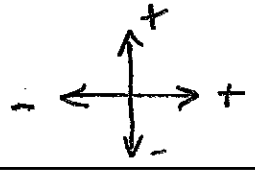



$a^2+b^2=c^2$

$\sin = \frac{OPP}{HYP}$

$\cos = \frac{ADJ}{HYP}$

$\tan = \frac{OPP}{ADJ} = \frac{\sin}{\cos}$

NAME: KEY DATE: PD:

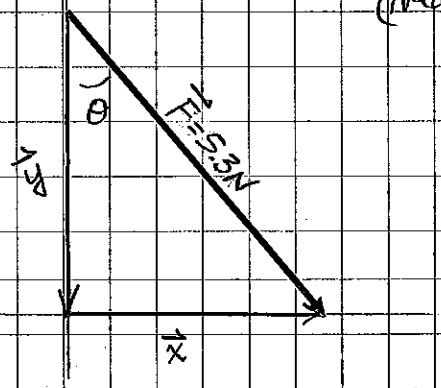
PHYSICS - Mr. Smith

## VECTORS WORKSHEET #2

Resolve each vector into its **x** and **y** components, and determine the magnitudes of these components. USE A RULER! Use a PROTRACTOR! Use PYTHAGORAS! NEATNESS COUNTS!! CHECK YOUR ANSWERS!

*For this entire worksheet, assume all are force vectors, and use the scale: 1.0 cm = 1.0 N*

**1**




$\theta = 40.^\circ$ (measured)

$\sin\theta = \frac{x}{F} \Rightarrow x = F\sin\theta$

$= (5.3)(\sin 40.^\circ)$

$\boxed{x = +3.4\ N}$ (at $0^\circ$)

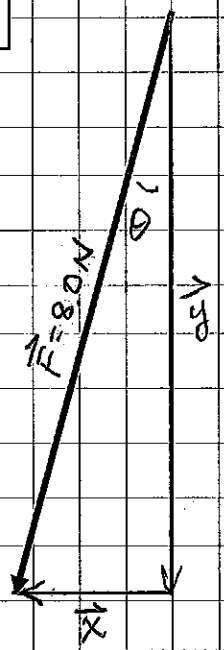
$\cos\theta = \frac{y}{F} \Rightarrow y = F\cos\theta$

$= (5.3)(\cos 40.^\circ)$

$\boxed{y = -4.1\ N}$ (at $270^\circ$)

* VERIFY WITH A RULER!!
* CHECK: $\tan\theta = \frac{x}{y}$ ??

**2**




$\theta = 15^\circ$ (measured)

$\sin\theta = \frac{x}{F} \Rightarrow x = F\sin\theta$

$= (8.0)(\sin 15^\circ)$

$\boxed{x = -2.1\ N}$ (at $180^\circ$)

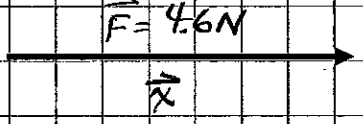
$\cos\theta = \frac{y}{F} \Rightarrow y = F\cos\theta$

$= (8.0)(\cos 15^\circ)$

$\boxed{y = -7.7\ N}$ (at $270^\circ$)

* VERIFY WITH A RULER!
* CHECK: $\tan\theta \stackrel{?}{=} \frac{x}{y}$

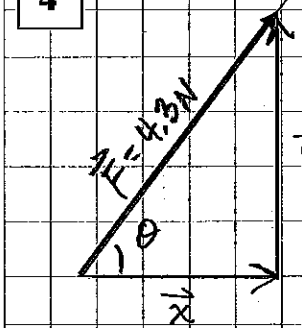
**3**




$\boxed{x = +4.6\ N}$ (at $0^\circ$).

$\boxed{y = 0\ N}$

**4**




MEASURE: $\theta = 53°$

$\sin\theta = \frac{y}{F} \Rightarrow y = F\sin\theta$

$= (4.3)(\sin 53°)$

$\boxed{y = +3.4\,N}$ (at 90°)

$\cos\theta = \frac{x}{F} \Rightarrow x = F\cos\theta$

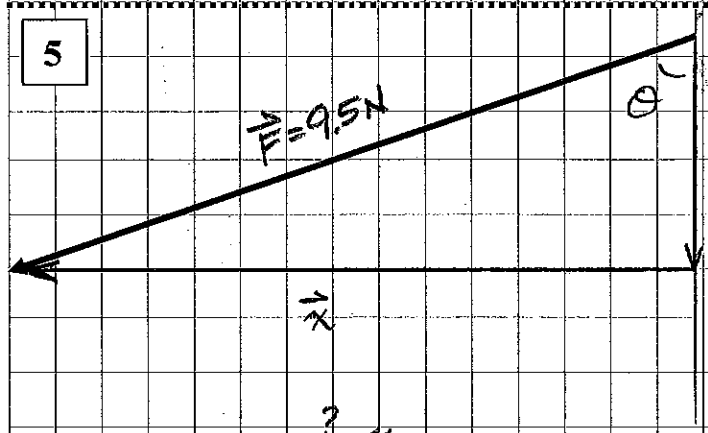
$= (4.3)(\cos 53°)$

$\boxed{x = +2.6\,N}$ at 0°

CHECK: $\tan\theta \stackrel{?}{=} \frac{y}{x}$

* VERIFY WITH A RULER!

**5**




MEASURE: $\theta = 71°$

$\sin\theta = \frac{x}{F} \Rightarrow x = F\sin\theta$

$= (9.5)(\sin 71°)$

$\boxed{x = -9.0\,N}$ (at 180°)

$\cos\theta = \frac{y}{F} \Rightarrow y = F\cos\theta$

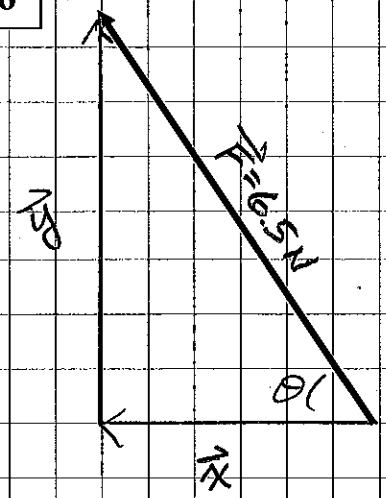
$= (9.5)(\cos 71°)$

$\boxed{y = -3.1\,N}$ (at 270°)

CHECK: $\tan\theta \stackrel{?}{=} \frac{x}{y}$

* VERIFY WITH A RULER!

**6**




MEASURE: $\theta = 56°$

$\sin\theta = \frac{y}{F} \Rightarrow y = F\sin\theta$

$= (6.5)(\sin 56°)$

$\boxed{y = +5.4\,N}$ (at 90°)

$\cos\theta = \frac{x}{F} \Rightarrow x = F\cos\theta$

$= (6.5)(\cos 56°)$

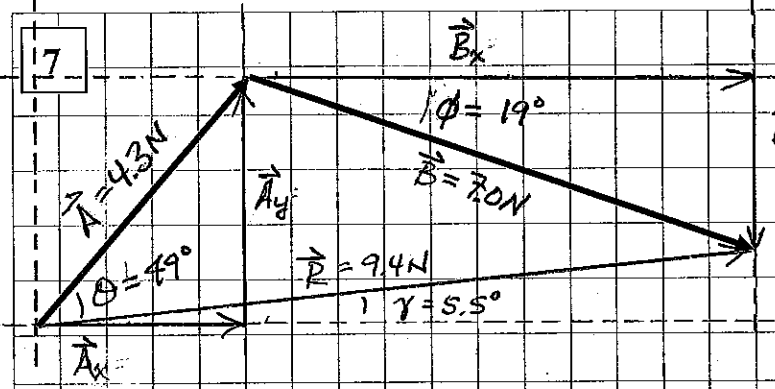
$\boxed{x = -3.6\,N}$ (at 180°)

* VERIFY WITH A RULER!

* CHECK: $\tan\theta \stackrel{?}{=} \frac{y}{x}$

Draw and label the resultant vector **R** for each of the following sets of vectors. Determine the magnitudes of **R** and the direction (state the angle relative to vertical or horizontal). USE A RULER! Do NOT USE A PROTRACTOR! USE TRIGONOMETRY! NEATNESS COUNTS!!

**7**




$\sin\phi = \frac{B_y}{B} \Rightarrow B_y = B\sin\phi$
$= (7.0)(\sin 19°)$
$B_y = -2.3N$

$\cos\phi = \frac{B_x}{B} \Rightarrow B_x = B\cos\phi$
$= (7.0)(\cos 19°)$
$B_x = +6.6N$

$\sin\theta = \frac{A_y}{A} \Rightarrow A_y = A\sin\theta$
$= (4.3)(\sin 49°)$
$A_y = +3.2N$

$\cos\theta = \frac{A_x}{A} \Rightarrow A_x = A\cos\theta$
$= (4.3)(\cos 49°)$
$A_x = +2.8N$

NOW, ADD VECTOR COMPONENTS:

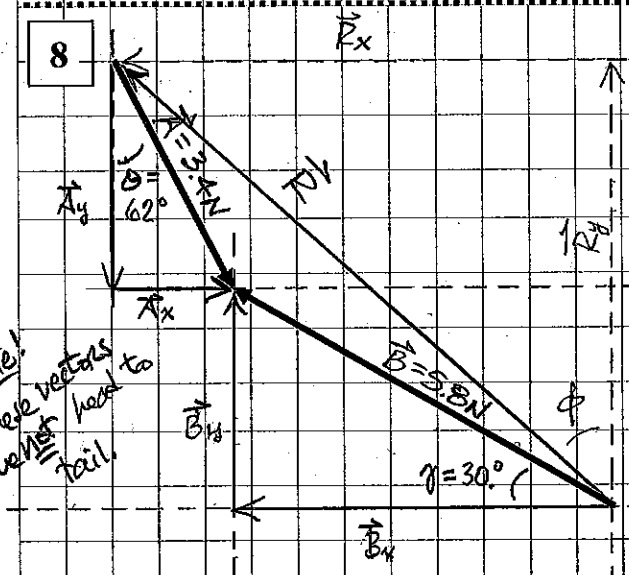
| | x-comp | y-comp |
|---|---|---|
| $\vec{A}$ | $A_x = +2.8N$ | $A_y = +3.2N$ |
| $\vec{B}$ | $B_x = +6.6N$ | $B_y = -2.3N$ |
| $\vec{R}$ | $R_x = A_x + B_x$ | $R_y = A_y + B_y$ |
| | $= 2.8 + 6.6$ | $= 3.2 - 2.3$ |
| | $R_x = 9.4N$ | $R_y = 0.9N$ |

So $R = (R_x^2 + R_y^2)^{1/2} = (9.4^2 + 0.9^2)^{1/2} = 9.44N$

and $\gamma = \sin^{-1}(R_y/R) = 5.5°$

$\therefore$ **$R = 9.4N$ at $5.5°$**

**8**




Note! These vectors head to tail!

$\sin\theta = \frac{A_x}{A} \Rightarrow A_x = A\sin\theta$
$= (3.4)(\sin 62°)$
$A_x = +3.0N$

$\cos\theta = \frac{A_y}{A} \Rightarrow A_y = A\cos\theta$
$= (3.4)(\cos 62°)$
$A_y = -1.6N$

NOW, ADD VECTOR COMPONENTS:

| | x-comp | y-comp. |
|---|---|---|
| $\vec{A}$ | $A_x = +3.0N$ | $A_y = -1.6N$ |
| $\vec{B}$ | $B_x = -5.0N$ | $B_y = +2.9N$ |
| $\vec{R}$ | $R_x = A_x + B_x$ | $R_y = A_y + B_y$ |
| | $= +3.0 - 5.0$ | $= -1.6 + 2.9$ |
| | $R_x = -2.0N$ | $R_y = 1.3N$ |

$\sin\gamma = \frac{B_y}{B} \Rightarrow B_y = B\sin\theta$
$= (5.8)(\sin 30°)$
$B_y = +2.9N$

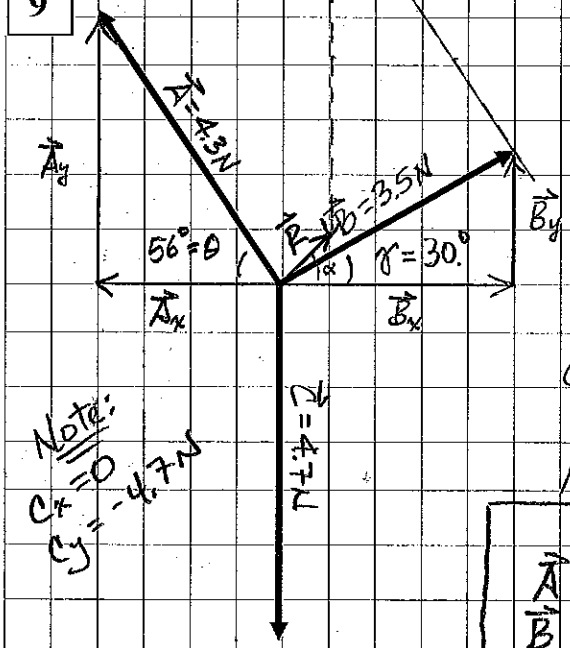
$\cos\gamma = \frac{B_x}{B} \Rightarrow B_x = B\cos\theta$
$= (5.8)(\cos 30°)$
$B_x = -5.0N$

So, $R = (R_x^2 + R_y^2)^{1/2} = 2.4N$

and $\phi = \sin^{-1}(\frac{R_x}{R}) = 56.4°$.

OR, **$R = 2.4N$ at $146.4°$**

**9**




Note:
$C_x = 0$
$C_y = -4.7N$

$\sin\theta = \frac{A_y}{A} \Rightarrow A_y = A\sin\theta = (4.3)(\sin 56°)$
$A_y = +3.6N$

$\cos\theta = \frac{A_x}{A} \Rightarrow A_x = A\cos\theta = (4.3)(\cos 56°)$
$A_x = +2.4N$

$\sin\gamma = \frac{B_y}{B} \Rightarrow B_y = B\sin\gamma = (3.5)(\sin 30.°)$
$B_y = +1.8N$

$\cos\gamma = \frac{B_x}{B} \Rightarrow B_x = B\cos\gamma = (3.5)(\cos 30.°)$
$B_x = +3.0N$.

NOW, ADD VECTOR COMPONENTS:

| | x-comp | y-comp |
|---|---|---|
| $\vec{A}$ | −2.4 | +3.6 |
| $\vec{B}$ | +3.0 | +1.8 |
| $\vec{C}$ | 0 | −4.7 |
| $\vec{R}$ | +0.6N | +0.7N |

LET α = angle of $\vec{R}$

Then $R = (R_x^2 + R_y^2)^{1/2} = \underline{0.9N}$

$\tan\alpha = \frac{R_y}{R_x} \Rightarrow \alpha = \tan^{-1}\left(\frac{R_y}{R_x}\right) = \underline{49.4°}$

$\therefore$ R = 0.9N at 49.4°

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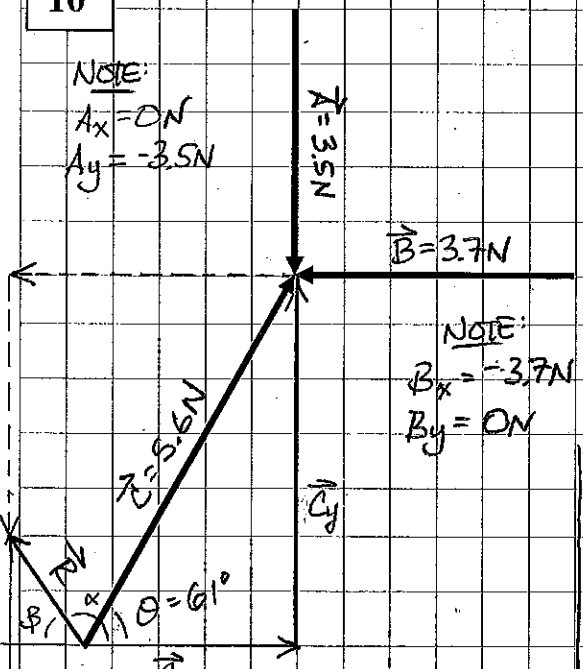
**10**




NOTE:
$A_x = 0N$
$A_y = -3.5N$

NOTE:
$B_x = -3.7N$
$B_y = 0N$

$\sin\theta = \frac{C_y}{C} \Rightarrow C_y = C\sin\theta = (5.6)(\sin 61°)$
$C_y = +4.9N$

$\cos\theta = \frac{C_x}{C} \Rightarrow C_x = C\cos\theta = (5.6)(\cos 61°)$
$C_x = +2.7N$.

NOW ADD VECTOR COMPONENTS:

| | x-comp | y-comp |
|---|---|---|
| $\vec{A}$ | 0 | −3.5 |
| $\vec{B}$ | −3.7 | 0 |
| $\vec{C}$ | +2.7 | +4.9 |
| $\vec{R}$ | −1.0N | +1.4N |

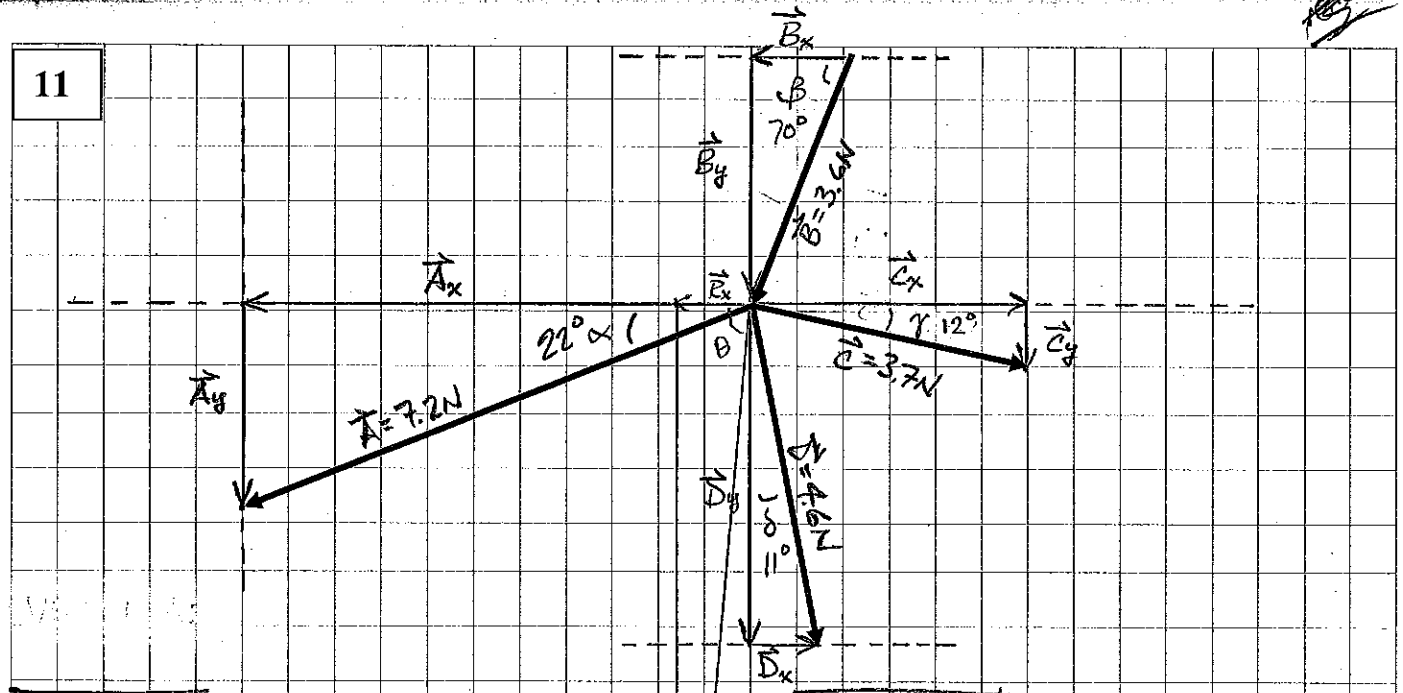
LET β = angle of $\vec{R}$

Then $R = (R_x^2 + R_y^2)^{1/2} = \underline{1.7N}$

$\tan\beta = \frac{R_y}{R_x} \Rightarrow \beta = \tan^{-1}\left(\frac{R_y}{R_x}\right) = \underline{54.5°}$

$\therefore$ R = 1.7N at 125.5°

**11**




**VECTOR A:**

$\sin\alpha = \frac{A_y}{A} \Rightarrow A_y = A\sin\alpha = (7.2)(\sin 22°)$

$A_y = -2.7N$

$\cos\alpha = \frac{A_x}{A} \Rightarrow A_x = A\cos\alpha = (7.2)(\cos 22°)$

$A_x = -6.7N$

**VECTOR B:**

$\sin\beta = \frac{B_y}{B} \Rightarrow B_y = B\sin\beta = (3.6)(\sin 70°)$

$B_y = +3.4N$

$\cos\beta = \frac{B_x}{B} \Rightarrow B_x = B\cos\beta = (3.6)(\cos 70°)$

$B_x = +1.2N$

**VECTOR C:**

$\sin\gamma = \frac{C_y}{C} \Rightarrow C_y = C\sin\gamma = (3.7)(\sin 12°)$

$C_y = -.8N$

$\cos\gamma = \frac{C_x}{C} \Rightarrow C_x = C\cos\gamma = (3.7)(\cos 12°)$

$C_x = +3.6N$

**VECTOR D**

$\sin\delta = \frac{D_x}{D} \Rightarrow D_x = D\sin\delta = (4.6)(\sin 11°)$

$D_x = +.9N$

$\cos\delta = \frac{D_y}{D} \Rightarrow D_y = D\cos\delta = (4.6)(\cos 11°)$

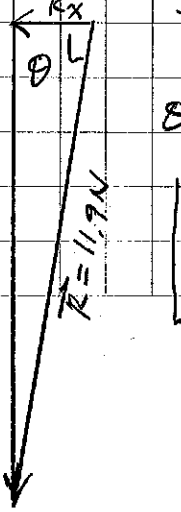
$D_y = -4.5N$

NOW ADD ALL VECTOR COMPONENTS:

| | x-comp | y-comp. |
|---|---|---|
| $\vec{A}$ | -6.7 | -2.7 |
| $\vec{B}$ | +1.2 | -3.4 |
| $\vec{C}$ | +3.6 | -0.8 |
| $\vec{D}$ | +0.9 | -4.5 |
| $\vec{R}$ | -3.4N | -11.4N |

$R = (R_x^2 + R_y^2)^{1/2} = \boxed{11.9N}$

this vector looks like this:




$\tan\theta = \frac{R_y}{R_x}$

$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right) = \boxed{73°}$

$\therefore \boxed{R = 11.9N \text{ at } 253°}$