

Q- To pull a car, one end of a rope 25 m long is attached to the car. The other end is fastened to a tree. A man exerts a force of 500 N at the midpoint of the rope pulling it 1 meter to the side. What is the **force** exerted on the automobile by the rope?

AS the force F creates tension in the rope, this tension will apply force on the car.

The two triangles will be same as the force F is applied at mid-point the longer sides are 12.5 m each and the common side is 1 m. thus the angle θ is the same on either side.

resolving the force acting on the man due to tensions in the rope along the common side of 1m and perpendicular to it the components along the common side are $T \sin \theta$ and along perpendicular direction $T \cos \theta$. The components in the perpendicular direction are in opposite to each other balances while the components in the direction of common side are in same direction added together and as the man in equilibrium balances the force on 500 N applied.

Thus we get

$$2T \sin \theta = 500 \text{ N}$$

$$\text{Gives } T = \frac{250}{\sin \theta}$$

Considering $\sin \theta = \text{perpendicular/hypogenous}$ in the right-angled triangle we get

$$\sin \theta = 1.0/12.5$$

Substituting this in equation (1) we get

$$T = 250 * 12.5 = 3125 \text{ N}$$

