1. A painting hangs from a single wire that is hanging from a nail on the wall. The wire holding the picture up makes an angle of 90.0° at the nail (not usually the case – it is usually higher). If the painting has a mass of 12.6 kg, what is the tension in the wire? What could be done to reduce the tension in the wire? [87.3 N, decrease the angle between the wires]

$\Sigma F_x = 0$

$T\cos 45 + -T\cos 45 = 0$

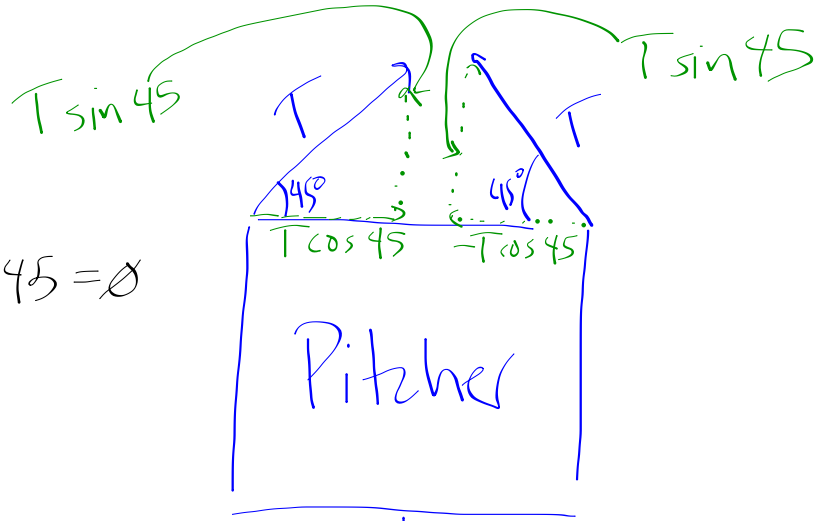
$0 = 0$

$\Sigma F_y = 0$

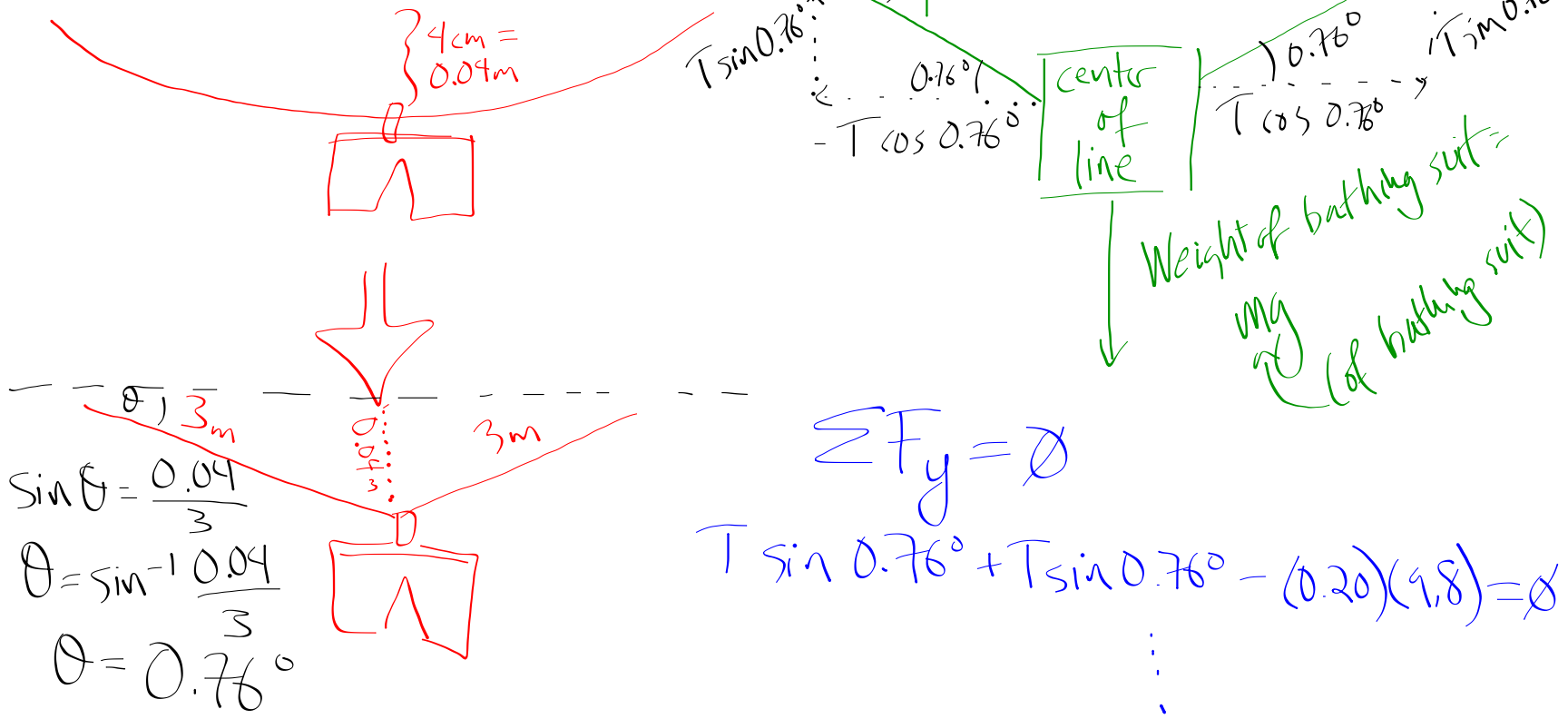
$T\sin 45 + T\sin 45 - mg = 0$

$2T\sin 45 = mg$

$T = \frac{mg}{2\sin 45} = \frac{(12.6)(9.8)}{2\sin 45} = \boxed{87.3\,N}$



2. A 0.20 kg bathing suit is hung by a clothespin in the center of a 6.0 m long clothesline that causes the line to sag 4.0 cm. What is the tension in the clothesline? (Hint: Draw a free body diagram of the point of the clothesline from which the bathing suit is hung from. Also, use the dimensions of the problem to find the angle for the tension forces.) [74 N]



$\sin\theta = \frac{0.04}{3}$

$\theta = \sin^{-1}\frac{0.04}{3}$

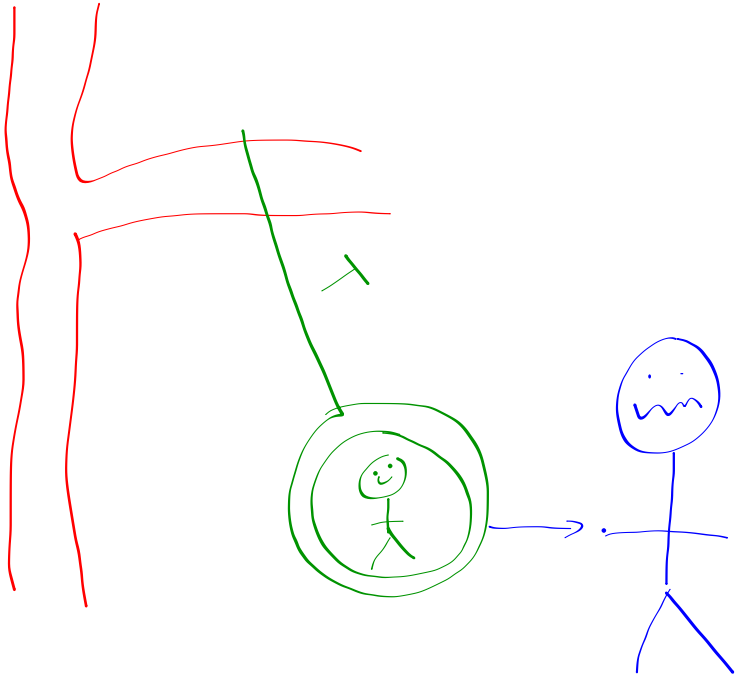
$\theta = 0.76°$

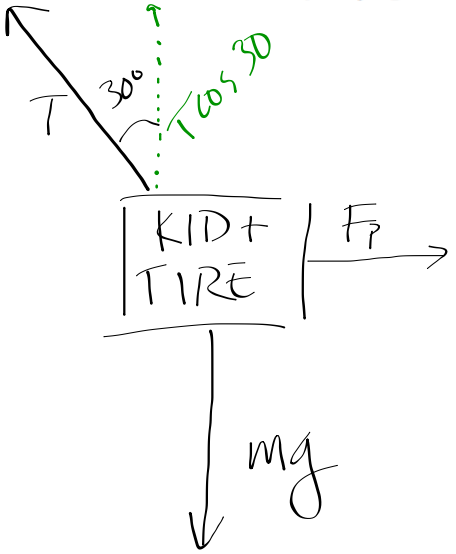
$\Sigma F_y = 0$

$T \sin 0.76° + T \sin 0.76° - (0.20)(9.8) = 0$

⋮

3. A child likes to hang on a tire tied to a tree branch. If the child and tire have a combined mass of 82.5 kg and are pulled back far enough to make an angle of 30.0° with the vertical, what is the tension in the rope needed to support her vertically? (Assume that whoever is holding the child and tire there is creating a force that will balance the horizontal component of the tension in the rope.) [934 N]





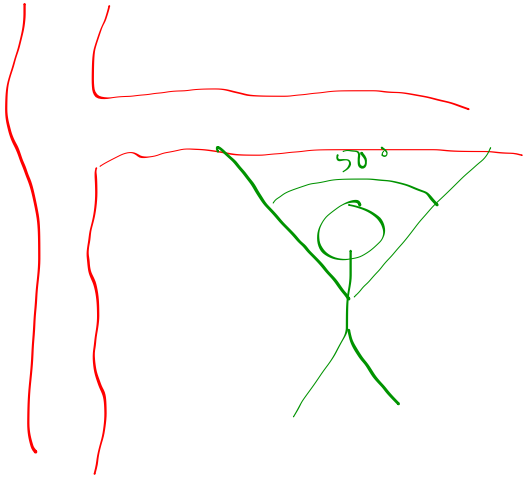
$\Sigma F_y = 0$

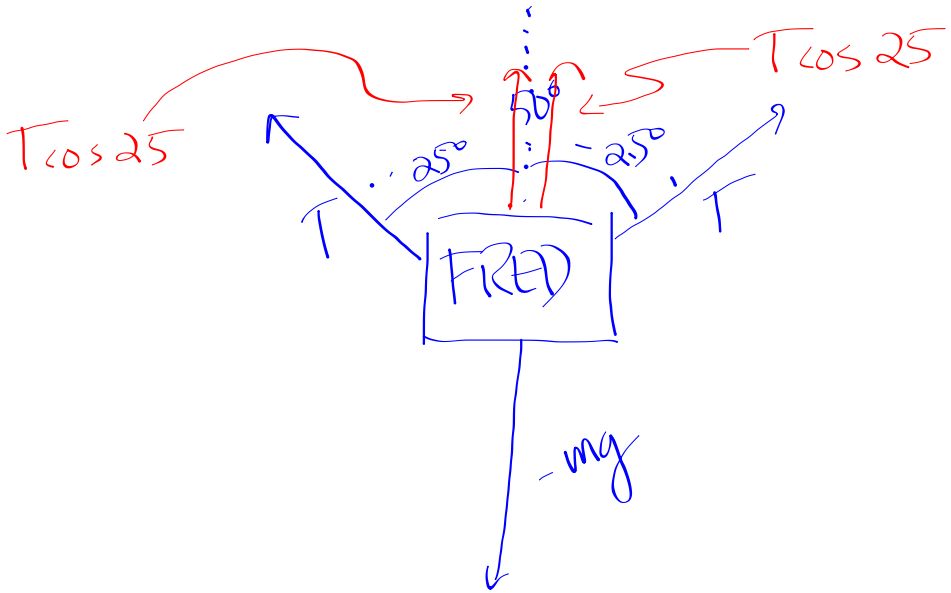
$T\cos 30 - mg = 0$

$T = \frac{mg}{\cos 30} = \frac{(82.5)(9.8)}{\cos 30}$

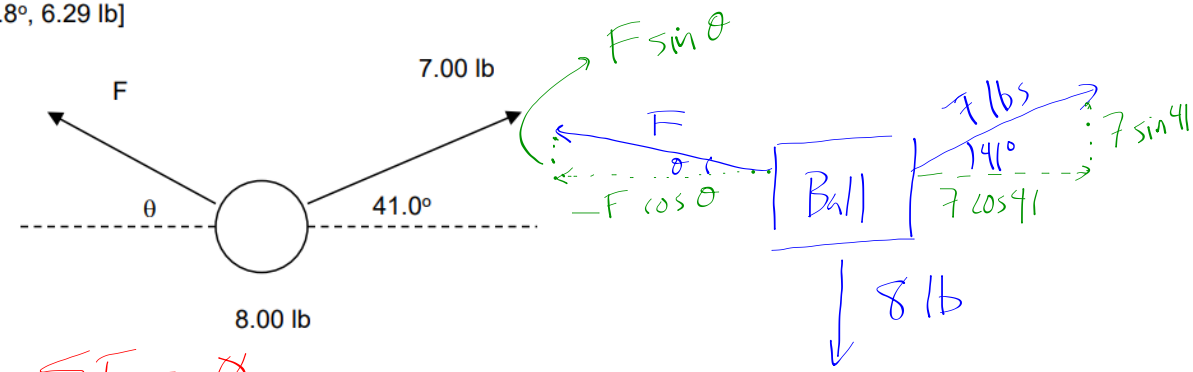
$T = 933.58\ N$

5. Fred hangs from a tree branch with both arms. If his mass is 72.0 kg and his arms make an angle of 50.0° (i.e., the angle between his arms is 50.0°), what tension does each arm experience in supporting his body? [389 N]





7. Find the indicated angle θ and the magnitude of the missing force F. The ball has a weight of 8.00 lb. [32.8°, 6.29 lb]



$\Sigma F_x = 0$

$-F\cos\theta + 7\cos 41 = 0$

$F = \dfrac{7\cos 41}{\cos\theta}$

$\Sigma F_y = 0$

$F\sin\theta + 7\sin 41 - 8 = 0$

$F = \dfrac{8 - 7\sin 41}{\sin\theta}$

$\dfrac{7\cos 41}{\cos\theta} = \dfrac{8 - 7\sin 41}{\sin\theta}$

$\dfrac{\sin\theta}{\cos\theta} = \dfrac{8 - 7\sin 41}{7\cos 41}$

$\tan\theta = \dfrac{8 - 7\sin 41}{7\cos 41}$

$\theta = \tan^{-1}\left(\dfrac{3.4}{5.28}\right)$

$\theta = 32.8°$

$F = \dfrac{7\cos 41}{\cos 32.8}$

$F = 6.29\ N$