(c) Constant $v_o \Rightarrow v = 0$.

Along slope: $f + F_g \sin \theta = 0$

$$f = \mu N$$
$$= \mu mg \cos \theta$$

So,

$$-\mu mg \cos \theta + mg \sin \theta = 0$$

$$\mu = \tan \theta$$

$$\mu = 0.12$$

(b) Net force on penguin.

$$m \frac{\Delta v}{\Delta t} = -\mu mg$$

Friction force opposite to motion.

$$\Delta t = \left( \frac{m g / \mu}{v_o} \right)^{-1}$$

$$\Delta t = 1.2 \text{ sec}$$
(a) \[ T - mg = ma \]
\[ T = ma + mg = m(a + g) \]
\[ T = 829.5 \text{ N} \]

(b) Work = \[ W = \frac{F \cdot \Delta s}{\mu} = +829.5 \times 11 \text{ Joules} \]
\[ W_T = 9,129.5 \text{ J} \]

(c) \[ W_6 = \frac{Fg \cdot \Delta s}{\mu} = mg \Delta s \]
\[ W_6 = -81516.2 \text{ J} \]
Helicopter

\[ W_{net} = \Delta k c = \frac{1}{2} m v^2 - \frac{1}{2} m v_f^2 \]

\[ \omega_T + \omega_G = \frac{1}{2} m v_f^2 \]

\[ v_f = \left[ \frac{924.5 - 8516.2}{6} \right]^{1/2} \]

\[ = \left[ \frac{2}{79} \right] \left( 9.1249.5 - 8.516.2 \right]^{1/2} \]

\[ v_f = 3.92 \text{ m/s} \]
\[ l = v_0 \cos\theta \cdot t \]  
\[ -h = v_0 \sin\theta \cdot t - \frac{1}{2} g \cdot t^2 \]  

Equation (1) \[ \Rightarrow t = \frac{l}{v_0 \cos\theta} \]  

Equation (1) + (2) \[ \Rightarrow -h = v_0 \sin\theta \cdot \frac{l}{v_0 \cos\theta} - \frac{1}{2} g \cdot \frac{l^2}{v_0^2 \cos^2\theta} \]  
\[ -h = l \tan\theta - \frac{g}{2} \cdot \frac{l^2}{v_0^2 \cos^2\theta} \]  
\[ \frac{g l^2}{2 v_0^2 \cos^2\theta} = l \tan\theta + h \]  
\[ v_0^2 = \frac{g l^2}{2 \cos^2\theta} \left[ l \tan\theta + h \right]^{-1} \]  
\[ v_0 = \left[ \frac{g l^2}{2 \cos^2\theta (l \tan\theta + h)} \right]^{1/2} \]  
\[ v_0 = 5.8 \text{ m/s} \]
BOLO!

\[ T_b - mg = \frac{\mu v^2}{R} \]  
\[ T_t + mg = \frac{\mu v^2}{R} \]  
\[ T_b = \frac{1}{2} T_t \]  

(1)  
(2)  
(3)

\[ (1) + (3): \quad 1.5 T_t - mg = \frac{\mu v^2}{R} \]

\[ (2): \quad T_t + mg = \frac{\mu v^2}{R} \]

\[ 2.5 T_t = 2 \frac{\mu v^2}{R} \]

\[ T_t = \frac{4}{5} \frac{\mu v^2}{R} \]

\[ \frac{4}{5} \frac{\mu v^2}{R} + mg = \frac{\mu v^2}{R} \]

\[ mg = \frac{1}{5} \frac{\mu v^2}{R} \]

\[ v^2 = 5gR \]

\[ v = \sqrt{5gR} \]