

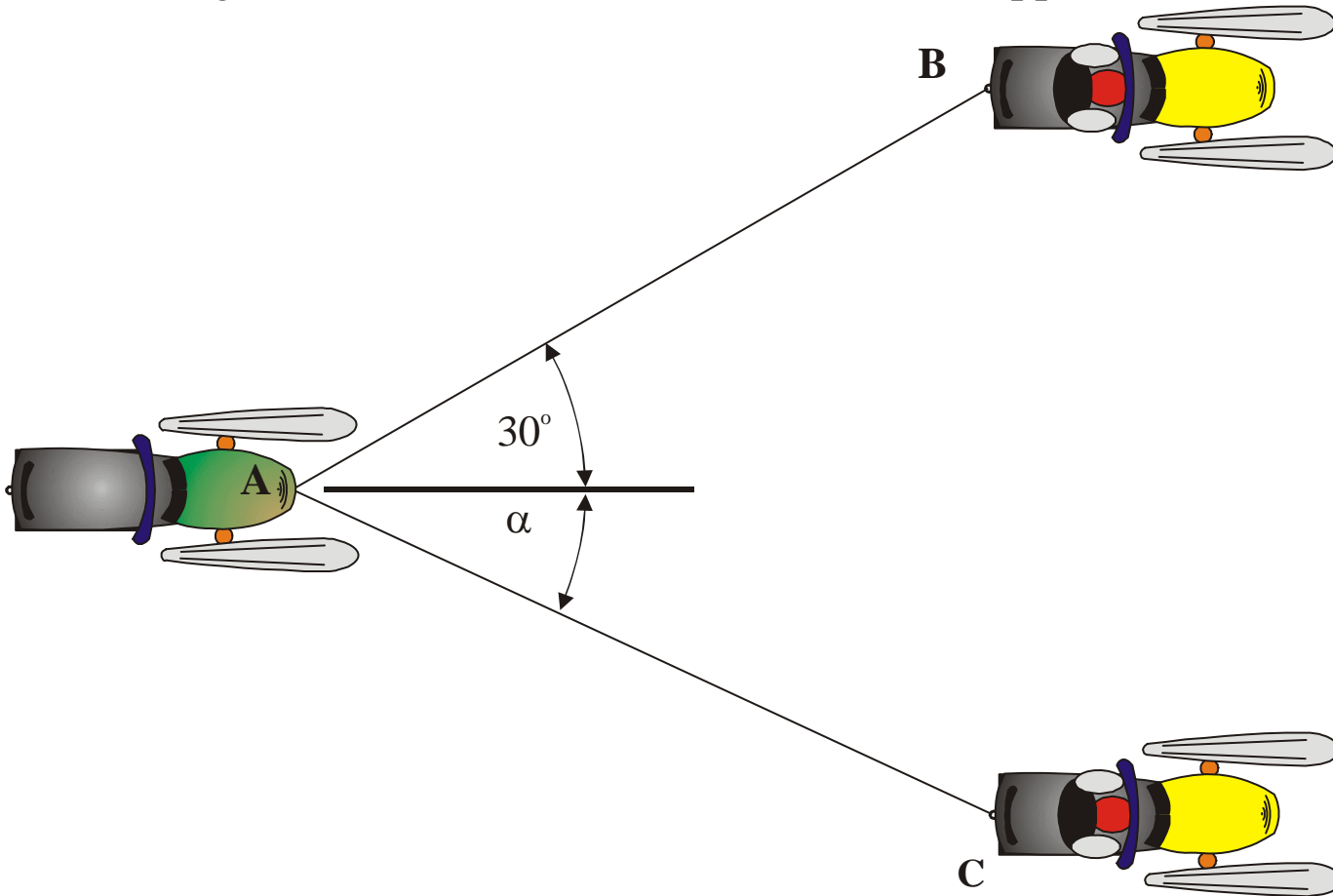
Example 2.3

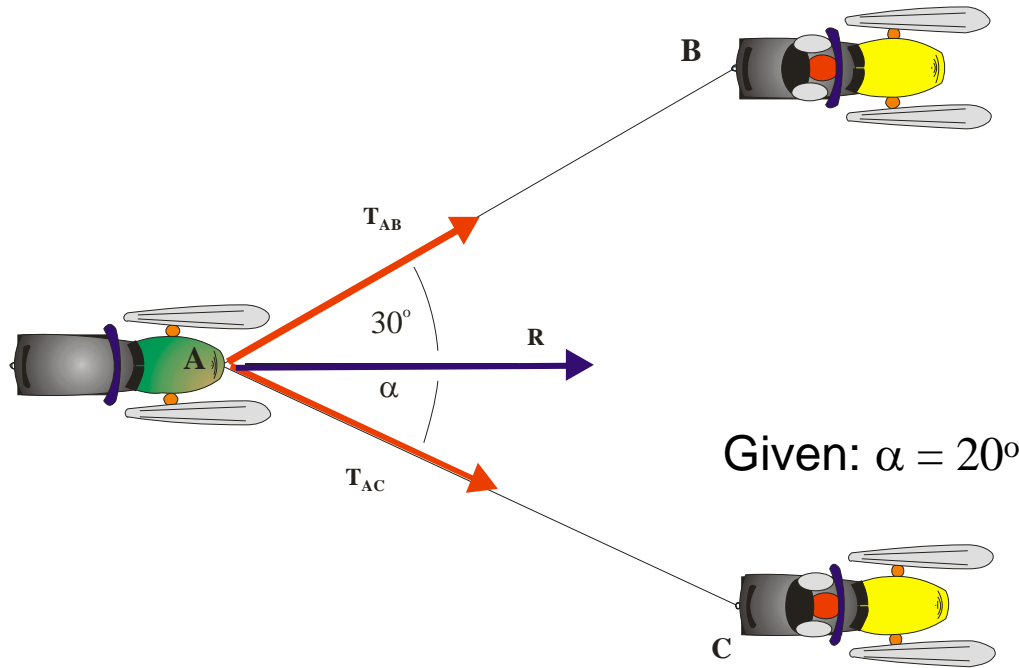
J. Frye

Example 2.3:

Two snowmobiles are pulling a disabled snowmobile by means of two ropes. The tension in rope AB is 1500 N and the angle α is 20° . Knowing that the resultant of the two forces applied at A is directed along the longitudinal axis of the disabled snowmobile, determine by trigonometry:

- (a) the tension in the rope AC,
- (b) the magnitude of the resultant of the two forces applied at A.





The resultant vector, \mathbf{R} , is the vector sum of force vectors \mathbf{T}_{AB} and \mathbf{T}_{AC} which are the tension forces of the cables exerted at point A.

$$\mathbf{T}_{AB} + \mathbf{T}_{AC} = \mathbf{R}$$

Hint: Make a small Table indicating what you know and what you don't know.

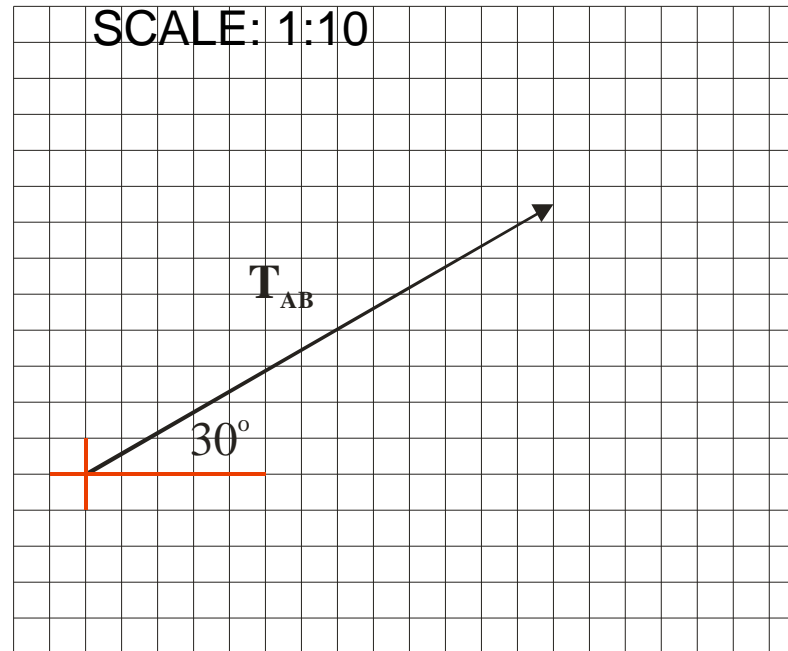
In this example we know:

Magnitude and Direction of \mathbf{T}_{AB} ,
Direction of \mathbf{T}_{AC} , and
Direction of \mathbf{R} .

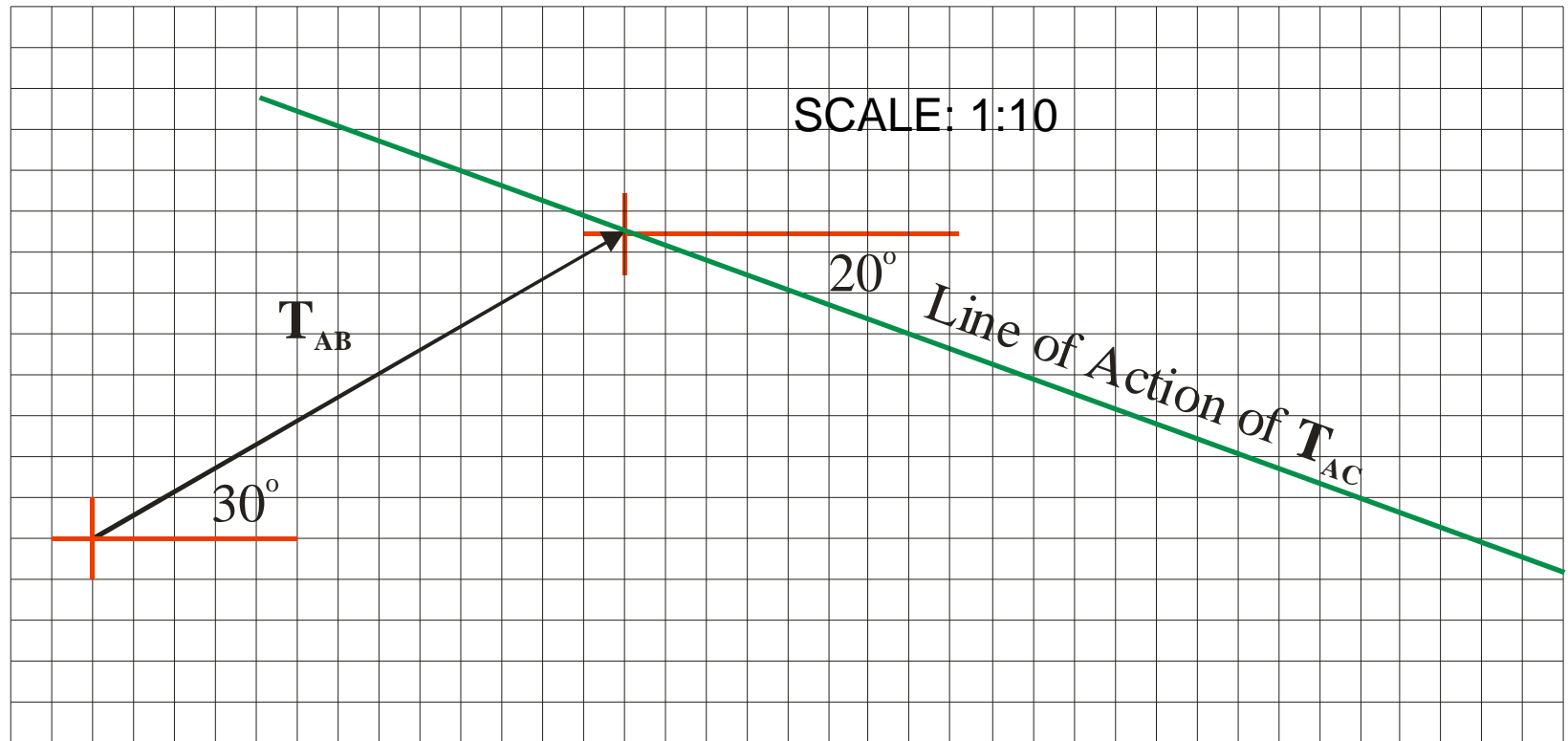
Force	Magnitude	Direction
\mathbf{T}_{AB}	1500	30°
\mathbf{T}_{AC}	?	20°
\mathbf{R}	?	0°

Graphical Solution:

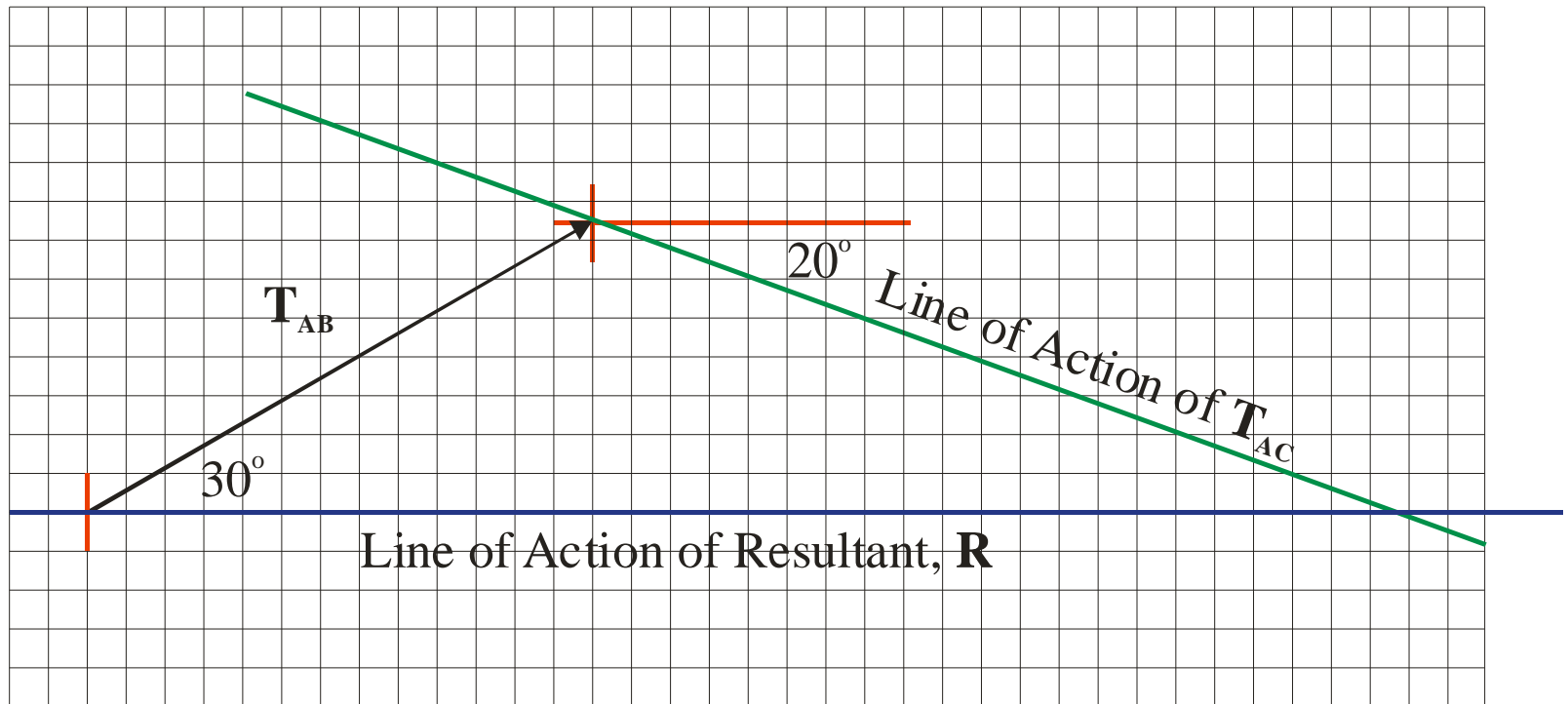
Begin by Plotting \mathbf{T}_{AB} to scale since you know both its magnitude and direction.



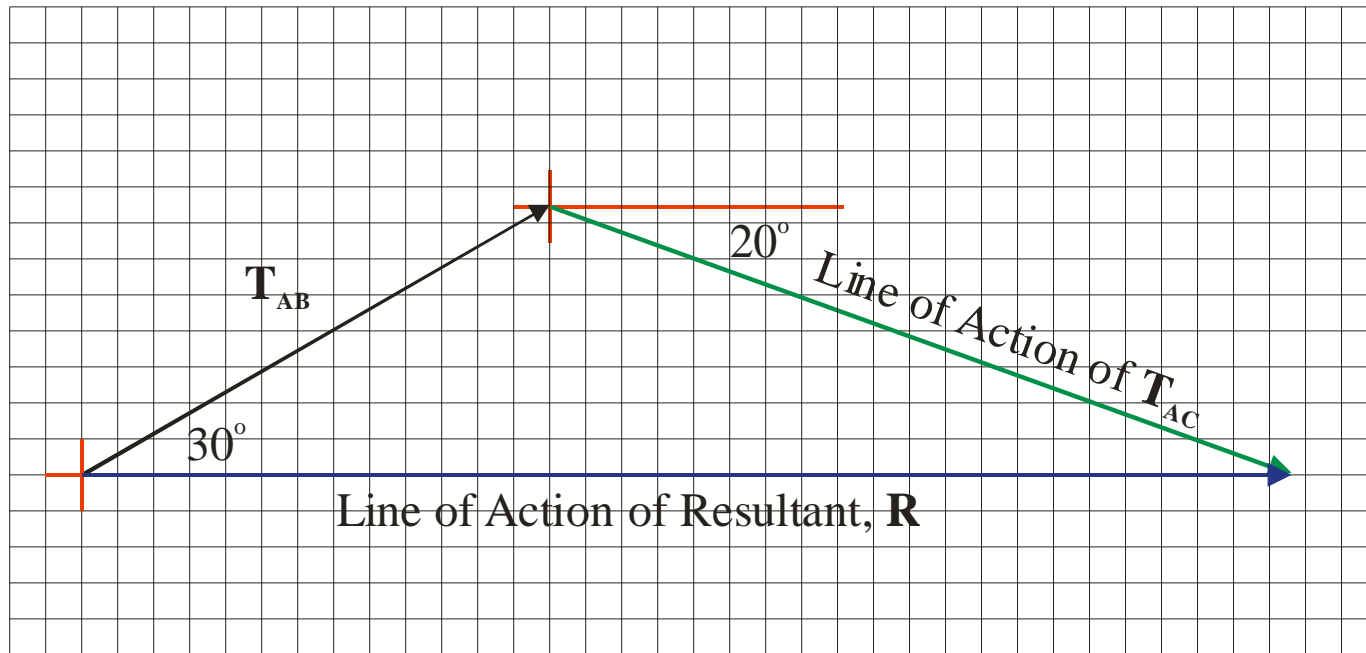
At “Tip” of T_{AB}
Draw in Line of Action of T_{AC}



Draw in Line of Action of Resultant, \mathbf{R}



Scale Magnitudes of R and T_{AC}



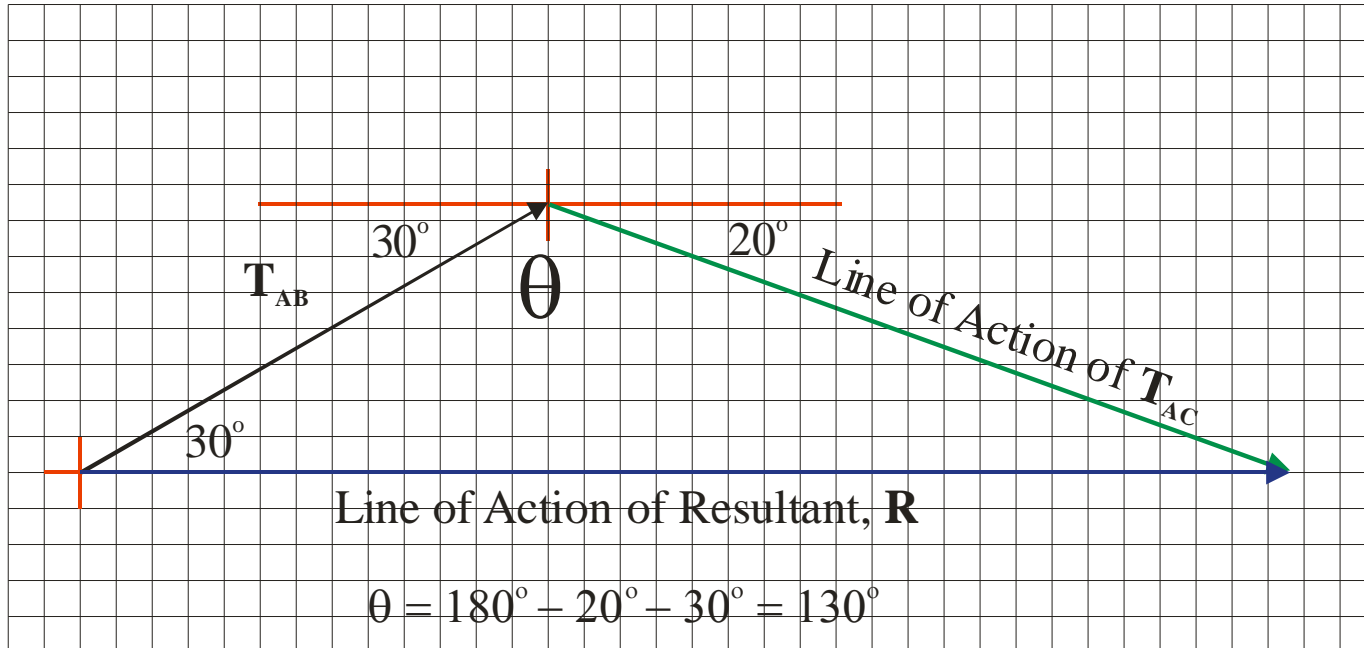
Scale Results:

$$T_{AB} + T_{AC} + R$$

$$R = 3200 \text{ N}$$

$$T_{AC} = 2000 \text{ N}$$

Trig Solution:



Sine Rule:

$$\frac{R}{\sin 130^\circ} = \frac{T_{AC}}{\sin 30^\circ} = \frac{1500}{\sin 20^\circ}$$

$$T_{AC} = 2192.85\text{N}$$

$$R = 3359.65\text{N}$$

Rectangular Components Solution:

At Point A:

$$\mathbf{R} = \mathbf{R}_x + \mathbf{R}_y$$

But $\mathbf{R}_y = 0$ since we are given that \mathbf{R} is directed along the longitudinal axis of the snowmobile. We write the equations :

$$\mathbf{R}_x = \sum F_x = 1500 \cos 30^\circ + T_{AC} \cos 20^\circ \quad (1)$$

$$\mathbf{R}_y = \sum F_y = 1500 \sin 30^\circ - T_{AC} \sin 20^\circ = 0 \quad (2)$$

From Equation (2):

$$T_{AC} = \frac{1500 \sin 30^\circ}{\sin 20^\circ} = 2192.85 \text{ N}$$

From Equation (1):

$$R = R_x = 1500 \cos 30^\circ + (2192.85) \cos 20^\circ = 3359.64 \text{ N}$$