(1) A 50 kg mass is suspended using ropes as shown. Find the tension in each rope.

$F = ma \rightarrow F = 50 \cdot 9.8 = 490N$

Rope 1 - 369.241 N

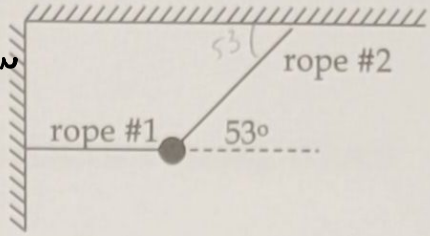
Rope 2 - 613.546N

#1 $\tan 53 = \frac{490}{x} \rightarrow x = \frac{490}{\tan 53}$

$x = 369.241$

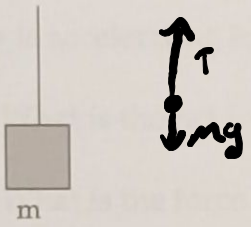
#2 $\sin 53 = \frac{490}{x} \rightarrow x = \frac{490}{\sin 53}$

$x = 613.54$



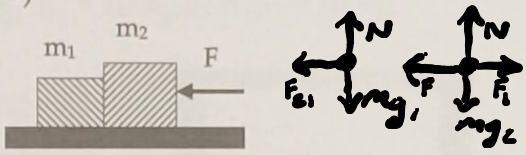
(2) **Free body diagrams.** Each situation contains labeled masses. For each object, draw a free body diagram identifying and labeling all forces acting on it. Lines represent ropes. Assume the mass of the ropes is small and can be neglected and that there is no friction. Note that separate forces need to have unique symbols (thus the weights of m_1 and m_2 can't both be labeled "w" or "mg"; "w_1" and "w_2" or "m_1g" and "m_2g" would be good labels).

a)



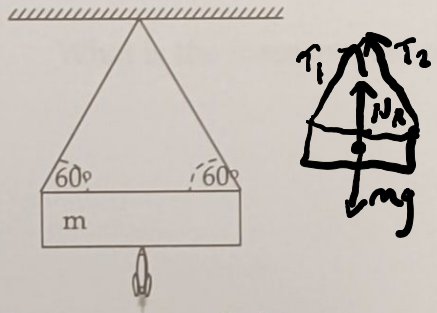
m is pulled by the rope and accelerating upwards.

b)



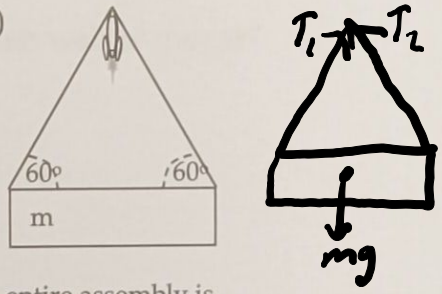
The masses lie on the floor. m_2 is being pushed by force F. Draw separate diagrams for the blocks.

c)



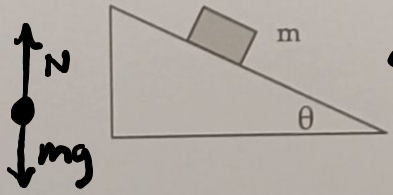
The ropes are attached to the ceiling and taut.

d)

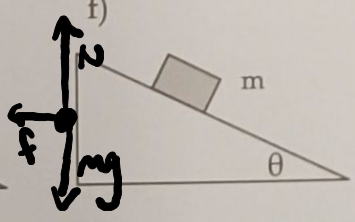


The entire assembly is accelerating downwards.

e)

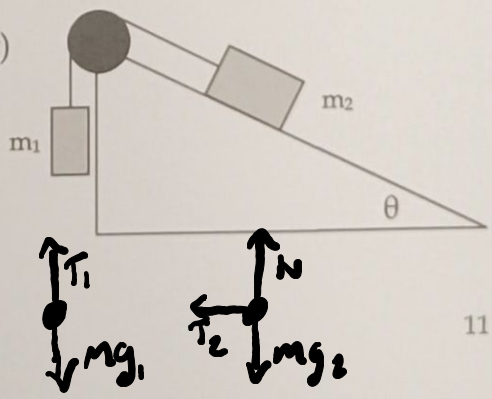


f)



Friction is holding the mass in place.

g)



$\cos 30 = \frac{1960}{x}$

$\frac{1960}{\cos 30} = x = 2263.24$

$\cos 30 = \frac{x}{1000}$

$x = 866.02$

$3920 - 2x = 2187.94$

(3) This problem refers to Figure 2c above with m = 400 kg.

a) Suppose the rocket is not present and the beam is not accelerating. What is the tension in each rope?

2263 N

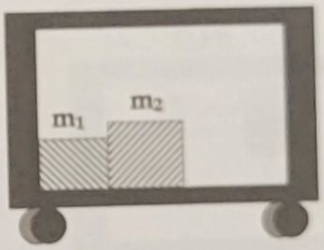
b) Now, suppose instead that the rocket is present and firing and the tension in each rope is 1000 N. What force must the rocket exert on mass m so that the beam does not accelerate?

2187.95N

(4) In Figure 2d above, m = 400 kg. Initially the mass is moving upwards at 12.0 m/s. Four seconds later its velocity is 16 m/s downwards. Assuming constant acceleration, what is the tension in the ropes during those four seconds?

646.63 N

(5) The car is accelerating to the right at 3.0 m/s^2, m_1 = 10 kg and m_2 = 20 kg.



a) What is the net force on m_2?

60 N

b) What is the force exerted on m_2 by m_1?

60N

c) What is the force exerted on m_1 by m_2?

60N

d) Jeopardy question: The question is similar to the first part and the answer is "30 N to the right". What is the question?

What is the net force of m1?

e) What is the force exerted on m_1 by the left wall of the car?

90N

4) $a = -7\ m/s^2$

$f_y - 3920 = 400(-7)$

$f_y = 1120$

$\frac{f_y}{2} = 560$

$\cos 80 = \frac{560}{x}$

$x = \frac{560}{\cos 80} = 646.632N$