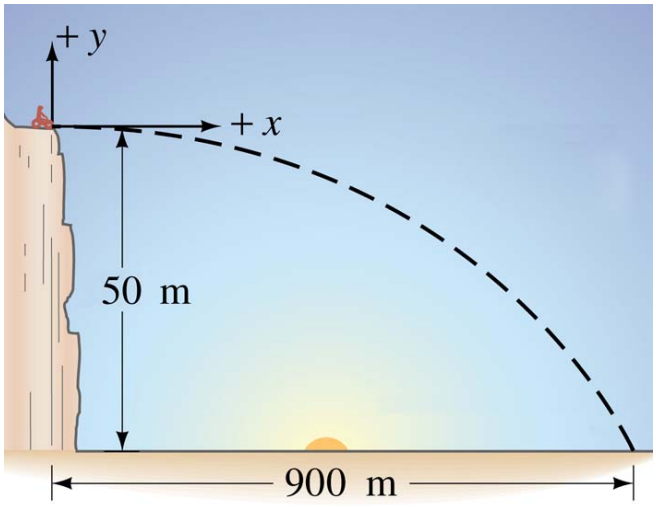
Phyx 135-1, Spring 2016, Quiz 1 **Name** _____

1) (10 points) A daredevil motorcycle rider drives his machine exactly horizontally off a cliff that is 50 m high. If he hits the ground 900 m from the cliff, how fast was he moving when he left the cliff?

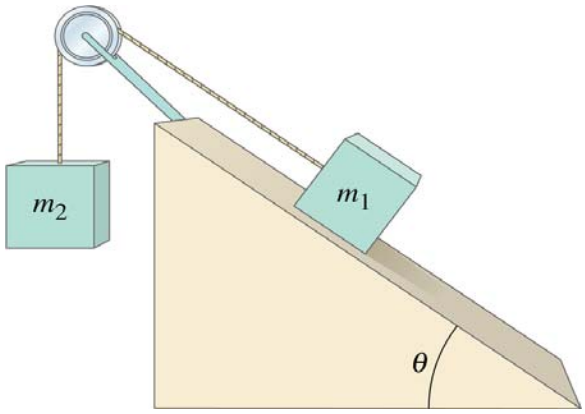


Solution

Using $d = \frac{1}{2} at^2$, we see that it will take the rider $50 = \frac{1}{2}(9.8)t^2$ seconds to fall to the ground. This is $t = (100/9.8)^{1/2} = 3.194$ s.

Since his motion in the x-direction is constant, his speed is simply given by $d = vt$, or $v = d/t = 900 / 3.194 = 282$ m/s = 631 mph!

2) In the arrangement shown at right, $m_1 = 1$ kg, $m_2 = 2$ kg, and $\theta = 40°$.



a) (5 points) At what acceleration is m_2 falling?
b) (5 points) What is the tension in the cord?

Solution

If we draw a free-body box around m_2, then we see that $m_2g - T = m_2a$. Likewise, if we draw a free-body box around m_1 (and use a bit of trig), then we see that $-m_1g \sin\theta + T = m_1a$.

If we add the two equations, we quickly get: $m_2g - m_1g \sin\theta = (m_1 + m_2)a$, or $a = [19.6 - 9.8 \sin(40°)] / (1 + 2) = 4.43$ m/s^2.

We can use either equation to find T. If we use the first one, then we have: $19.6 - T = (2)(4.43)$, or $T = 10.74$ N.