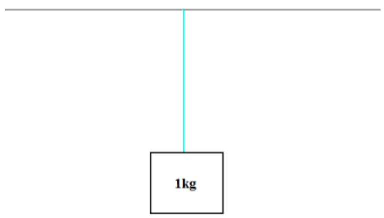
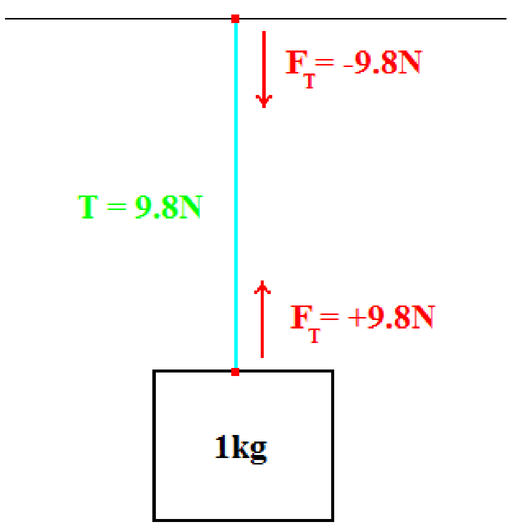
# Tension




In the simple diagram above, a 1kg block is attached to a light rope which is also tied to the ceiling above. Unless indicated otherwise, ropes, cords, strings, etc. in physical situations are treated as having negligible mass.

Because the block hangs stationary, the net force is zero. The force of gravity is -9.8N, which means the rope must apply an upward force of +9.8N. This is called a force of tension. At the other end of the rope, the rope pulls down on the ceiling with a force of tension of -9.8N. Altogether, one can simply say that the rope carries a tension of 9.8N, which is just the magnitude of the tension throughout the entire rope.




Ropes, cords, strings, etc. also have the general property which they cannot apply much of a shear force. This means they cannot apply a force perpendicular to their orientation. In the diagram above, the cord is oriented vertically, so it cannot apply a force to the crate left or right.

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| Answer Webassign Question 1 |

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| Answer Webassign Question 2 |

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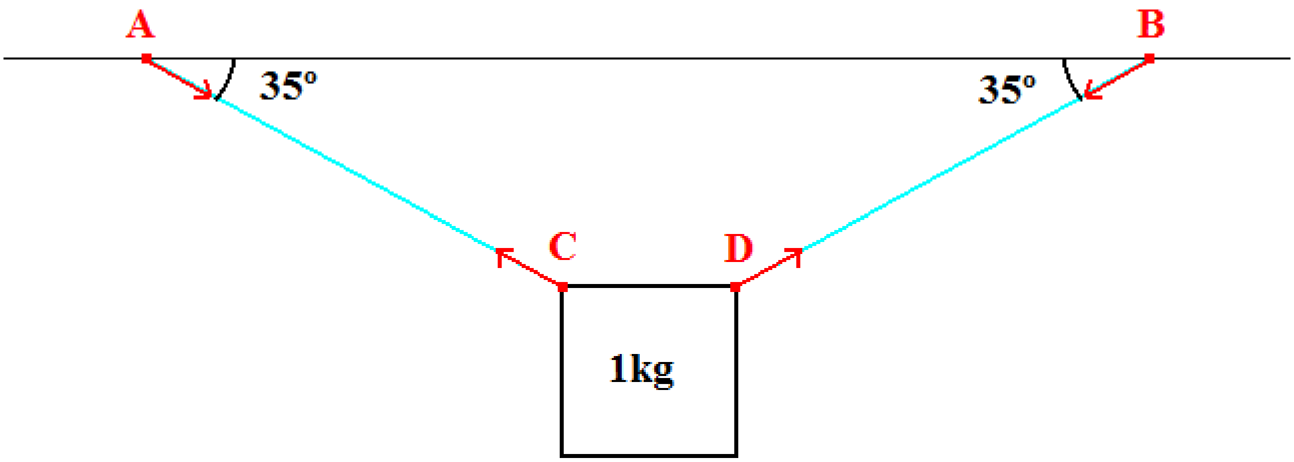
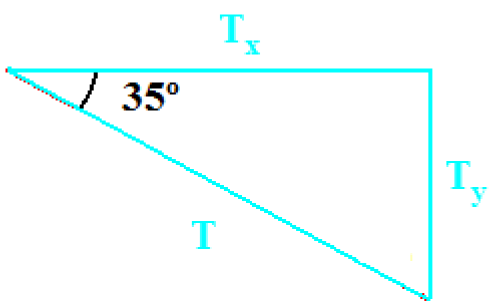
| Answer Webassign Question 3 |

This also holds true in the diagram below.




The two blue cords each hold a tension of 8.54N. At point A, the force of tension is (8.54N, 325º), at B it is (8.54N, 215º), at C, (8.54N, 145º), and at D, (8.54N, 35º).

How was the 8.54N determined? Let's focus on just one of the two cords. I'll draw a vector diagram for the tensions it holds.




Again, the actual tension exists along the hypotenuse of this diagram because the tension must be parallel to the actual rope itself. But this diagonal still has x and y components. We know that $T_y$ is responsible for pulling upwards against half of the force of gravity. The other rope will take care of the other half. So $T_y$ must equal 4.9N. Now it becomes solvable with trigonometry:

$\sin 35^\circ = \frac{4.9N}{T}$ and T = 8.54N

| Answer Webassign Question 4 |
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| Answer Webassign Question 5 |
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