Examples # 4 and 5

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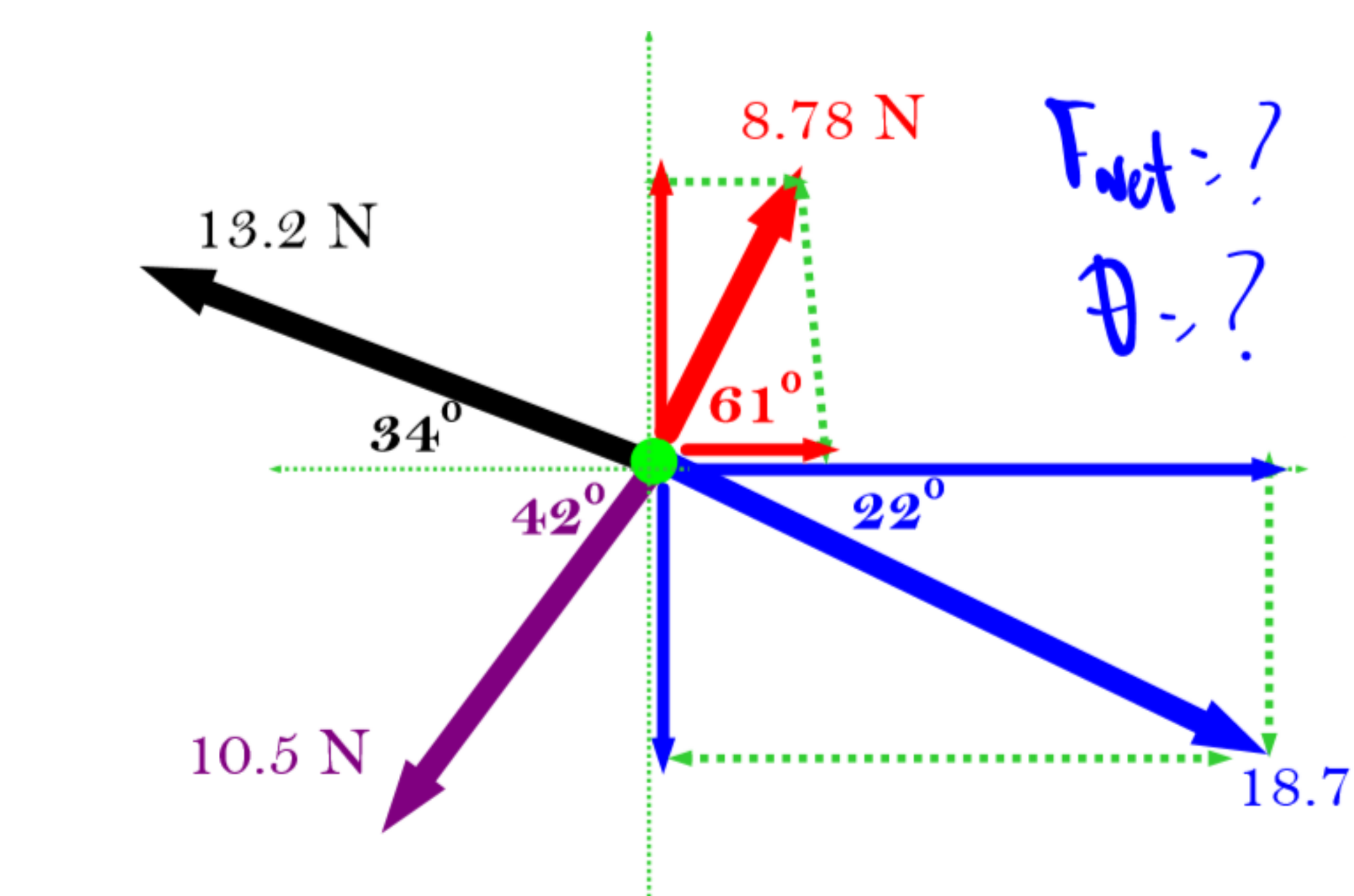


$F_{net} = ?$

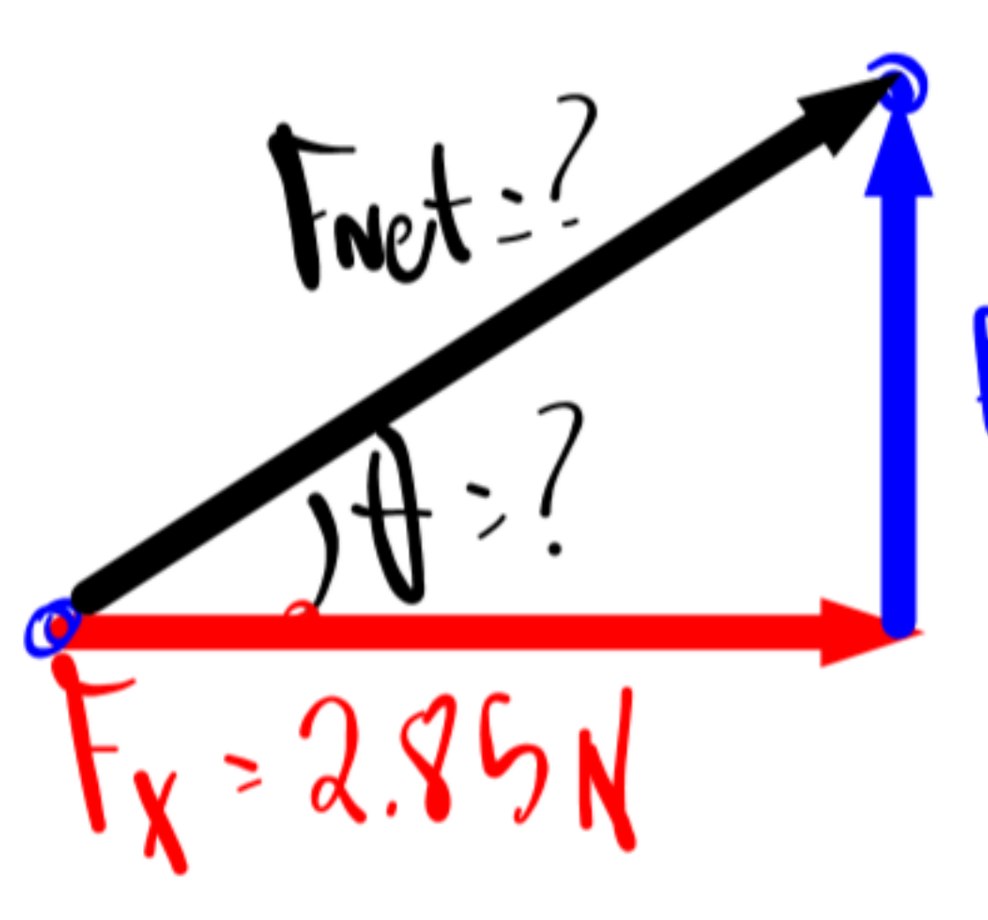
$\theta = ?$

Force (Magnitude) = ?

Direction (Angle) = ?

$sin\theta = \frac{opp.}{hyp.}$ $tan\theta = \frac{opp.}{adj.}$

$cos\theta = \frac{adj.}{hyp.}$



$F_y = 1.03\ N$

$F_{net}^2 = 2.85^2 + 1.03^2$

$F_{net} = \sqrt{2.85^2 + 1.03^2}$

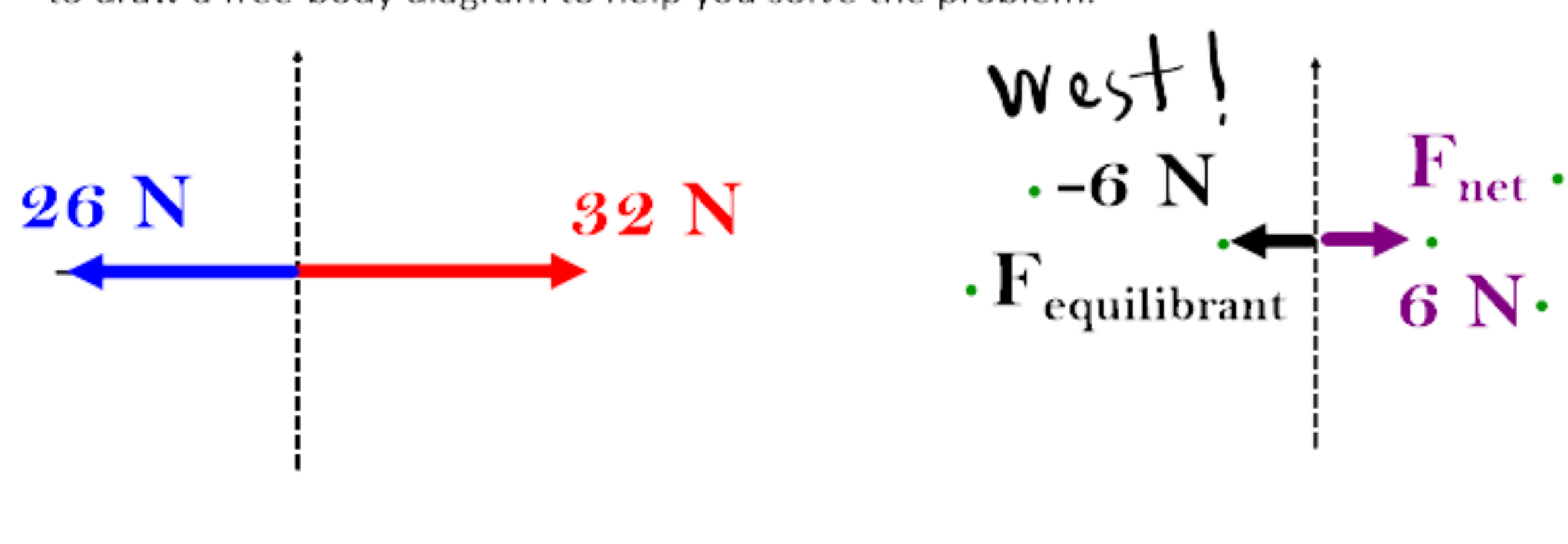
$F_{net} = \sqrt{9.17}$

$F_{net} = 3.03\ N$

$\theta = \tan^{-1}\left(\frac{F_y}{F_x}\right) \approx 20°$

$\theta = \tan^{-1}\left(\frac{1.03}{2.85}\right) = 19.9°$ N of E

A 32-N force acts on a small mass in the positive *x*-direction. A 26-N force also acts on it in the negative *x*-direction. What is the equilibrant of these two forces? You may want to draw a free-body diagram to help you solve the problem.



4. Two forces are exerted on an object. A 43-N force acts exactly 240° and a 67-N force acts at 300°.

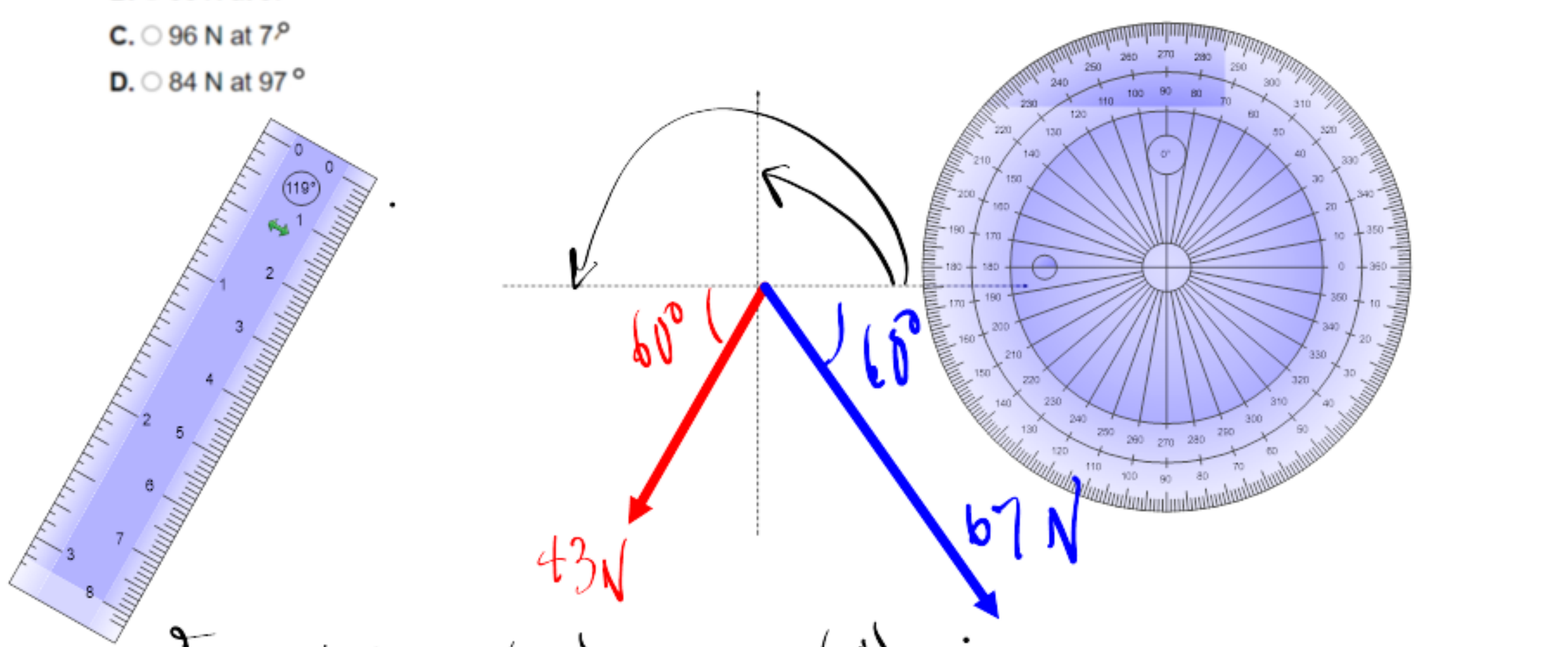
What are the magnitude and direction of the equilibrant?

A. ○ 96 N at - 83°

B. ○ 96 N at 97°

C. ○ 96 N at 7°

D. ○ 84 N at 97°



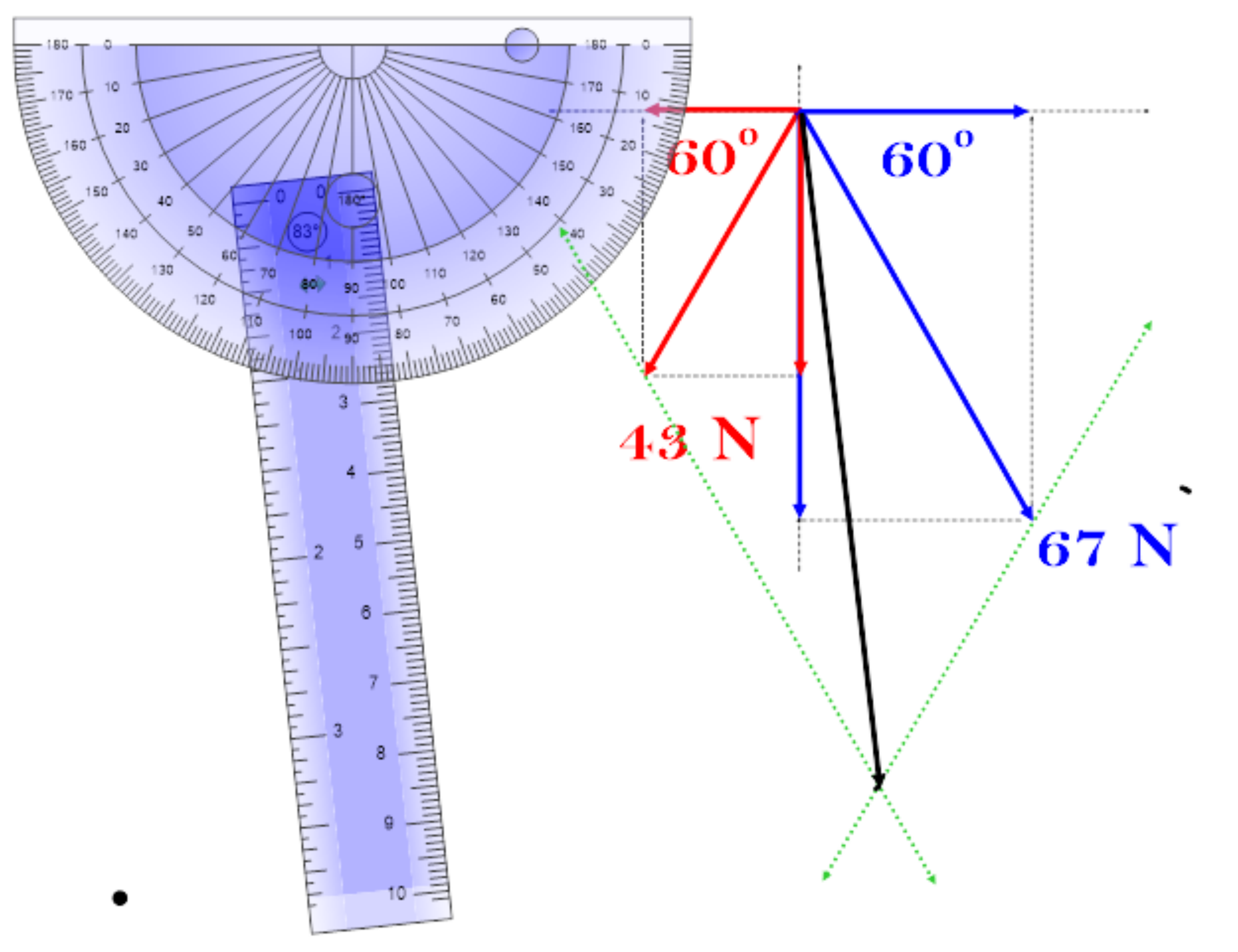
$T_x = 67\cos(60°) - 43\cos(60°) = 12\ N$

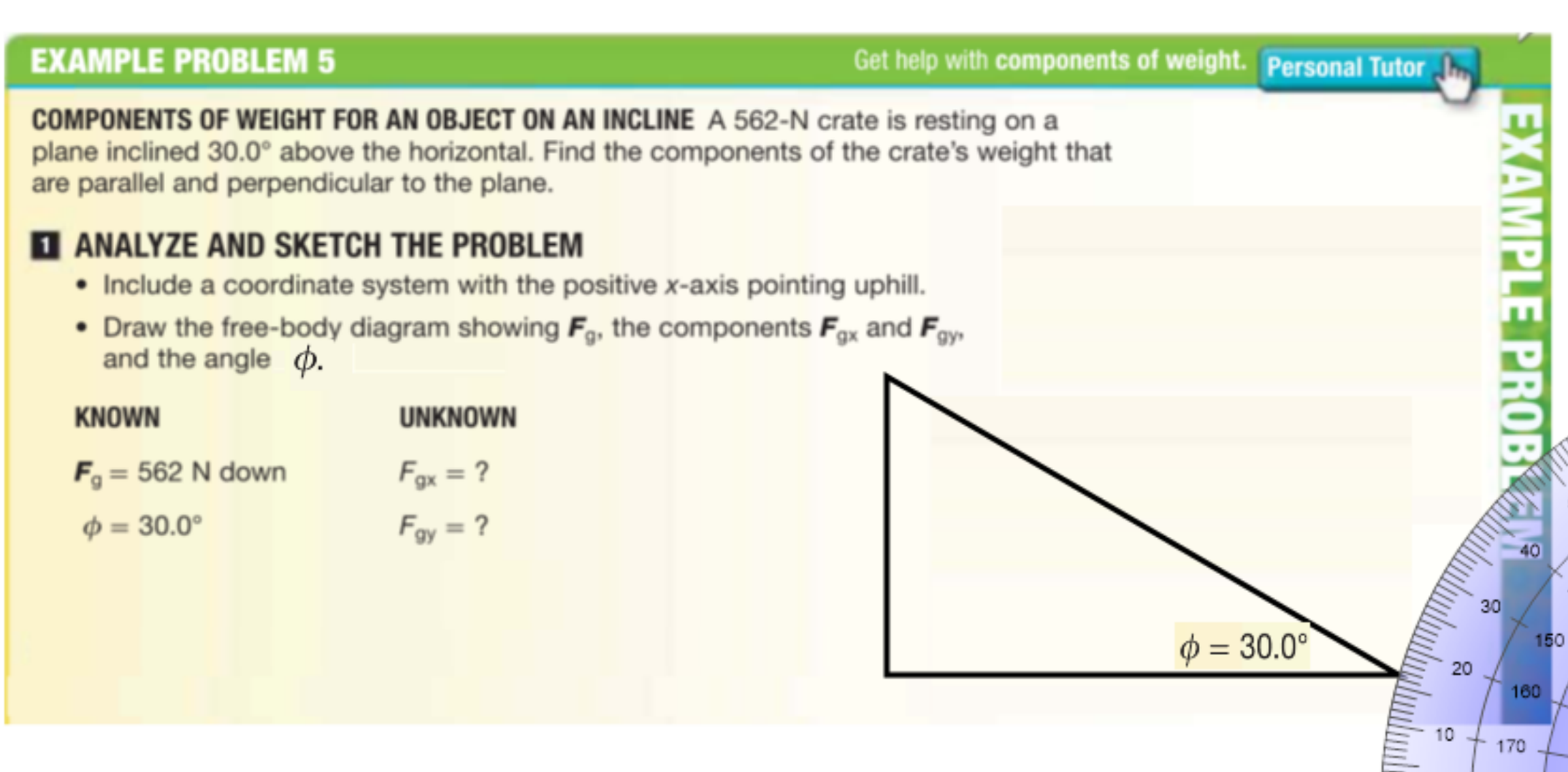
$T_y = 0 - 43\sin(60°) - 67\sin(60°) = -95\ N$

$F_{net}^2 = 12^2 + (-95)^2$

Net { $F_{net} = \sqrt{12^2 + 95^2} = 96\ N$; $\theta = \tan^{-1}\left(\frac{-95}{12}\right) = -83°$ S of E }

equilibrant { $F_{equi.} = 96\ N$; $\theta = -83°$ N of W }





EXAMPLE PROBLEM 5 Get help with **components of weight.** Personal Tutor

COMPONENTS OF WEIGHT FOR AN OBJECT ON AN INCLINE A 562-N crate is resting on a plane inclined 30.0° above the horizontal. Find the components of the crate's weight that are parallel and perpendicular to the plane.

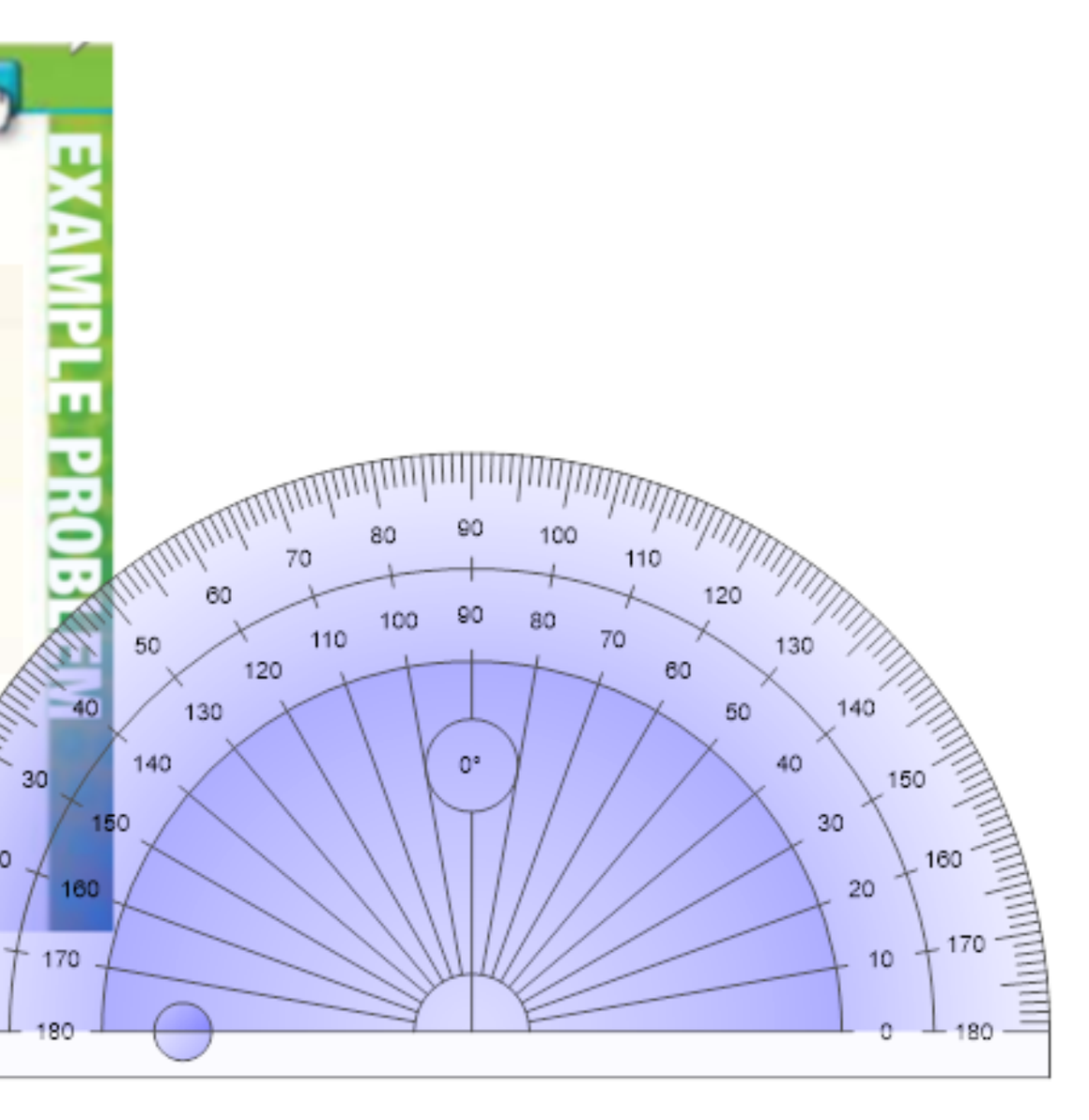
1 ANALYZE AND SKETCH THE PROBLEM

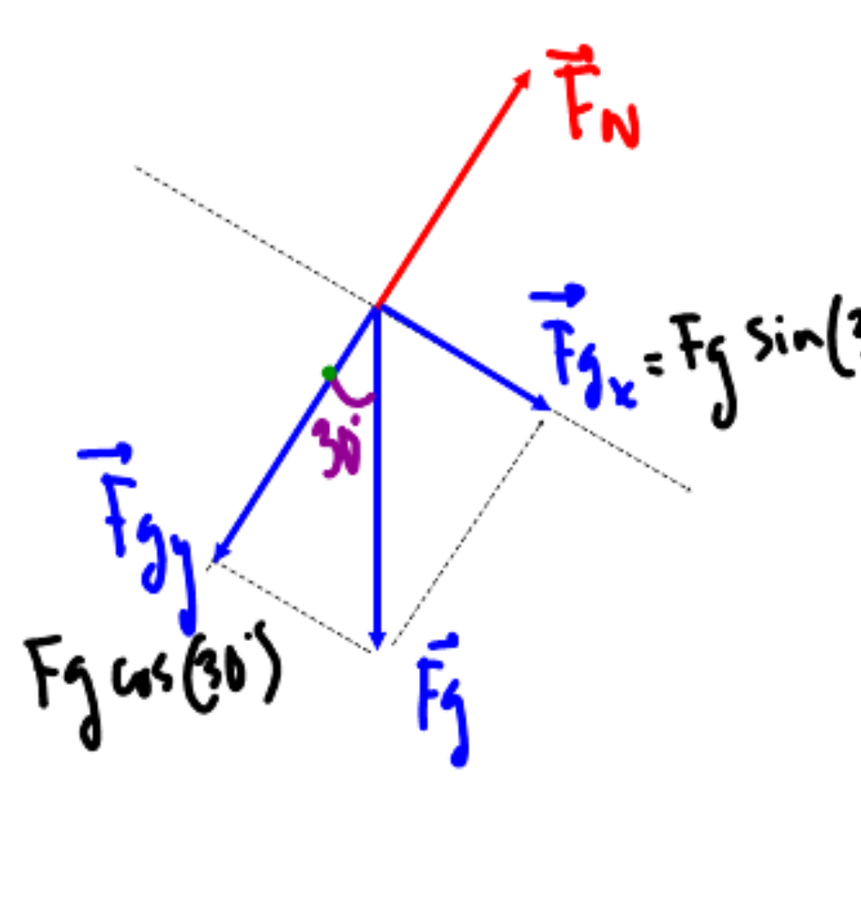
- Include a coordinate system with the positive *x*-axis pointing uphill.
- Draw the free-body diagram showing F_g, the components F_{gx} and F_{gy}, and the angle ϕ.

KNOWN	UNKNOWN
F_g = 562 N down	F_{gx} = ?
ϕ = 30.0°	F_{gy} = ?

ϕ = 30.0°

EXAMPLE PROBLEM





$F_{gx} = F_g \sin\theta = 562 \sin 30$

$F_{gx} = 281\ N$

$F_{gy} = F_g\cos(30) = 562\cos(30)$

$F_{gy} = 487\ N$

5. A 475-N truck is sliding down a plane inclined at 40 above the horizontal. Calculate the magnitude of the acceleration.

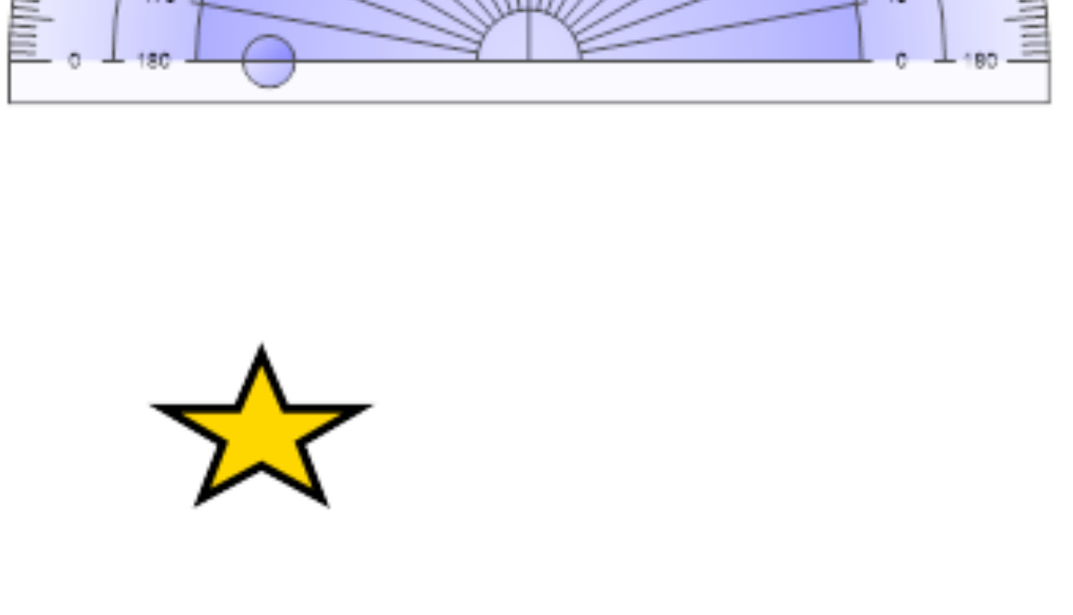
A. ○ 6.29 m/s — No m/s

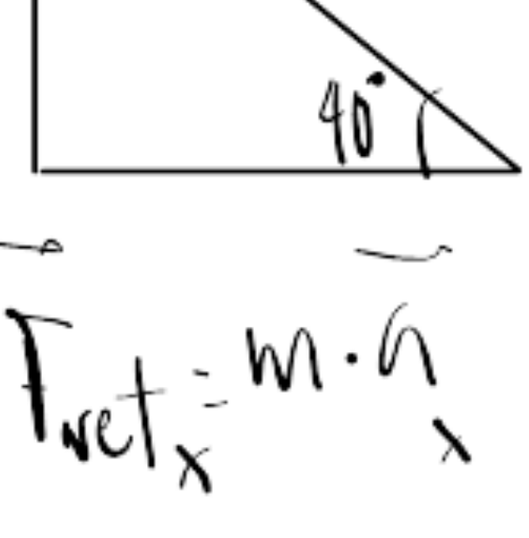
B. ○ 6.29 m/s²

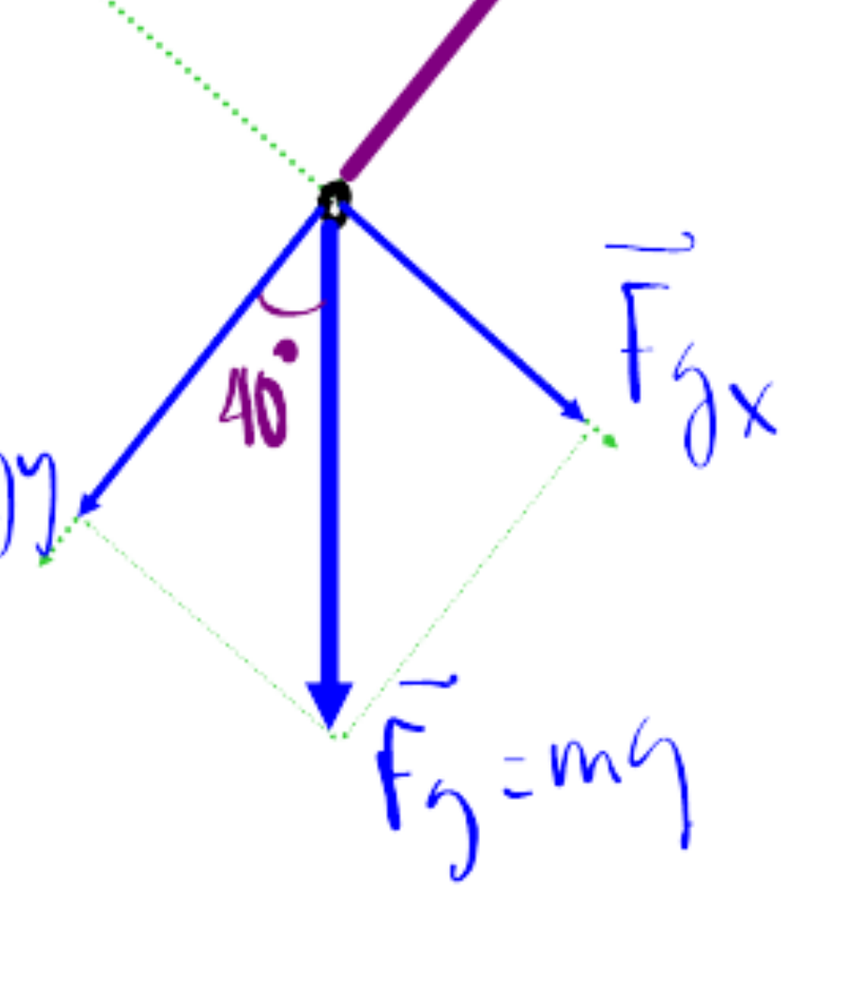
C. ○ 7.51 m/s²

D. ○ 62.9 m/s²

$a = ?$







$\vec{F}_{net_x} = m \cdot \vec{a}_x$

$F_{gx} = m \cdot a$

$F_g \sin\theta = m \cdot a$

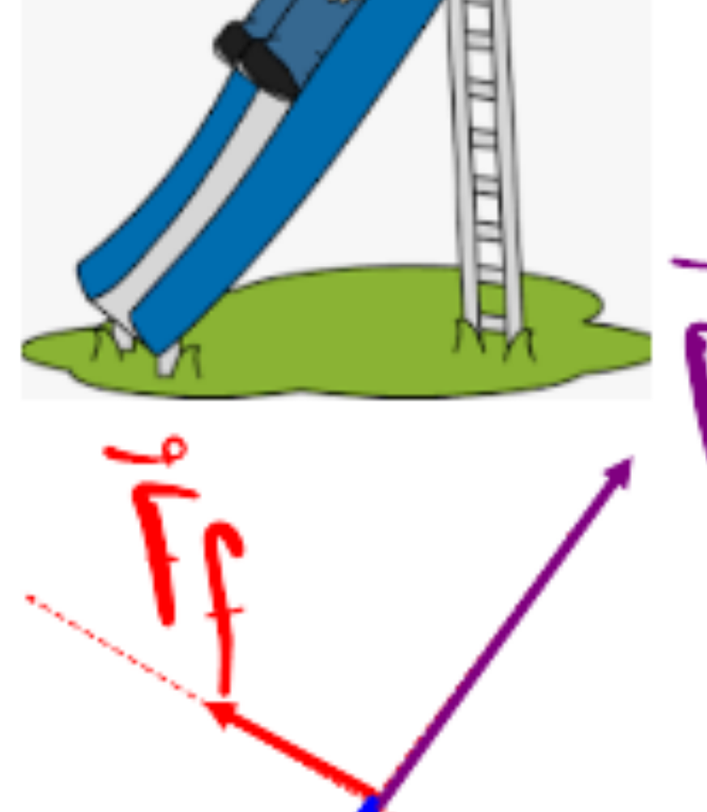
$mg \sin\theta = m \cdot a$

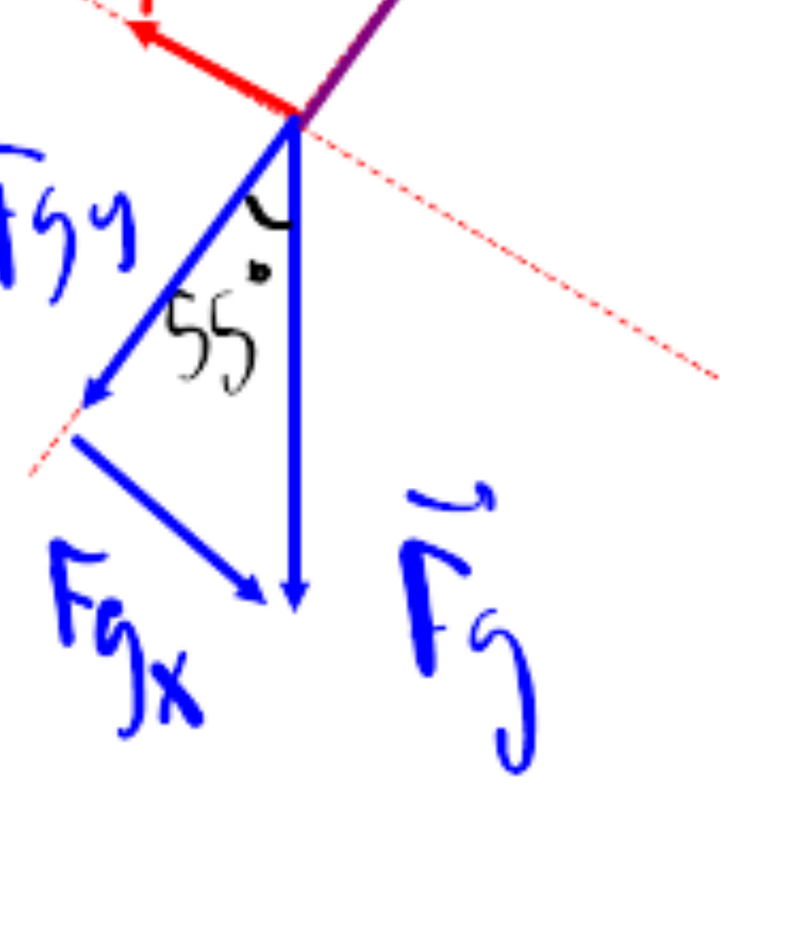
$a = g\sin\theta = 9.8 \times \sin(40°)$

$a = 6.3\ \frac{m}{s^2}$

A child with a mass of 30.0 kg is moving down a slide at a playground. The angle the slide makes with the ground is 55.0°, and the coefficient of kinetic friction between the child and the slide is 0.250. What is the frictional force on the child? What is the resultant acceleration of the child?

You may want to draw a free-body diagram to help you solve the problem.





$F_f = \mu \cdot F_N$

$F_f = \mu \cdot F_{gy} = \mu\, mg\cos\theta$

$F_f = 0.25 \times 30 \times 9.8 \times \cos(55°)$

$F_f = 42.2\ N$

$\vec{F}_{net} = m \cdot \vec{a}$

$F_{gx} - F_f = m \cdot a$

$mg\sin\theta - F_f = m \cdot a$

$30 \times 9.8 \times \sin(55°) - 42.2 = 30 \times a$

$\frac{198.6}{30} = a = 6.62\ \frac{m}{s^2}$