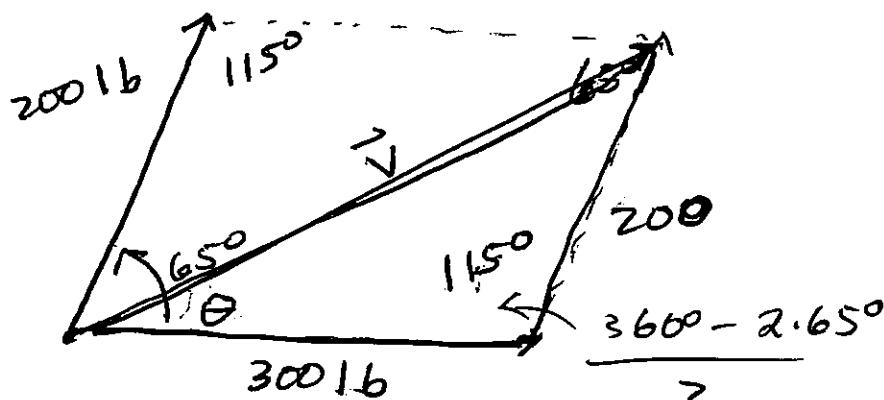


Applications

EXAMPLE Two draft horses are pulling on a tree stump with forces of 200 pounds and 300 pounds. If the angle between the forces is 65° , then what is the magnitude of the resultant force? What is the angle between the resultant and the 300-pound force?



\vec{V} is the resultant. It is the sum of the forces.

$$\begin{aligned} & \frac{360^\circ - 2 \cdot 65^\circ}{2} \quad \text{Find } |\vec{V}| \\ & = \frac{360^\circ - 130^\circ}{2} \\ & = \frac{230^\circ}{2} = 115^\circ \end{aligned}$$

The angles of a parallelogram have sum 360° .

LAW of Cosines $c^2 = a^2 + b^2 - 2ab \cos C$

$$|\vec{V}|^2 = (200)^2 + (300)^2 - 2(200)(300) \cos 115^\circ$$

$$|\vec{V}| \approx 425.1 \text{ lb}$$

Find θ

Law of Sines

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

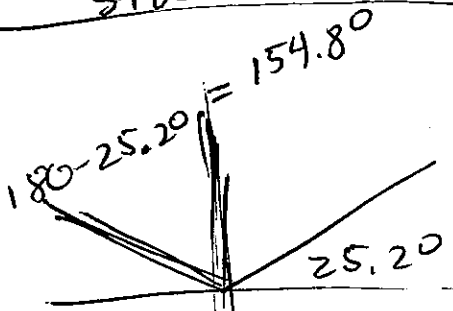
$$\frac{\sin \theta}{200} = \frac{\sin 115^\circ}{425.1} \leftarrow |\vec{V}|$$

$$\sin \theta = \frac{200 \sin 115^\circ}{425.1}$$

$$\theta = \sin^{-1} \left(\frac{200 \sin 115^\circ}{425.1} \right)$$

$$\approx 25.2^\circ$$

Side Note



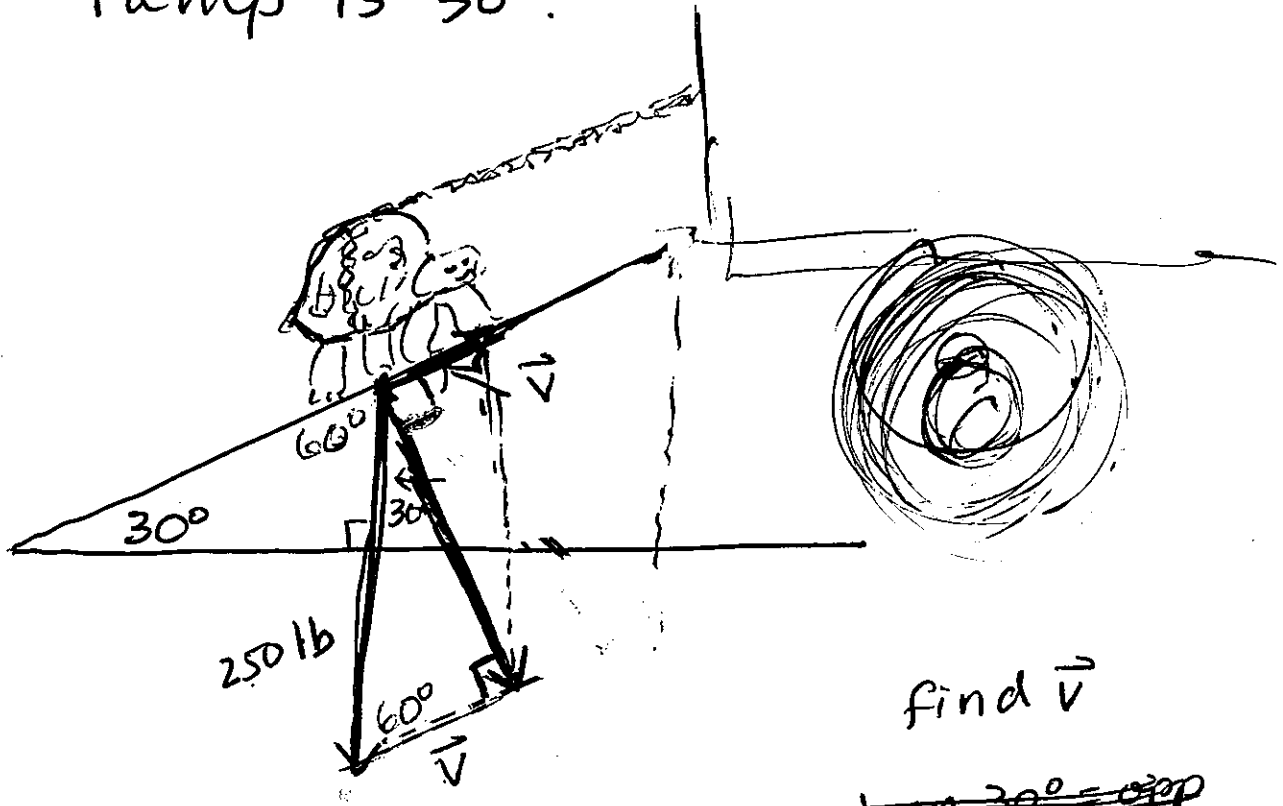
Note

$$\sin 154.8^\circ = \sin 25.2^\circ$$

↑
but θ is less
than 65° .

EXAMPLE Workers at the Audubon

Zoo must move a giant tortoise to his new home. Find the amount of force required to pull a 250-lb tortoise up a ramp leading into a truck. The angle of elevation of the ramp is 30° .



find \vec{v}

~~$\tan 30^\circ = \frac{opp}{adj}$~~

$$\cos 60^\circ = \frac{adj}{hyp} = \frac{|\vec{v}|}{250}$$

$$|\vec{v}| = 250 \cos 60^\circ$$

$$|\vec{v}| = (250) \left(\frac{1}{2}\right) = 125 \text{ lb}$$