No.

Date

THIS BOOK BELONGS TO : SEAN LAI

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"THE WAY TO SUCEED IS TO
DOUBLE YOUR FAILURE RATE"

No.

Date

THINGS THAT BUG ME:

1) HOME PRICES ARE UPWARDS OF 10X MY ANNUAL INCOME.
2) REPAIR OF MANY MODERN DEVICES/VEHICLES IS DIFFICULT BY DESIGN
3) DIVISIVENESS + LACK OF COMMUNICATION BETWEEN PEOPLE WHO DISAGREE
4) DIFFICULTY OF FINDING WELL FITTING CLOTHES

No.

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THINGS THAT BUG MY FRIENDS + FAMILY

1) LACK OF STANDARDIZED/EASY HOME AUTOMATION
2) RACISM + INTOLERANCE
3) DIFFICULTY OF COOKING EGGS
4) MINUTIA OF UNCONTROLABLE PROBLEMS

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PROBLEMS IN SOCIETY THAT MIGHT HAVE AN ENGINEERING SOLUTION

1) PRODUCT LIFESPAN / DESIGNED OBSELESCENCE
2) LACK OF PROPER INCENTIVES TO MAKE MANUFACTURING MORE SUSTAINABLE

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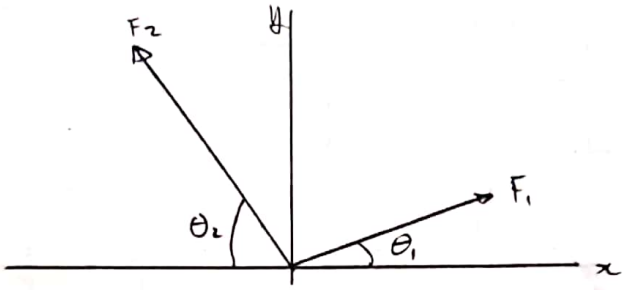
OPPORTUNITIES FOR CREATIVE PROBLEM SOLVING IN MY COMMUNITY

1) THE WHOLE WORLD NEEDS FACEMASKS + VENTILATORS
2) NEED FOR TRANSPORTATION/DELIVERY TO THE VULNERABLE
3)

(2) Given:



$F_1 = 20\,kN$
$F_2 = 30\,kN$
$\theta_1 = 30°$
$\theta_2 = 50°$

Find: $\bar{F}_1 + \bar{F}_2$, magnitude + direction of resultant force

Solution:

$$\bar{F}_1 = F_1 \cos\theta_1 \hat{i} + F_1 \sin\theta_1 \hat{j}$$
$$\bar{F}_2 = F_2 \cos\theta_2 \hat{i} + F_2 \sin\theta_2 \hat{j}$$

$$\rightarrow \bar{F}_1 + \bar{F}_2 = (F_1 \cos\theta_1 - F_2 \cos\theta_2)\hat{i} + (F_1 \sin\theta_1 + F_2 \sin\theta_2)\hat{j}$$

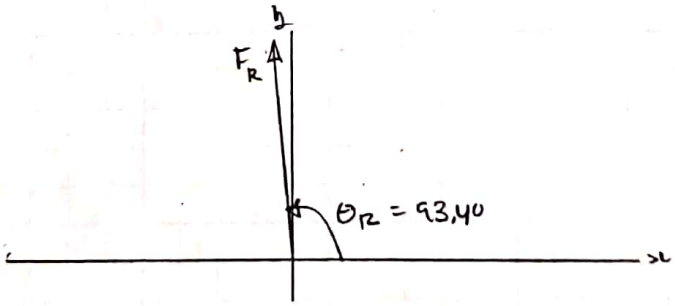
let $\bar{F}_1 + \bar{F}_2 = \bar{F}_R$ $\quad \bar{F}_R = (-1.96)\hat{i} + (32.98)\hat{j}\ kN$

$$|F_R| = \sqrt{1.96^2 + 32.98^2}$$
$$|F_R| = 33.04\ kN$$

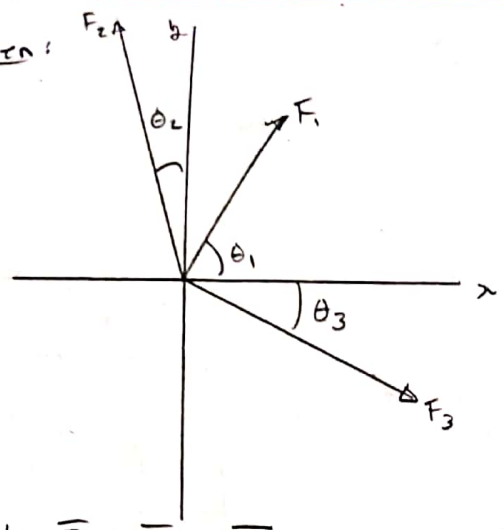
$$\theta_R = \tan^{-1}\left(\frac{32.98}{-1.96}\right)$$
$$= -86.6°$$

$\rightarrow \theta_R = 180 - 86.6°$ from pos. x-axis
$= 93.4°$

$\rightarrow$ **$\bar{F}_R = 33.04\ kN$ at $93.4°$**



③ Given:



$F_1 = 70\,lb$ $\quad \theta_1 = 55°$

$F_2 = 150\,lb$ $\quad \theta_2 = 22°$

$F_3 = 90\,lb$ $\quad \theta_3 = 35°$

Find: $\overline{F_1} + \overline{F_2} + \overline{F_3}$, resultant force from positive x-axis

let $\overline{F_R} = \overline{F_1} + \overline{F_2} + \overline{F_3}$

$$\rightarrow \overline{F_R} = (F_1\cos\theta_1 - F_2\sin\theta_2 + F_3\cos\theta_3)\hat{i} + (F_1\sin\theta_1 + F_2\cos\theta_2 - F_3\sin\theta_3)\hat{j} \text{ lbs}$$

$$\overline{F_R} = 54.9\hat{i} + 141\hat{j} \text{ lbs}$$

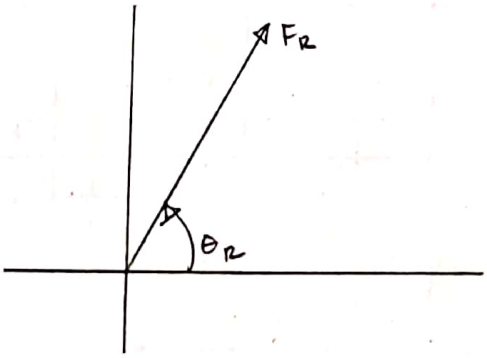
$$|F_R| = \sqrt{54.9^2 + 141^2}$$

$$|F_R| = 151.3 \text{ lbs}$$

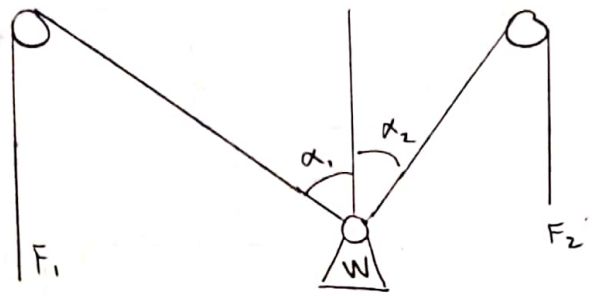
$$\theta_R = \tan^{-1}\left(\frac{141}{54.9}\right)$$

$$\theta_R = 68.73°$$

$$\rightarrow \boxed{F_R = 151.3 \text{ lbs at } 68.73°}$$



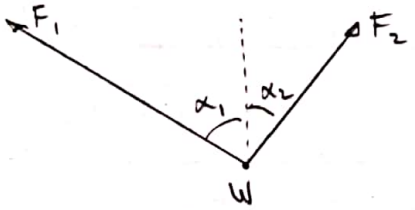
④ Given:



Find: Resultant horizontal + vertical forces on W

Solution:

FBD

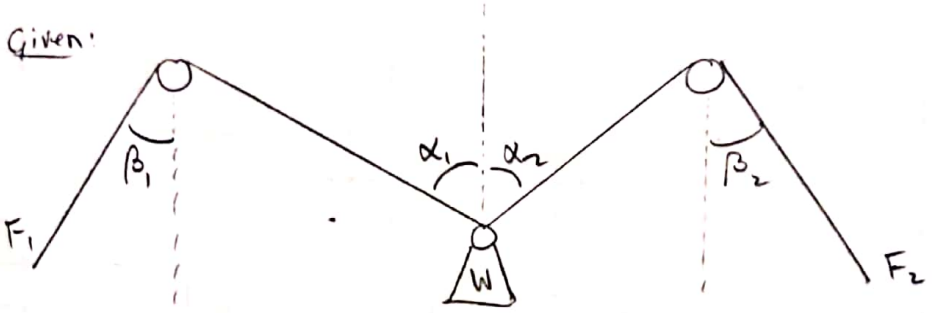


x-direction: $+F_2 \sin\alpha_2 - F_1 \sin\alpha_1$

y-direction: $+F_2 \cos\alpha_2 + F_1 \cos\alpha_1$

$$\rightarrow \boxed{\bar{F}_R = (F_2 \sin\alpha_2 - F_1 \sin\alpha_1)\hat{i} + (F_1 \cos\alpha_1 + F_2 \cos\alpha_2)\hat{j}}$$

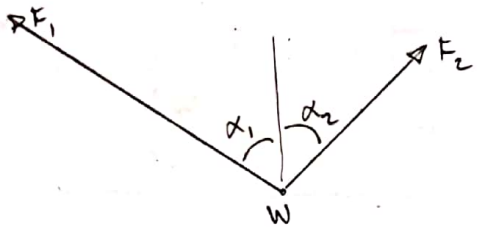
⑤ Given:



Find: Resultant horizontal + vertical forces of W

Solution: same as for problem ④. β_1, β_2 will not affect forces on W.

FBD:



$$\bar{F}_R = \bar{F}_1 + \bar{F}_2$$

$$\boxed{\bar{F}_R = (-F_1 \sin\alpha_1 + F_2 \sin\alpha_2)\hat{i} + (F_1 \cos\alpha_1 + F_2 \cos\alpha_2)\hat{j}}$$