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Class Problem 1

1) A 2 Mg car is being towed by a winch. If the winch exerts a force of T = 100s N on the cable where s is the displacement of the car in meters, determine the speed of the car when s = 10m and it starts from rest. Neglect friction. [v = 2.24 m/s]

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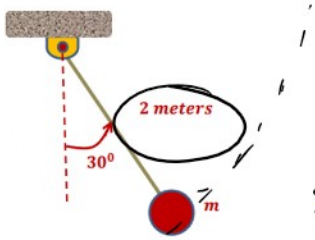
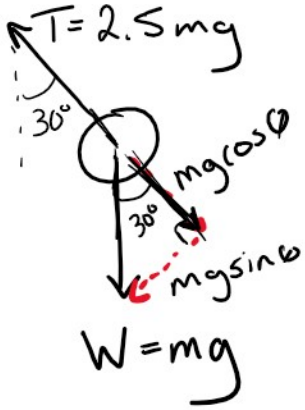
Example 1

A pendulum with mass m is swinging in the vertical plane, a load cell monitors the tension T of the rope. If the tension T = 2.5mg at 30 ° from vertical, determine the acceleration of the mass m and the velocity of mass m at 30°.





=

$+\nearrow \sum F_N = m a_N$

$2.5mg - mg\cos\theta = m a_N$

$2.5(9.81) - (9.81)\cos(30) = a_N$

$a_N = 16.02\ m/s^2$

$+\nearrow \sum F_T = m a_T$

$-mg\sin\theta = m a_T$

$a_T = -(9.81)(\sin 30)$

$= -4.905\ m/s^2$

$a_{TOTAL} = \sqrt{16.02^2 + (-4.905)^2} = 16.76\ m/s^2$

$a_N = \frac{v^2}{r}$

$16.02 = \frac{v^2}{2}$

$v = 5.66\ m/s$

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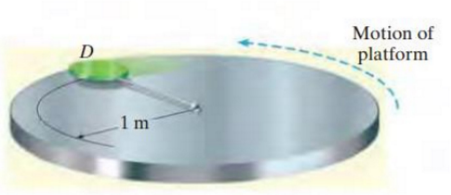
Example 2:



The 3 kg disk D is attached to the end of a cord. The other end of the cord is attached to a ball and socket joint located at the center of the platform. If the platform rotates rapidly, and the disk is placed on it and released from rest as shown , determine the time it takes for the disk to reach a speed great enough to break the cord. The maximum tension that the cord can sustain is 100N, and the coefficient of kinetic friction between the disk and the platform is $\mu_k = 0.1$

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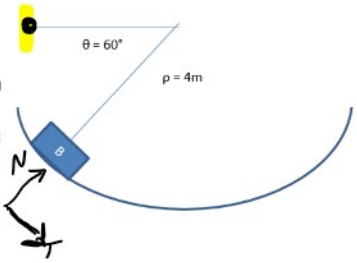
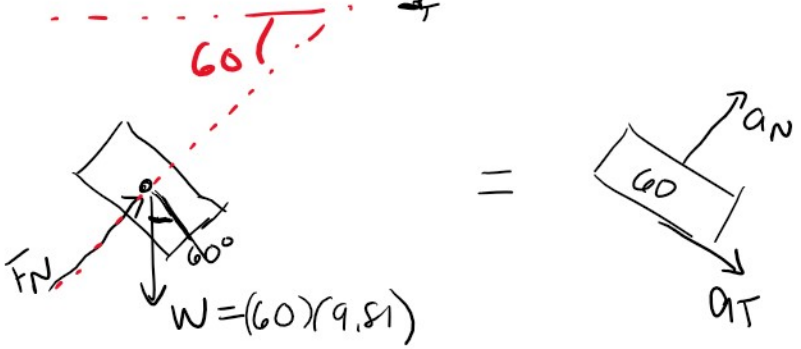
Example 3

A 60 kg snowboarder starts from rest when θ = 0° and coasts down a halfpipe (assume $u_k = 0$). If the magnitude of the total acceleration is 17.69m/s² when θ = 60°, determine the magnitude of the normal reaction force the track exerts on the snowboarder when he is at that location. Determine the angle α makes with the horizontal.





$\Sigma F_N = ma_N$

$F_N - W\sin 60 = 60\,a_N$

$F_N - (60)(9.81)\sin 60 = 60(16.99)$

$F_N = 1529.5$ KN

$\Sigma F_T = ma_T$

$(60)(9.81)\cos 60 = 60\,a_T$

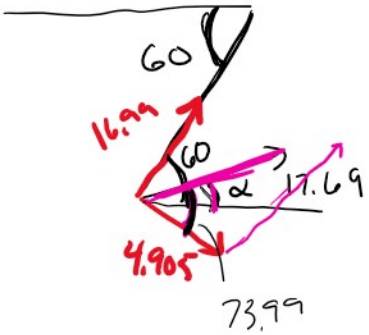
$a_T = 4.905\ m/s^2$

$a_{TOTAL} = \sqrt{a_N^2 + a_T^2}$

$a_{TOTAL}^2 = a_N^2 + a_T^2$

$17.69^2 = a_N^2 + 4.905^2$

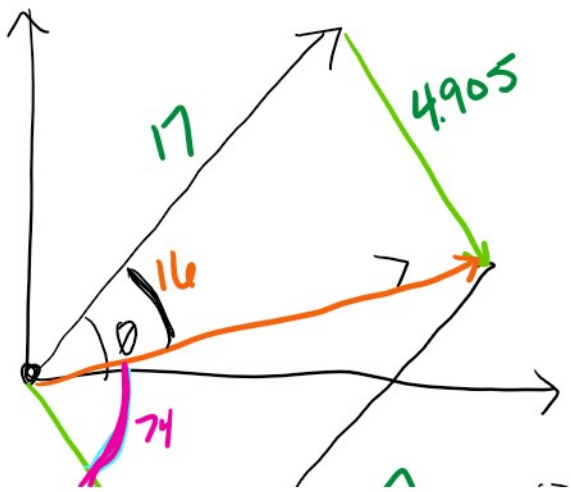
$a_N = 16.99\ m/s^2$

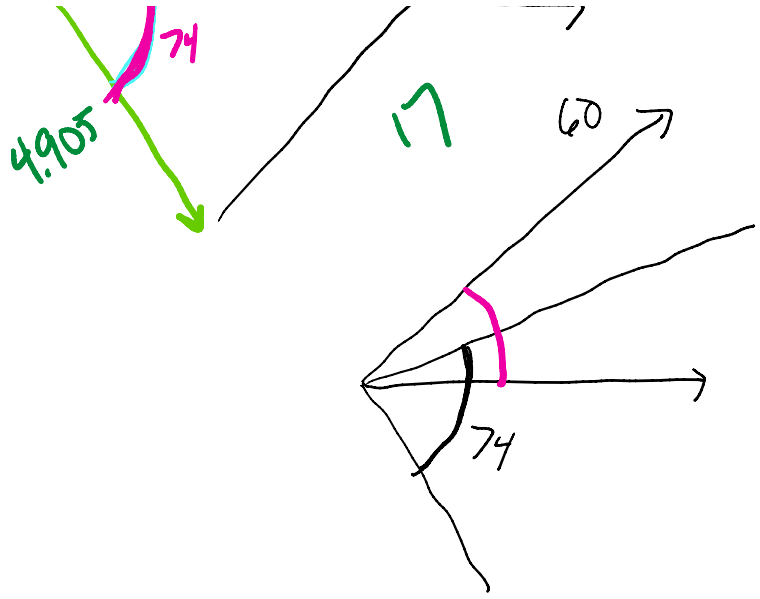


$\theta = \tan^{-1}\left(\frac{16.99}{4.905}\right)$

$= 73.90$

$\alpha = 14°$




74
49.05
17
60
74

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