UNIVERSITY OF NEW BRUNSWICK	FACULTY OF ENGINEERING	
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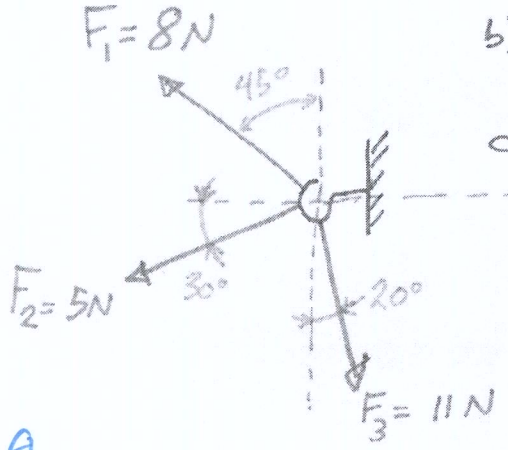
Problem No. Particle · Resultant	By Alan Lloyd	of

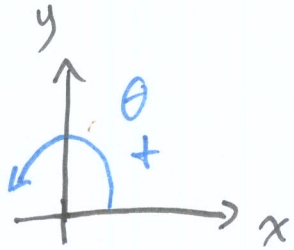
PROBLEM: For the hook below:

a) Using vector addition, Find the resultant force vector

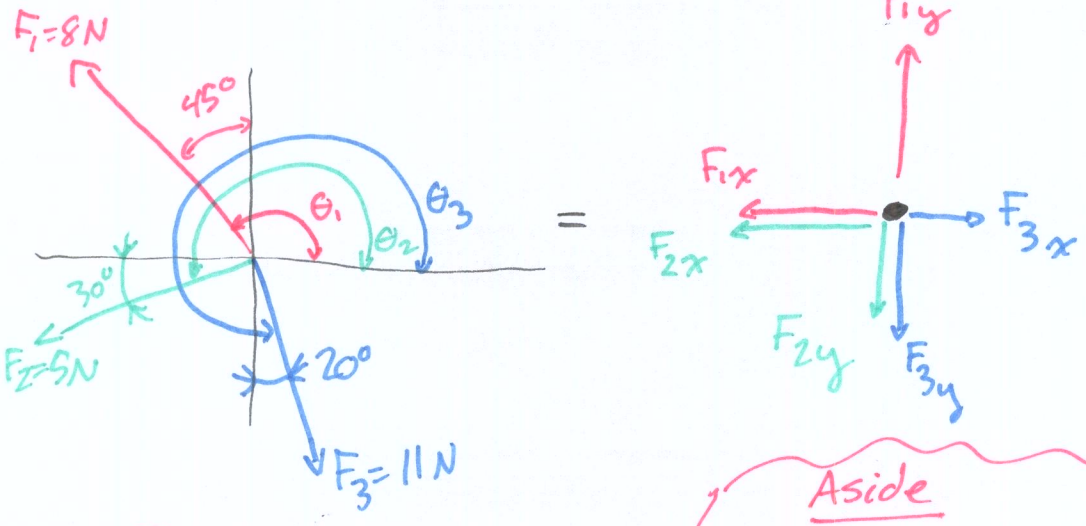
b) Using cartesian force components, find the resultant force vector

c) Find the reaction force vector using particle equilibrium and the resultant force.





- FREE BODY DIAGRAM (FBD)



$\theta_1 = 90° + 45° = 135°$

$\theta_2 = 180° + 30° = 210°$

$\theta_3 = 270° + 20° = 290°$

Aside

Make sure your calculator is in degrees.

• Find Force components

$F_x = F\cos\theta$
$F_y = F\sin\theta$
} true only if we follow sign convention

x - components

$F_{1x} = F_1\cos\theta_1 = 8\cos 135° = F_{1x} = -5.657\,N$
$F_{2x} = F_2\cos\theta_2 = 5\cos 210° = F_{2x} = -4.330\,N$
$F_{3x} = F_3\cos\theta_3 = 11\cos 290° = F_{3x} = +3.762\,N$

y - components

$F_{1y} = F_1\sin\theta_1 = 8\sin 135° = F_{1y} = +5.657\,N$
$F_{2y} = F_2\sin\theta_2 = 5\sin 135° = F_{2y} = -2.5\,N$
$F_{3y} = F_3\sin\theta_3 = 11\sin 290° = F_{3y} = -10.337\,N$

• Find Resultant Force components

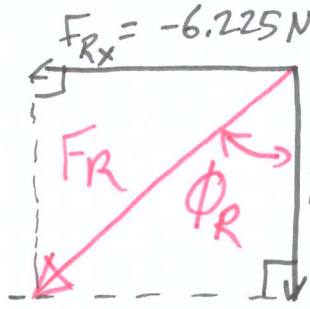
$F_{R_x} = \Sigma F_x = F_{1x} + F_{2x} + F_{3x}$

$F_{Rx} = -5.657 - 4.330 + 3.762 = \boxed{F_{Rx} = -6.225N}$

$F_{R_y} = \Sigma F_y = F_{1y} + F_{2y} + F_{3y}$

$F_{Ry} = +5.657 - 2.5 - 10.337 = \boxed{F_{Ry} = -7.180N}$

• FIND $\vec{F}_R$



$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2}$

$F_R = \sqrt{(-6.225)^2 + (-7.180)^2}$

$\boxed{F_R = 9.503\,N}$ (SAME AS FROM PART A)

$\tan\phi_R = \left|\frac{F_{Rx}}{F_{Ry}}\right| \rightarrow \phi_R = \tan^{-1}\left|\frac{F_{Rx}}{F_{Ry}}\right|$

$\phi_R = \tan^{-1}\left|\frac{-6.225}{-7.180}\right| = \boxed{\phi_R = 40.93°}$

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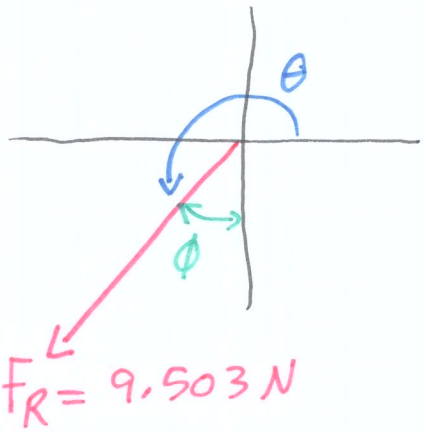
- DRAW Summary

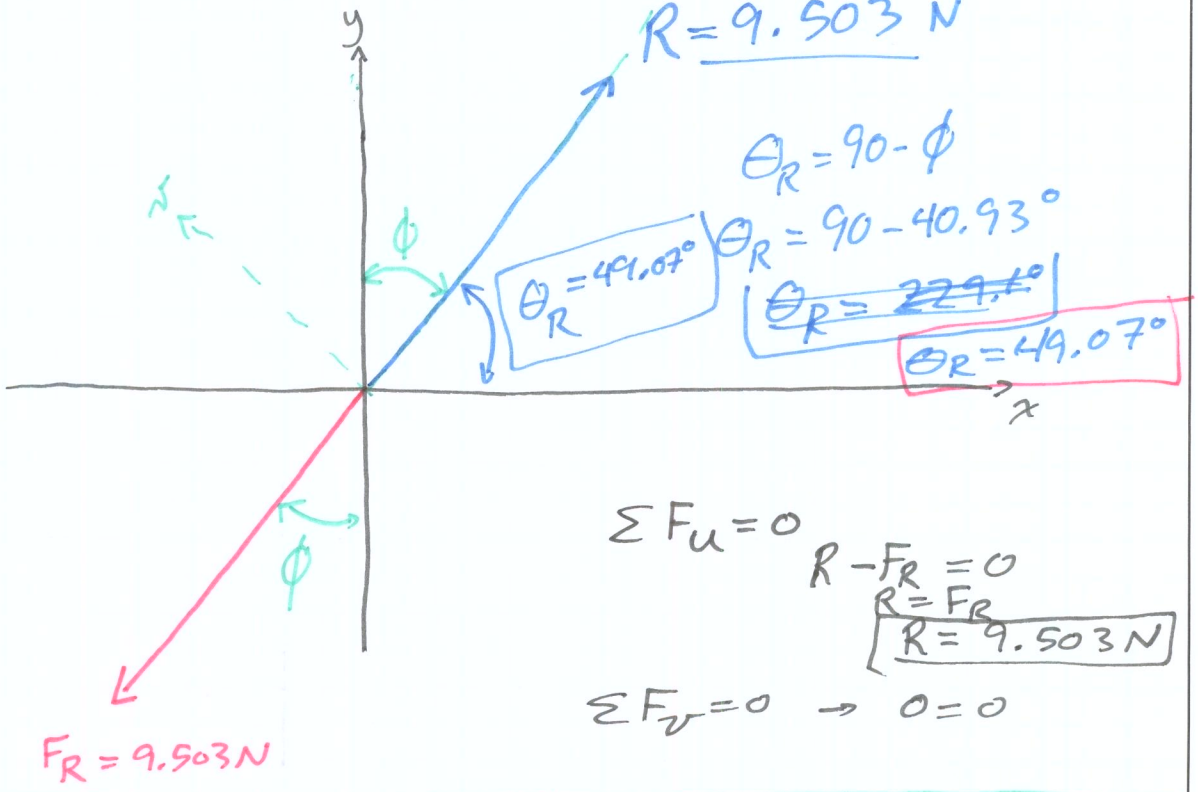
$\theta = 270 - \phi$

$\theta = 270 - 40.93$

$\boxed{\theta = 229.1^\circ}$



(C) FIND REACTION USE F_R



$\theta_R = 90 - \phi$

$\theta_R = 90 - 40.93^\circ$

~~$\theta_R = 229.1^\circ$~~

$\theta_R = 49.07^\circ$

$\Sigma F_u = 0$

$R - F_R = 0$

$R = F_R$

$\boxed{R = 9.503\,N}$

$\Sigma F_v = 0 \rightarrow 0 = 0$

OPTION 1

- FORCE in x, y components
- Solve For R_x, R_y
- Find R
- Find θ_R

OPTION 2

- Define a u, v axis
- u is along our line of action
- v is pependicular