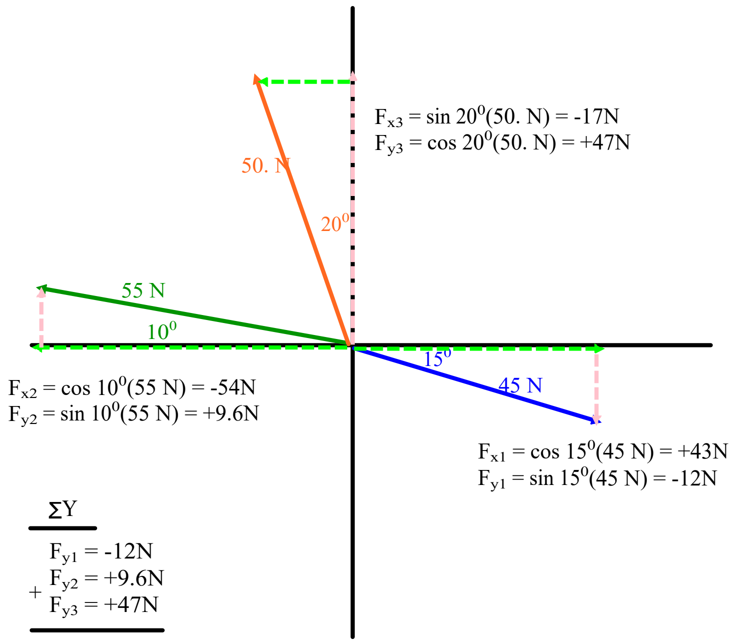




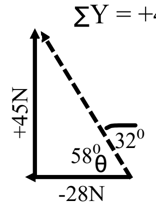
$F_1 = 45$ N at 345^0

$F_2 = 55$ N at 170^0

$F_3 = 50.$ N at $110.^0$



ΣX	ΣY
$F_{x1} = +43N$	$F_{y1} = -12N$
$F_{x1} = -54N$	$F_{y2} = +9.6N$
$F_{x1} = -17N$	+ $F_{y3} = +47N$
$\Sigma X = -28N$	$\Sigma Y = +45N$



$R = \sqrt{(28N^2 + (45N)^2}$

$R = 53N$ at 122^0

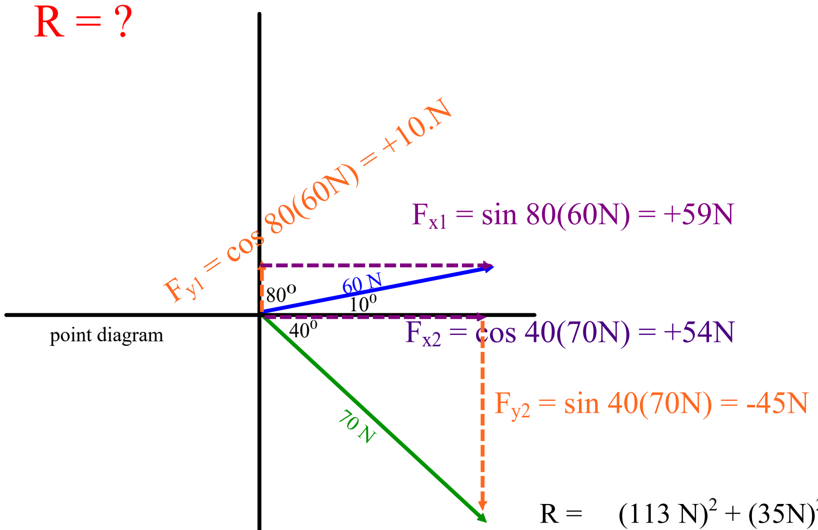
$\tan \theta = 45N/28N$

$\theta = 58^0$

$32^0 + 90^0 = 122^0$

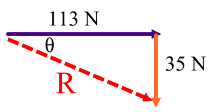
or, $180^0 - 58^0 = 122^0$

60.0 N at 10.0^0
70.0 N at 320^0
R = ?



$R = \sqrt{(113\ N)^2 + (35N)^2} = 139\ N$

ΣX	ΣY
+59N	+10N
+54N	-45N
+113.N	-35N



$\tan \theta = 35N/113.N = 17^0$

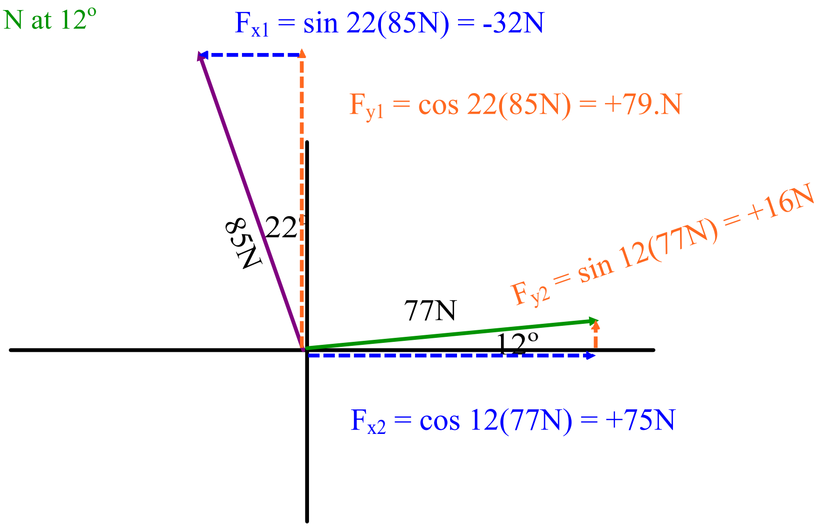
$360^0 - 17^0 = 343^0$

R = 118 N at 343^0

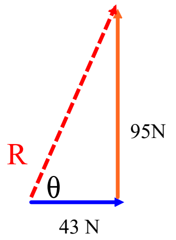
$F_1 = 85$ N at 112°

$F_2 = 77$ N at 12°

R = ?



ΣX	ΣY
+-32N	+79N
+75N	+16N
+43.N	+95N



$R = \sqrt{(43\ N)^2 + (95N)^2} = 104\ N$

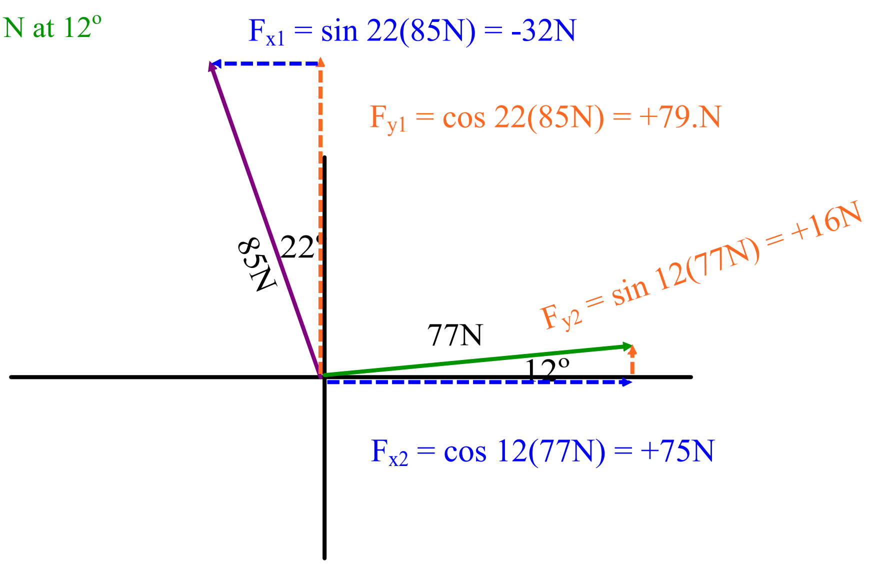
Tan θ = 95N/43.N = 66°

R = 104 N at 66°

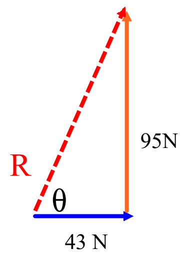
$F_1 = 85$ N at 112°

$F_2 = 77$ N at 12°

R = ?



ΣX	ΣY
+-32N	+79N
+75N	+16N
+43.N	+95N



$R = \sqrt{(43\ N)^2 + (95N)^2} = 104\ N$

Tan θ = 95N/43.N = 66°

R = 104 N at 66°