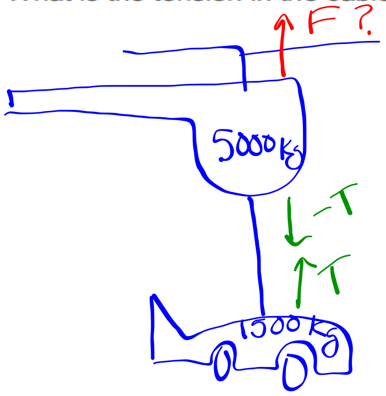
6. (p. 68 #36) A 5000-kg helicopter accelerates upward at 0.550 m/s^2 while lifting a 1500-kg car.
   a) What is the lift force exerted by the air on the blades of the helicopter?
   b) What is the tension in the cable (ignore its mass) that connects car to helicopter?



acceleration $= 0.550\ m/s^2$

(a)

F

5000kg

$-T$ $-15525\,N$

$mg = 5000 \cdot 9.8 = -49000\,N$

$\Sigma F_y = ma_y$

$F + -15525 + -49000 = (5000)(.55)$

$\boxed{F = 67{,}275\,N}$

upward force on helicopter

(b)

T

1500kg

$mg = 1500 \cdot 9.8 = -14{,}700\,N$

$\Sigma F_y = ma_y$

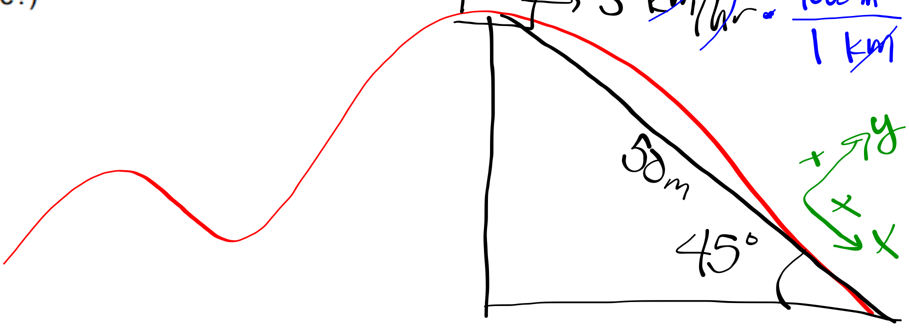
$T + -14{,}700 = (1500)(.55)$

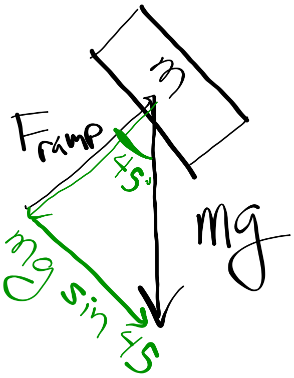
$\boxed{T = 15{,}525\,N}$

tension in cable

4. (p. 67 #28) A roller coaster reaches the top of the steepest hill with a speed of 5.0 km/h. It then descends the hill which is at an average angle of 45° and is 50-m long. What will its speed be when it reaches the bottom? Neglect friction. (Hint: what did you just learn about the component of gravity's acceleration down an incline?)

$5\ \cancel{km}/\cancel{hr} \cdot \frac{1000\ m}{1\ \cancel{km}} \cdot \frac{1\ \cancel{hr}}{3600\ s} = 1.39\ \frac{m}{s}$





$\Sigma F_x = m a_x$

$\frac{\cancel{m} g \sin 45}{\cancel{m}} = \frac{\cancel{m} a_x}{\cancel{m}}$

$a = g \sin 45 = 9.8 \sin 45$

$= 6.93\ m/s^2$

$x_0 = 0$
$x = 50$
$v_0 = 1.39\ m/s$
$v =$
$a = 6.93\ m/s^2$
$t =$

$v^2 = v_0^2 + 2a(x - x_0)$

$= (1.39)^2 + 2(6.93)(50)$

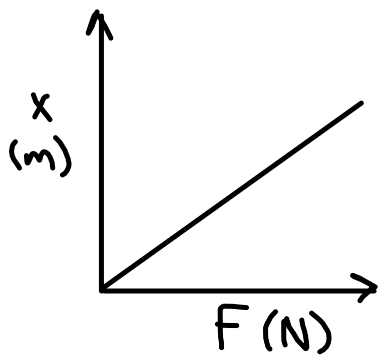
$\boxed{v = 26.4\ m/s}$

Forces from Springs

All objects deflect (stretch or compress) when forces are applied to them.

When the deflection is directly proportional to the size of the applied force, the object is said to behave like an ideal spring.

Almost everything behaves like a spring to some extent. Therefore, springs are worth talking about.



An ideal spring behaves in a linear fashion. The greater the applied force, the greater the deflection.

$$\boxed{\mathbf{F_{spring} = kx}}$$

x = the deflection (in m, or ft) of spring from its non-deflected length

k = spring constant (N/m, N/cm, lb/in, etc...) This is unique for each spring

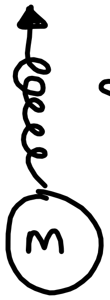
EXAMPLE 1:

$F_s = kx$

$= (8400)(0.05)$

$F_s = 420\ N$

$5\ cm$ = $0.05\ m$



$8400\ N/m = k$

$a = 2.9\ m/s^2$

WHAT IS m?

$\Sigma F_y = ma_y$

$420 + -mg = m(2.9)$

$420 + -m(9.8) = m(2.9)$

$9.8m + 2.9m = 420$

$m(9.8 + 2.9) = 420$

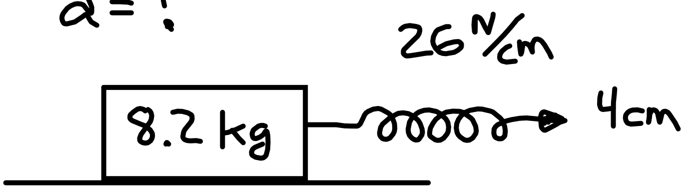
$m = 33.07\ kg$

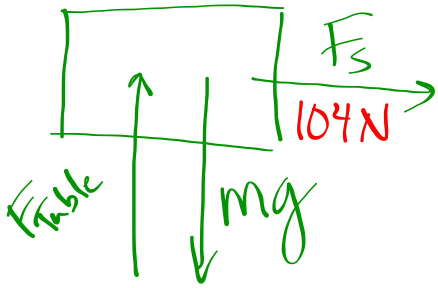
Example 2

$a = ?$

$F_s = kx$

$= 26 \cdot 4 = 104\,N$



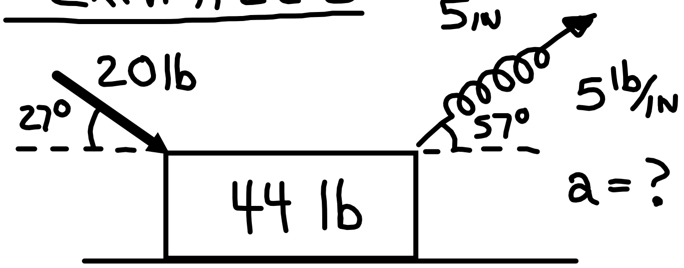


$\Sigma F_x = ma_x$

$104 = (8.2)\,a$

$a = 12.68\ m/s^2$

EXAMPLE 3:



EXAMPLE 4: