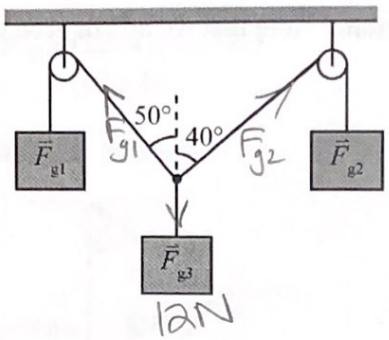
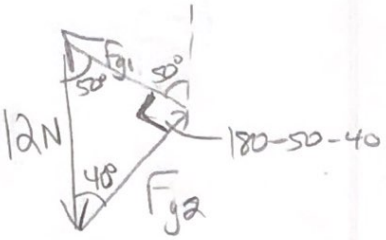
PRACTICE EXERCISES

Formulas: $\sum \vec{F} = 0$ $\sum \vec{F}_x = 0$ $\sum \vec{F}_y = 0$

1. $\vec{F}_{g_1}$, $\vec{F}_{g_2}$, and $\vec{F}_{g_3}$ are the weights of three objects suspended by pulleys, as illustrated. Assuming the pulleys in this system are frictionless and weightless and that magnitude of third weight is $F_{g_3} = 12$ N, what are the magnitudes of $\vec{F}_{g_1}$ and $\vec{F}_{g_2}$?





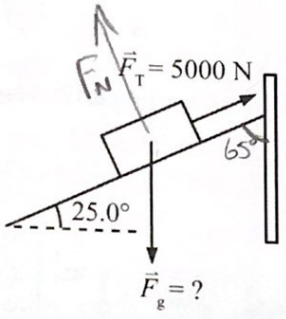
$F_{g1} = 12\cos 50°$

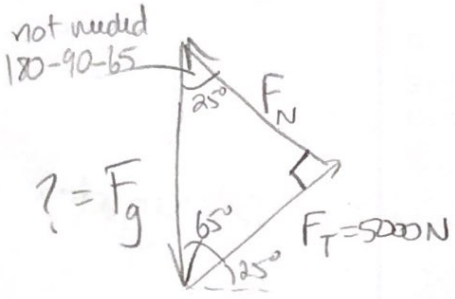
$= 7.7\text{ N}$ ✓

$F_{g2} = 12\cos 40°$

$= 9.2\text{ N}$ ✓

2. An object is suspended on a frictionless inclined plane by a rope parallel to the incline, as illustrated above. If the angle of the incline is 25.0° and the tension on the rope is 5 000 N, what is the weight of the object?

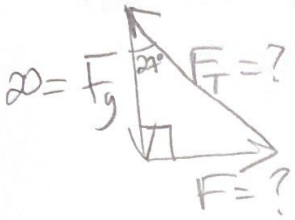


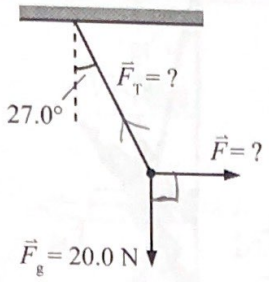


$\cos 65 = \frac{5000}{F_g}$

$F_g = \frac{5000}{\cos 65} = 1.18 \times 10^4\text{ N}$ ✓

3. A 20.0 N child sitting on a playground swing is being pushed by her father. When the swing rope makes an angle of 27.0° to the vertical, what is the force exerted by her father? What is the magnitude of tension in the rope, F_T?





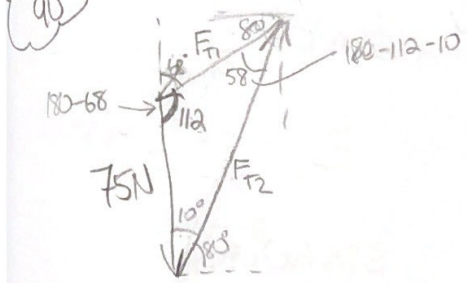
$\tan 27° = \frac{F}{20}$

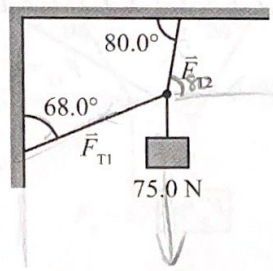
$F = 10.2\,N$ ✓

$\cos 27° = \frac{20}{F_T}$

$F_T = 22.4\,N$ ✓

4. Two ropes are attached to a 75.0 N object as illustrated ~~above~~. Find the magnitude of the tension (F_{T1} and F_{T2}) in the ropes.





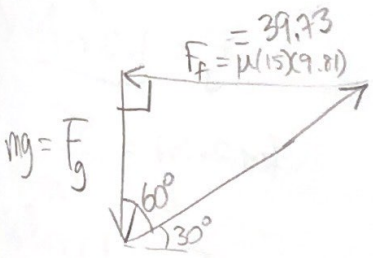
$\frac{F_{T1}}{\sin 10°} = \frac{75}{\sin 58°}$

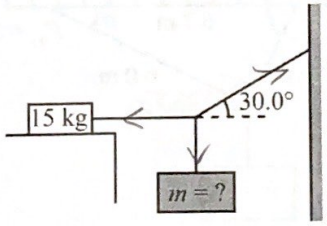
$F_{T1} = 15.4\,N$ ✓

$\frac{F_{T2}}{\sin 112°} = \frac{75}{\sin 58°}$

$F_{T2} = 82.0\,N$ ✓

5. A 15 kg object rests on a table. A cord is attached to this object and also to a wall. Another object is hung from this cord as shown above. If the coefficient of friction between the 15 kg object and the table is 0.27, what is the maximum mass that can be hung?

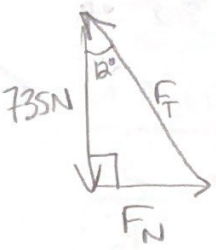




$\tan 60° = \frac{39.73}{m(9.81)}$

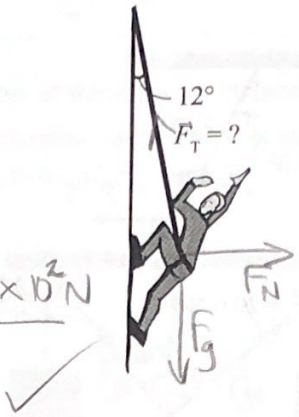
$m = 2.3\,kg$ ✓

6. A 735 N mountain climber is rappelling down the face of a vertical cliff. If the rope makes an angle of 12° with the vertical face, what is the magnitude of tension in the rope?

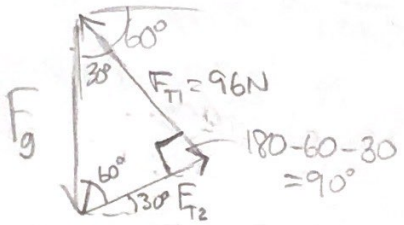


$\cos 12 = \frac{735}{F_T}$

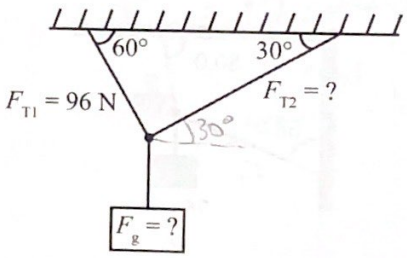
$F_T = 7.5 \times 10^2 N$ ✓



7. In the static arrangement shown above, find F_g and F_{T2}.



180-60-30 = 90°



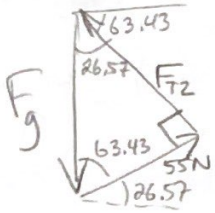
$\tan 30 = \frac{F_{T2}}{96N}$

$F_{T2} = 55 N$ ✓

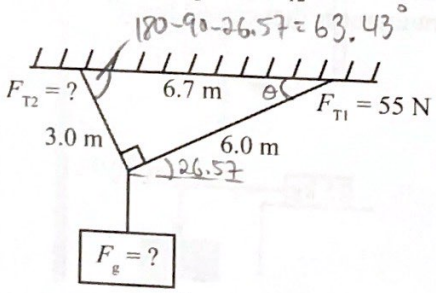
$\sin 60° = \frac{96}{F_g}$

$F_g = 1.1 \times 10^2 N$ ✓

8. In the static arrangement shown above, find F_g and F_{T2}.



180-90-26.57 = 63.43°



use side lengths to find angles.

$\tan \theta = \frac{3m}{6m}$

$\theta = 26.57°$

$\sin 26.57 = \frac{55}{F_g}$

$F_g = 1.2 \times 10^2 N$

$\tan 26.57 = \frac{55}{F_{T2}}$

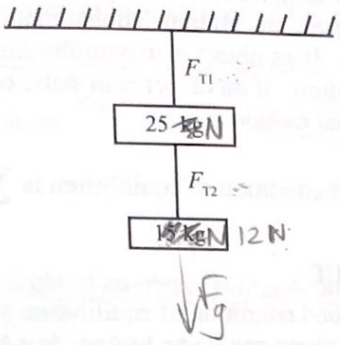
$F_{T2} = 1.1 \times 10^2 N$ ✓

9. A 25 N block is suspended by a cord to a tree branch. In turn, a 12 N block is suspended from the first block as shown in the diagram. What are the values of F_{T1} and F_{T2}?

errors in diagram

only the 15 N hangs from F_{T2} so

$F_{T2} = 12N$ ✓

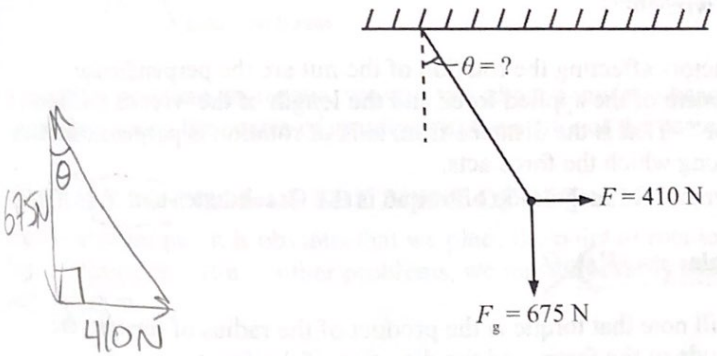


both masses hang from F_{T1} so

$F_{T1} = 25N + 12N$

$= 37N$ ✓

10. A 675 N object is pulled horizontally by a force of 410 N as shown in the diagram above. What is the angle θ between the rope and the vertical?



so easy compared to using components!

$\tan\theta = \frac{410}{675}$

$\theta = 31.3°$ ✓