Convert 36 inches to feet. Show your work so that a classmate can follow what you did and why you did it. Remember 12inches = 1 foot

$$\frac{36\,in}{1} \times \frac{1\,ft}{12\,in} = 3\,ft$$

NASA had originally planned on firing the rocket engines to put Mars Orbiter in orbit about 160 Km from the surface. How many miles would this have been? 0.6 miles = 1 km

$$\frac{160\ \text{Km}}{1} \times \frac{0.6\ \text{miles}}{1\ \text{Km}} = 96\ \text{miles}$$

Convert Your age in years to seconds.

$$\frac{\text{years}}{1} \times \frac{365\text{ days}}{1\text{ year}} \times \frac{24\text{ hrs}}{1\text{ day}} \times \frac{60\text{ min}}{1\text{ hr}} \times \frac{60\text{ sec}}{1\text{ min}}$$

Convert 5280 Ft. to cm.

12in =1 ft   2.54 cm = 1in

$$\frac{5280\ ft}{1} \times \frac{12\ in}{1\ ft} \times \frac{2.54\ cm}{1\ in} = 160{,}934.4\ cm$$

Know the difference between Qualitative and Quantitative

Qualitative deals w/ Qualities Quanatitive deals w/ Quanatics

Blue ~~t~~ vs. 5

Convert 1,260,000 to Scientific Notation.

6 5 4 3 2 1

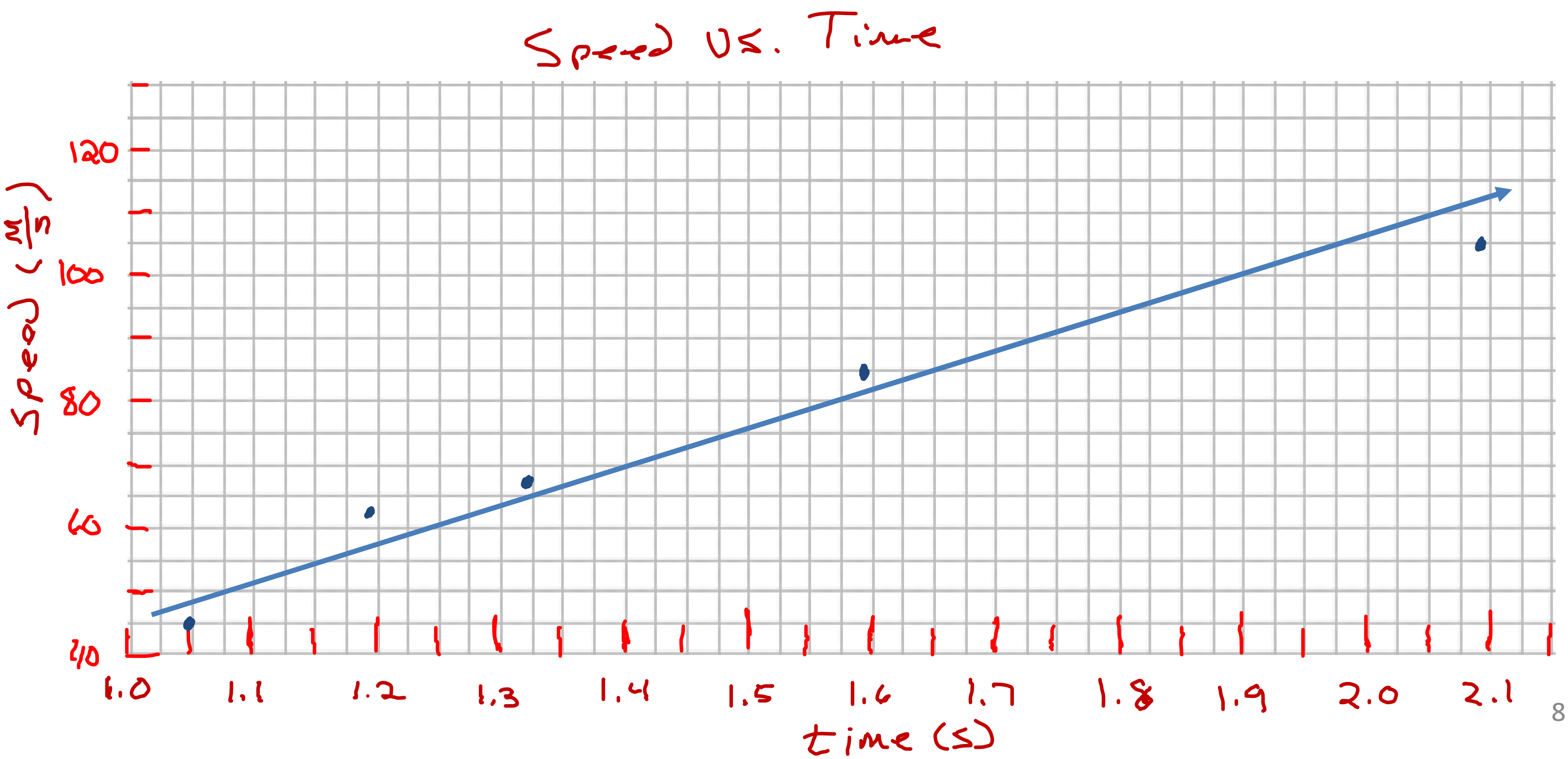
1.26×10^6

Looking at the following, how many significant figures are in each?

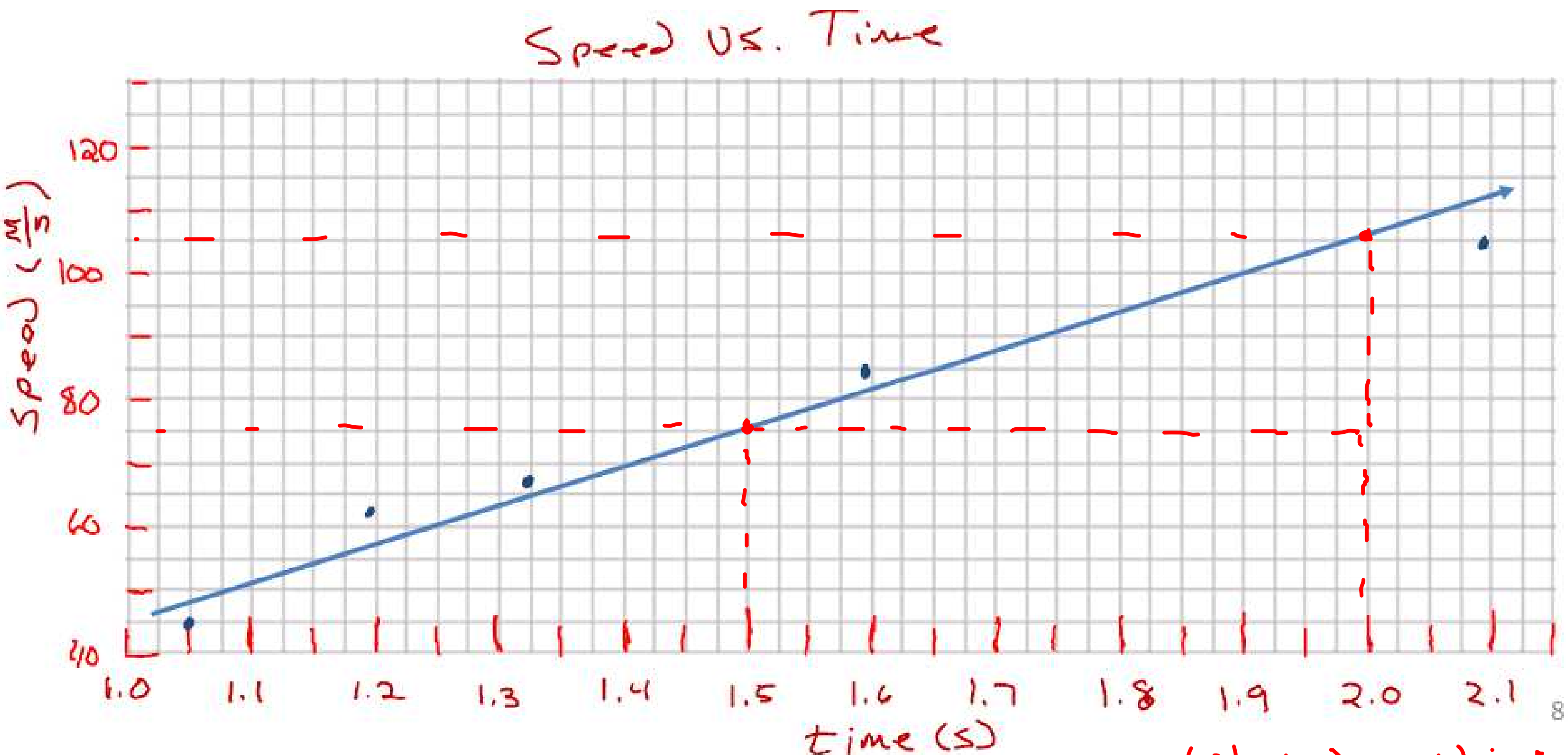
- **1.0070 m** 5
  17.10 kg 4
- **100,890 L** 5
- **3.29 x 10^3 s** 3
- **0.0054 cm** 2
- **3,200,000 mL** 2

Create a Speed verses Time Graph from the data.

Speed	Time
45 m/s	1.10 s
62 m/s	1.19 s
66 m/s	1.32 s
84 m/s	1.58 s
104 m/s	2.09 s



Using the graph above, determine the slope of the Speed vs. Time Graph.



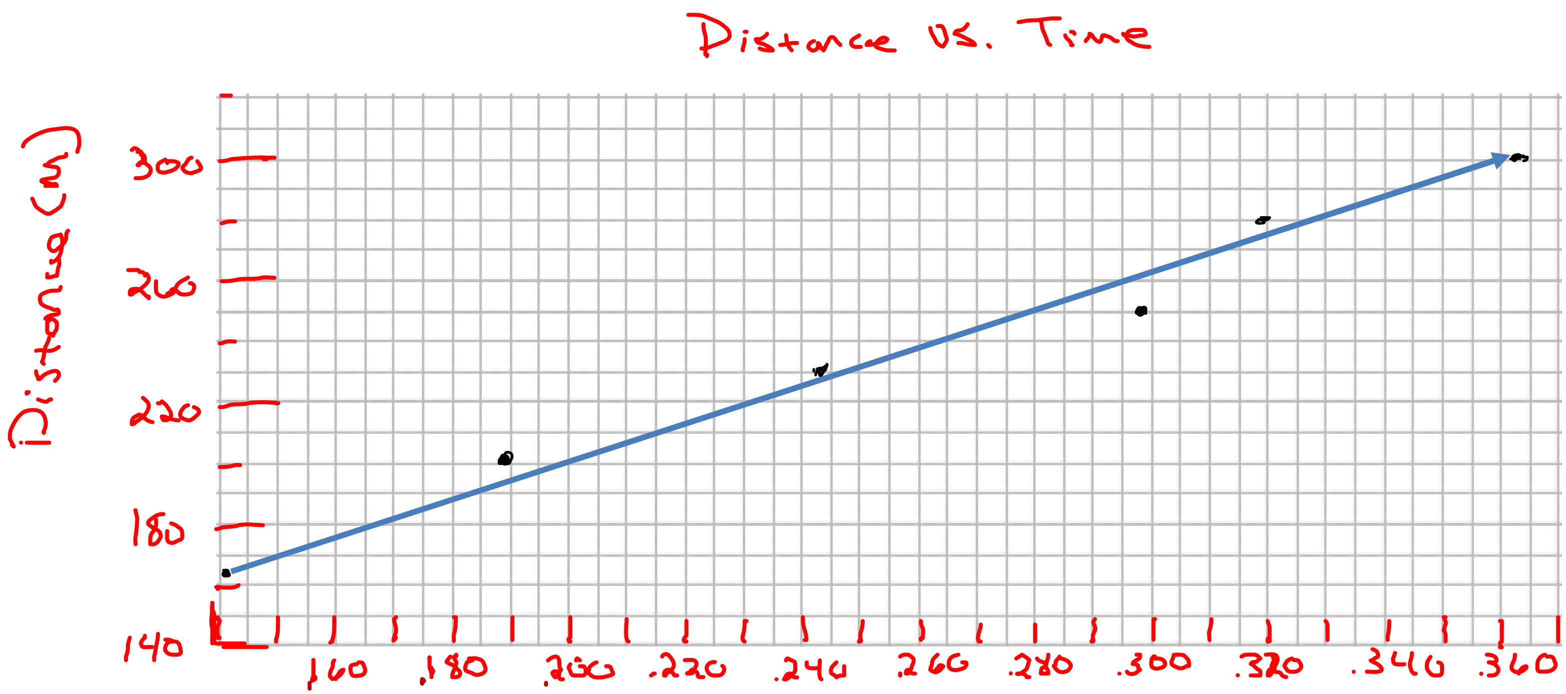
What does this represent?

$$\frac{\text{rise}}{\text{run}} \qquad \frac{105 - 75}{2.0 - 1.5} = \frac{30\ m/s}{0.5\ s} = 60\ \frac{m}{s^2}$$

Acceleration!

Create a Distance verses Time Graph

Distance (m)	Time (s)
162.3	0.1431
200.0	0.1973
230.4	0.2446
256.4	0.2904
280.9	0.3248
303.0	0.3617



A caterpillar crawling up a leaf slows from 0.75 cm/s to 0.50 cm/s at a rate of -0.05 cm/s^2 How long does it take the caterpillar to make the change?

$V_i = 0.75 \frac{cm}{s}$

$V_f = 0.50 \frac{cm}{s}$

$a = -0.05 \frac{cm}{s^2}$

$\Delta t = ?$

$V_f = V_i + at$

$\downarrow$

$V_f - V_i = at$

$\downarrow$

$\frac{V_f - V_i}{a} = t$

$\frac{0.50 - 0.75}{-0.05} = \boxed{5 s}$

A rock is dropped from a castle lookout, assuming no air resistance, how fast did it hit the king who was looking out a window 10 meters below? (Hint: $a_g = 10 m/s^2$.)

$V_i = 0$

$V_f = ?$

$\Delta y = 10\,m$

$a_g = 10\,m/s^2$

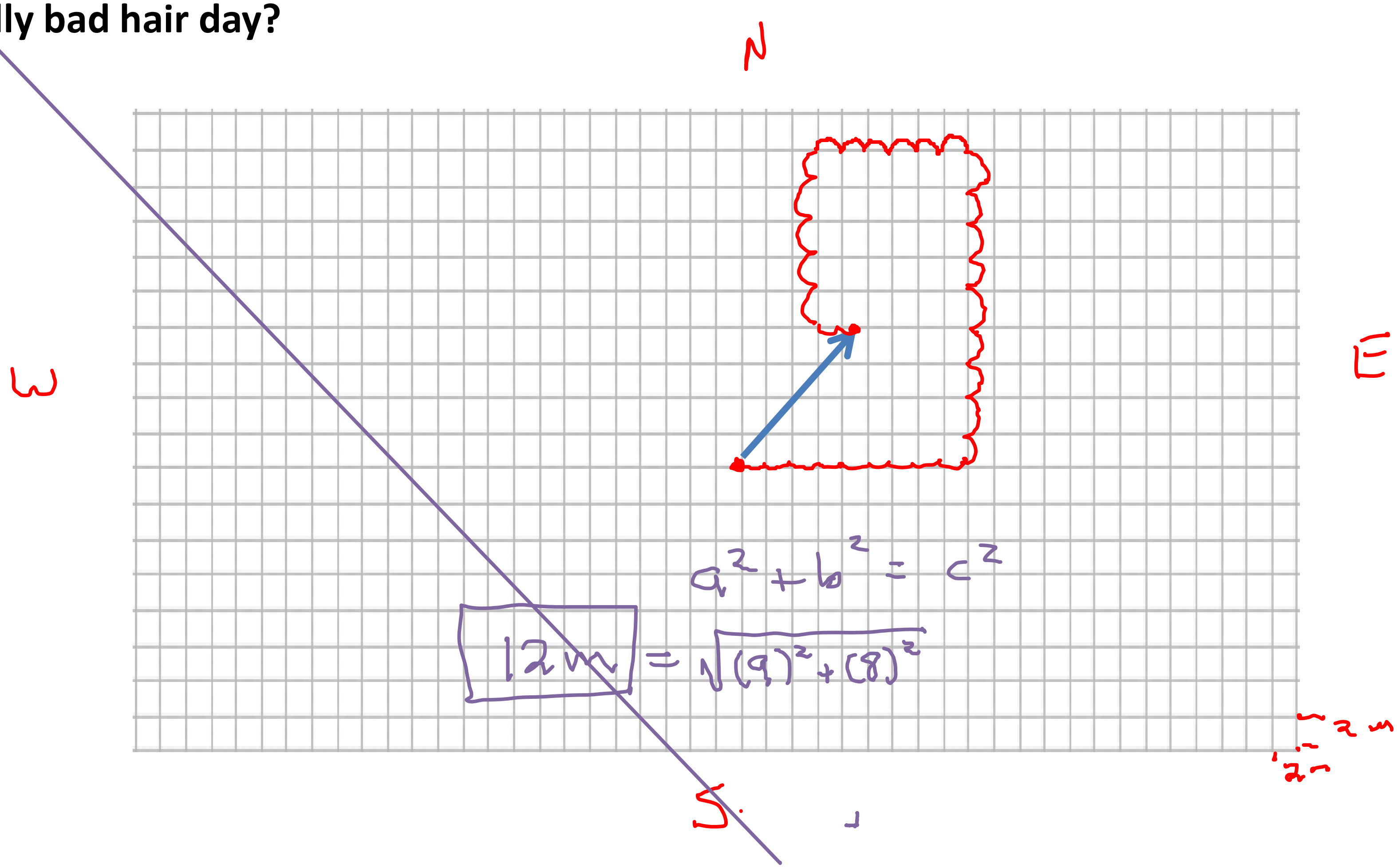
$V_f^2 = V_i^2 + 2a\Delta y$

$\downarrow$

$V_f = \sqrt{\cancel{V_i^2}^{\,0} + 2a\Delta y}$

$\boxed{V_f = 14\,m/s}$

I am TERRIFIED of the lines (my mother has a very fragile back). Out of devotion for my Madre, I have learned to walk only East, West, North, and South. So, during my recent vacation to saunter in the park, I walk my usual path. I start next to a people polluting pigeon I move 15 m east, 18 m north, 12 m west, 10 m south and (just to confuse anyone that might be following me that day) another 3 m east. This day, however, the bird flies from where he was to a tree branch directly above my head and pollutes me! Using your graph paper below determine how far (and in what direction) did the pigeon have to fly to reach its polluting perch and give me a really bad hair day?



Determine the following (Use correct Sig Figs):

$(8.00 \times 10^{8}) \div (4.00 \times 10^{2}) =$ 2.00×10^{6}

$(2.00 \times 10^{3}) \times (2.50 \times 10^{5}) =$ 5.00×10^{8}

$(5.56 \times 10^{4}) + (2.50 \times 10^{6}) =$ 2.26×10^{6}

$(7.00 \times 10^{8}) - (2.50 \times 10^{5}) =$ 7.00×10^{8}

The speedometer of a car moving northward reads 60 km/h. It passes another car that travels southward at 60 km/h. Do both cars have the same speed? Do they have the same velocity? Explain your answer!

Same speed different velocity (has direction)

Joe tries to make a basket; how long is he in the air if he leaps with a velocity of 1.5 m/s up?

$V_i = 1.5 \, m/s$

$a_y = -10 \, m/s^2$

$V_f = 0$

$t = ?$

$V_f = V_i + at$

solve for t

$V_f - V_i = at$

$$\frac{V_f - V_i}{a} = t \quad = t_{tot} = 2t$$

$$\boxed{t_{tot} = 0.31s}$$

If Joe had been moving forward with a velocity of 3 m/s, how far forward would he have traveled during the time he was in the air?

$V_x = 3 \, m/s$

$t = 0.31 \, s$

$V = \frac{d}{t}$ $\quad d = V \times t$ $\quad 3 \, m/s \times 0.31 \, s = 0.917 \, m$

or $\boxed{1 \, m}$

A marble rolling at a speed of 2 m/s drops off of a table on to a platform that is 0.315m below. How far does it travel horizontally before hitting the platform?

$V_{Ix} = 2\ m/s$

$\Delta x = ?$

$V_{iy} = 0\ m/s$

$t = ?$

$a_y = -10\ m/s^2$

$\Delta y = 0.315m$

$\Delta y = (\cancel{V_i t})^{0} + (\frac{1}{2}at^2)$

$\Delta y = \frac{1}{2}at^2$

solve for t

$t = \sqrt{\frac{\Delta y}{\frac{1}{2}a}} = 0.25\ s$

solve for Δx $\quad v = \frac{d}{t} \quad d = v \times t$

$\Delta x = v \times t \Rightarrow 2\ m/s \times 0.25\ s$

$\boxed{= 0.5\ m}$

A marble rolling at a speed of 2 m/s drops off of a table on to a platform that is 0.315m below At what angle does it hit the platform?

$V_{ix} = 2\,m/s$

$V_{iy} = ?$

$V_{fy} = ?$

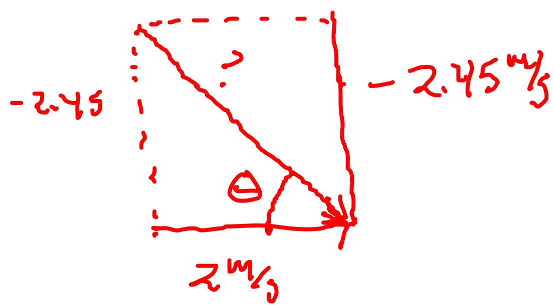
$\Delta t = 0.25\,s$

$V_{fy} = V_{iy} + at$

$a_g = -10\,m/s^2$

$V_{fy} = \cancel{V_{iy}}^{\,0} + at$

$V_{fy} = -2.45\,m/s^2$



$\sin\theta = \frac{O}{H}$ $\quad \sin^{-1}\frac{O}{H} = \theta$

$\cos\theta = \frac{A}{H}$ $\quad \cos^{-1}\frac{A}{H} = \theta$

$\tan\theta = \frac{O}{A}$ $\quad \tan^{-1}\frac{O}{H} = \theta$

so $\tan^{-1}\frac{-2.45}{2\,m/s} = 51^\circ$

Above Horizon

A drives off of a cliff and hits the ground traveling in the x direction at a rate of 2.4 m/s. If the car was in the air 0.91 seconds, at what velocity and direction does it hit the ground?

$V_{fx} = 2.4 \, m/s$

$V_{xy} = ?$

$\theta = ?$

$V_{fy} = ?$

$V_{iy} = 0 \, m/s$

$\Delta t = 0.91 \, s$

$V_f = V_i + at$

$a_g = -10 \, m/s^2$

$V_{fy} = \cancel{V_i}^{0} + at$

$V_{fy} = at$

$V_{fy} = 9.1 \, m/s$

$a^2 + b^2 = c^2$

$\sqrt{(9.1)^2 + (2.4)^2} = V_{xy} = 9.4 \, m/s$

$\theta = \cos^{-1}\left(\frac{2.4}{9.4}\right)$

$\boxed{= 75^\circ}$

A baseball is hit with a velocity of 20 m/s at an angle of 45 degrees to the horizon? What is V_x and V_y for the baseball?

$\sin\theta = \frac{O}{H}$

$V_y = H \sin\theta = O = 14.14\ m/s$

$\cos\theta = \frac{A}{H}$

$V_x = H \cos\theta = A = 14.14\ m/s$

$$\boxed{\begin{array}{l} V_y = 14.14\ m/s \\ V_x\ \ 14.14\ m/s \end{array}}$$

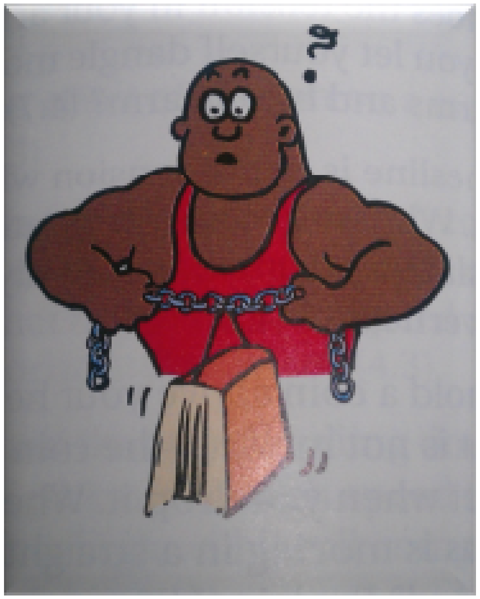
If an elephant were chasing you, its enormous mass would be very threatening. But if you zigzagged, the elephant's mass would be to your advantage. Why?

Newton's 1st law of motion obj. in motion stay in motion unless out side force acts

The elephant would have to apply a large force to change directions.

Why can't the strong man pull hard enough to make the chain straight?

There will always be a force in the y direction pulling down.



A jet traveling due east at 500 m/s is accelerated due east at a rate of 40 m/s^2 for 5 seconds. If the effects of air resistance and gravity are ignored, what is the final speed of the plane?

$V_f = ?$

$V_i = 500\ m/s$

$a = 40\ m/s^2$

$t = 5\ s$

$V_f = V_i + at$

$V_f = V_i + at$

$V_f = 500\ m/s + (40\ m/s^2 \times 5\ s)$

$V_f = 500 + 200 = \boxed{700\ m/s}$

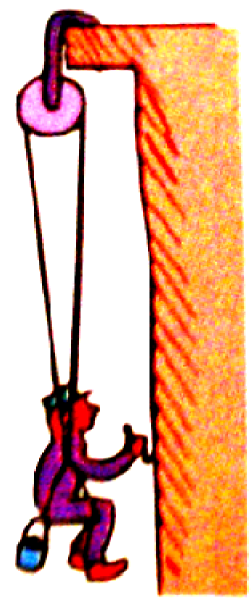
An African elephant can reach heights of 13 feet and possess a mass of as much as 6000 kg. If an elephants mass is 6000kg, determine the weight of an African elephant in Newton's and in pounds. (Given: 1.00 N = .225 pounds)

$w = m \times g$

$6000\ kg \times 10\ m/s^2 = 60{,}000\ N$

$$\frac{60{,}000\ \cancel{N}}{1} \times \frac{0.225\ lbs}{1.00\ \cancel{N}} = \boxed{13{,}500\ lbs}$$

Harry the painter swings year after year from his bosun's chair. His weight is 500 N and the rope, unknown to him, has a breaking point of 300 N. Why doesn't the rope break when he is supported as shown?



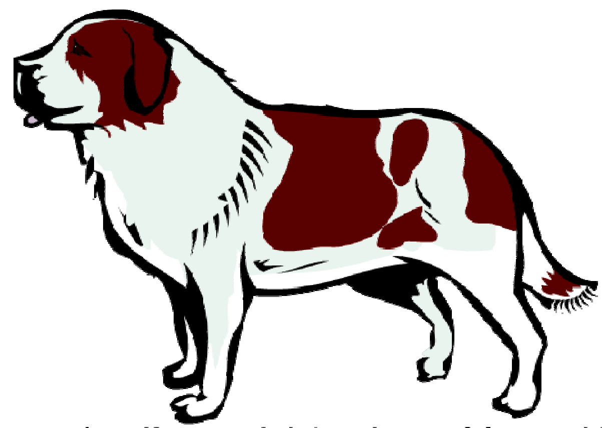
Because each strand holds half his weight.

A dragster has a mass of 1000 kg. What is the acceleration produced by a force of 2000 N?

$F = m \times a$

$a = \frac{F}{m} \quad \frac{2000\,N}{1000\,kg} = 2\,m/s^2$

Skye is trying to make her 70.0 kg (Don't forget this is Mass not weight) Saint Bernard go out the back door but the dog refuses to walk. What is the coefficient of sliding friction between the dog and the floor if the frictional force is 20.0 Newton's?



$w = m \times g$

$70 \times 10 = 700N$

$F_f = \mu F_N$

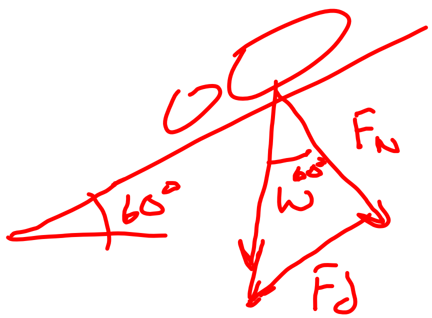
so $\mu = \frac{F_f}{F_N} = \frac{20N}{700N} = \boxed{0.029 = \mu}$

force of sliding friction = (coefficient of sliding friction) (normal force)

$$F_f = \mu F_N$$

A Panda Bear slides down a snow covered ramp in the San Diego Zoo. If the ramp is 60 degrees to the horizontal, (Cosine of 60 degrees is 0.5) and the bears mass is 500. kg, what is the normal force that the ramp is placing on the panda?

$W = m \times g = 500kg \times 10\frac{m}{s^2} = 5000N$



$5000N \times \cos 60^\circ = \boxed{2450N = F_N}$

T Time Towing company carries a 150.-kg engine at a constant speed. The engine is being acted on by air resistance causing the tow line to make an angle of 10.0° to the vertical, what is the tension in the line?

$F = m \times a$

$1{,}500N = 150kg \times 10 m/s^2$

$\cos 10^\circ = \frac{A}{H}$

$H = \frac{A}{\cos 10^\circ}$

$H = \frac{1500N}{\cos 10^\circ} = \boxed{1523N}$

What would the mass of a 50Kg rock be on the moon?

Mass does not change!

$\boxed{50\,Kg}$

One Object has twice as much mass as another object. The first object also has twice as much Velocity Gravitational acceleration Inertia

- Velocity
- Gravitational acceleration
- Inerita

Two people pull on a rope in a tug-of-war. Each pulls with 400 N of force. What is the tension in the rope?

- **0N**
- **400N**
- **600N**
- **800N**

A skater increases her velocity from 2.0 m/s to 10.0 m/s in 4.0 seconds. What is the acceleration of the skater?

$$a = \frac{v_f - v_i}{\Delta t} = \frac{10.0 - 2.0}{4\,s} = 2\,m/s$$

If she has a mass of 50kg what is the force she uses to increase her speed?

$F = m \times a$

$50kg \times 2 m/s^2 = \boxed{100N}$

What is the reaction force of the ice?

Equal but opp.

−100N

Using the law of Conservation of Momentum, find the unknown quantitates.

	p_{before}		Impulse			p_{final}
	m_1	v_1	f	t	Δp	p_{net}
1.	3	20	? 0.5	20	10 ?	70
2.	?	-5	+5	? 8s	40	-20
3.	? 11kg	2	2	4	? 8	30
4.	4	? -0.5	? 30	10	30	28

$P_B = P_A$

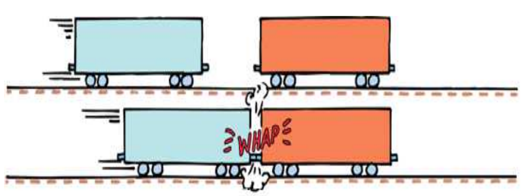
$P_B + I = P_A$

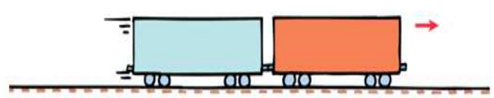
Predict the mass & velocity after the collision of two different rail cars that collide and stick to each other of varying mass and velocity (as shown below).

	Before				After	
	m_1	v_1	m_2	v_2	m	v
1.	2	3	2	-3	4	0
2.	10	10	5	-5	15	5
3.	15	8	5	-10	20	3.5
4.	6	4	4	-4	10	0.8

P_{Befor} P_{After}

$$(m_1 \times v_1) + (m_2 \times v_2) = m_{12} \times v_{12}$$





Find the unknown quantitates.

Q. #	V_i (m/s)	V_f (m/s)	Δt (s)	a (m/s²)
1.	10	20	10	? 2 m/s²
2.	50	30	? 4 s	-5
3.	? 24 m/s	20	2	-2
4.	40	? 80	4	10

$a = \frac{V_f - V_i}{\Delta t}$

$t = \frac{V_f - V_i}{a}$

$V_i = V_f - at$

$V_f = V_i + at$

A ship accelerates from a stop to a speed of 10. m/s in 600. seconds. If the force used to do this was 3.0 x 10^3 Newton's, what was its mass?

$a = \frac{V_f - V_i}{\Delta t}$ $\frac{10 - 0}{600} = 0.0166 \frac{m}{s^2}$

$F = m \times a$ 3×10^3 N = 3000N

$m = \frac{F}{a} = \boxed{180{,}000 \text{ kg} = m}$

A pitcher throws a baseball with a velocity of 121. ft/sec toward home plate that is 60.5 feet away. Assuming the horizontal velocity of the ball remains constant, how long does it take to reach the plate?

$S = \frac{d}{t} \rightarrow t = \frac{d}{S}$ $\frac{60.5\,m}{121.\,ft} = 0.5\ sec$

Find the unknown values.

	W (J)	F (N)	d(m)	t(s)	P(w)
1.	12	? 2N	6	3	? 4watts
2.	40	10	? 4/m	? 20s	2

$W = F \times d$ $\quad P = \frac{W}{t}$

A roller coaster gets stuck at the very top of the loop. If it has a mass of 1000kg and the loop is 40 meters from top to bottom, how much potential energy does it have relative to the bottom of the loop?

$PE = m \cdot g \cdot h$

$1000kg \times 10 m/s^2 \times 40m = 400{,}000 J$

A 1000kg roller coaster reaches the very top of its loop and stops moving just for a moment, at this point it has 40,000J of PE relative to the bottom of the loop. Once it moves and travels to the bottom of the loop, how fast will it be traveling (ignore friction)?

$KE_{Bott} = PE_{top}$

$KE = 40{,}000\,J$

solve for v

$KE = \frac{1}{2} m v^2 \longrightarrow \quad v = \sqrt{\frac{2KE}{m}} = \boxed{9\ m/s = v}$

Hypothermia can occur if the body temperature drops to 35.0°C, although people have been known to survive much lower temperatures. On January 19, 1985, 2 year old Michael Trode was found in the snow near his Milwaukee home with a body temperature of 16.0 °C, If Michael's mass was 10.0 kg, how much heat did his body lose, assuming his normal body temperature was 37.0 °C ($c_{\text{human body}}$ = 3470 J/kg°C).

Heat Transferred During a Temperature Change

Mass (*in kg*)　　Specific Heat (*in J/kg•°C*)

Heat (*in J*) $\rightarrow$ $$Q = mc_p \Delta T$$ $(T_f - T_i)$ $\leftarrow$ Change of Temperature (in °C)

$10\,kg \times 3470\,\frac{J}{kg\,°C} \times 21°C = 728{,}700\,J$

A crane lifted a cargo box from a barge. If the crane had 5 supporting cables, and the input force was 50,000 Newton's. What was the weight of the cargo box neglecting friction in the system?

of support strings = IMA ~ MA = $\frac{F_{out}}{F_{in}}$

$5 \sim \frac{50,000}{F_{in}}$ $F_{in} \sim \frac{50,000N}{5} = 10,000N$

The Sears Tower in Chicago sways back and forth at a frequency of about 0.1 Hz. What is its period of vibration?

$$T = \frac{1}{f} = 10 \text{ sec.}$$

Convert from period (T) to frequency (f):	
1 sec 1hz	4 sec 0.25 hz
0.1 sec 10 hz	2 sec 0.50 hz
0.5 sec 2 hz	0.25 sec 4 hz

$$f = \frac{1}{T}$$

Mr. Knote, a piano tuner taps his tuning fork with a mallet. The period of the vibrating tuning fork is .003 seconds, what is the wavelength of the wave produced? V $_{\text{sound in air}}$ = 343 meters per second

$f = \frac{1}{T} = \frac{1}{0.003} = 333.33\,hz$

$v = f \times \lambda$

$343\,m/s = 333.33\,hz \times ?$

$\frac{343}{333} = 1.03\,m = 1\,m$

(sig figs)

A car traveling with an initial velocity of 10 m/s, accelerates at 3 m/s², for 5 seconds. What is the car's final velocity?

$V_f = V_i + at$

$10\,m/s + (3\,m/s^2 \times 5\,s) = \boxed{25\,m/s}$

Anthea rubs two latex balloons against her hair, causing the balloons to become charged negatively with 2.0 x 10^{-6} C. She holds them a distance of 0.70 m apart. What is the electric force between the two balloons? Is it one of attraction or repulsion?

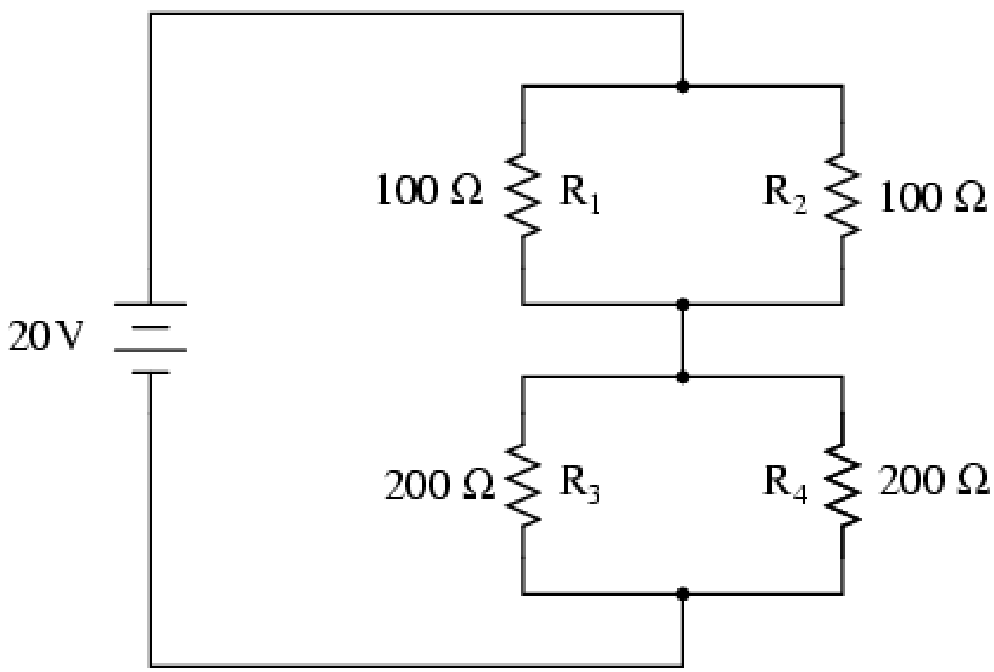
$$F_e = K\frac{q_1 \times q_2}{(d)^2}$$

$$9\times10^9 \times \frac{2.0\times10^{-6} \times 2.0\times10^{-6}}{0.7\ m} = \boxed{0.05N}$$

They both are (−) so it will be a force of repulsion.

As a rocket rises, its kinetic energy changes. At the time the rocket reaches its highest point, most of the kinetic energy of the rocket has been- transformed to PE

What is the voltage across R_1,R_2, R_3, and R_4?



$R_{12} = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}} = 50\Omega$

$R_{34} = \frac{1}{\frac{1}{R_3}+\frac{1}{R_4}} = 100\Omega$

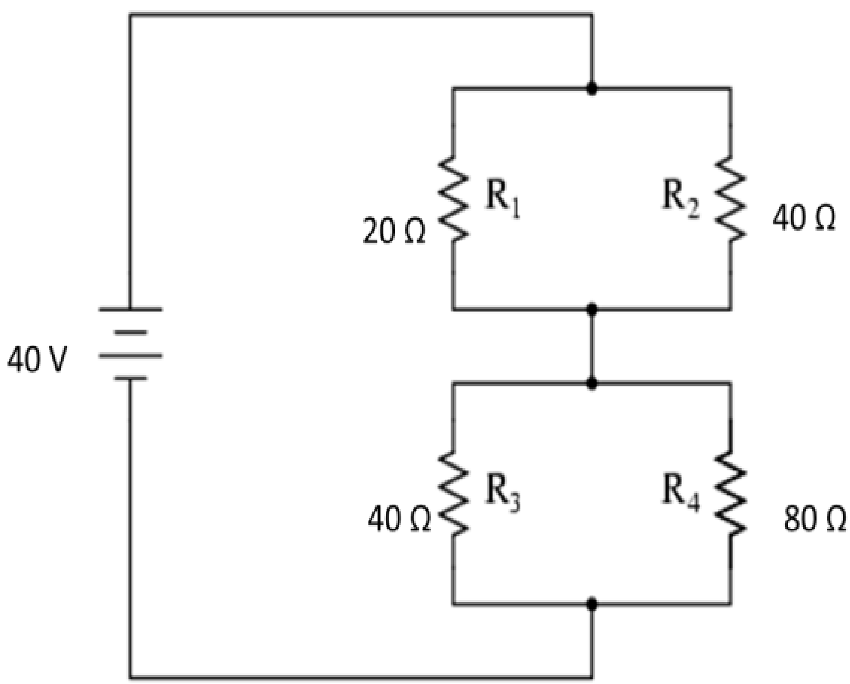
$V_{12} = I_{tot} \times R_{12} = 6.66V$

$V_{34} = I_{tot} \times R_{34} = 13.33V$

$R_{tot} = R_{12} + R_{34} = 150\Omega$

$V = I \times R \quad I = \frac{V}{R} \quad \frac{20V}{150\Omega} = 0.13$ Amps

What is current flowing through R_4?



$R_{12} = 13.33$

$R_{34} = 26.66$

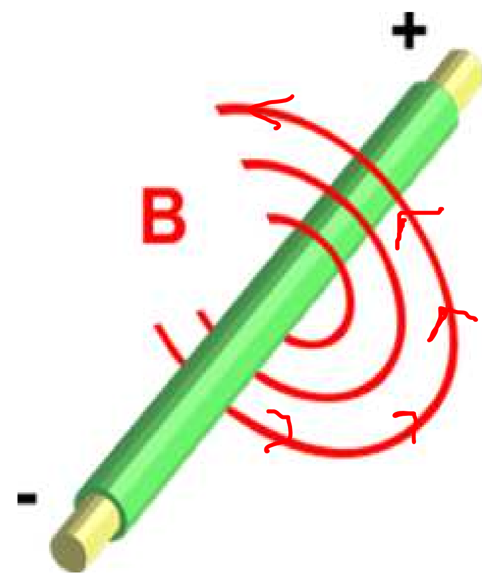
$R_{tot} = R_{12} + R_{34} = 40\Omega$

$V = I \times R \quad I = \frac{V}{R} = 1 \text{ amp.}$

$V_{34} = I \times R = 26.66\,V$

$I_3 = \frac{V}{R} = \boxed{0.66 \text{ Amps}}$

Place arrows on the diagram that show the direction of current and of the magnetic field.



A 20,000kg jet on an aircraft carrier can be launched from 0 to 50 m/s in 2.5 seconds. What is the distance covered during that time by the jet?

$$\Delta d = \cancel{v_i}^{\phi} t + \frac{1}{2} a t^2$$

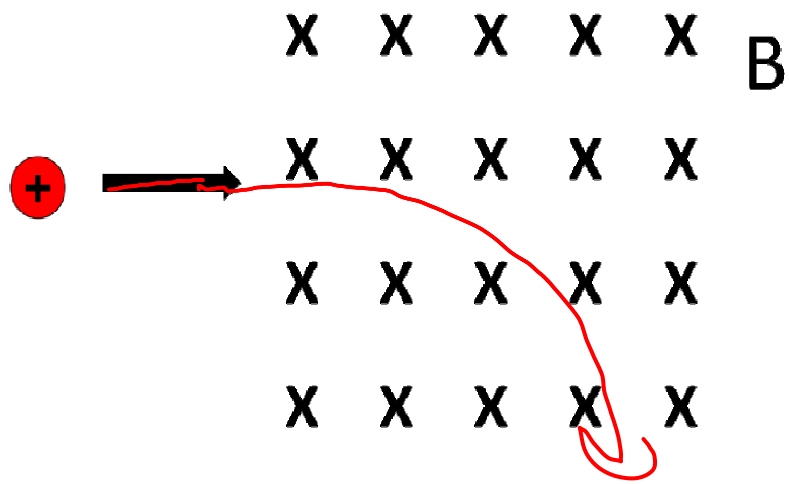
$$\Delta d = 0 + \frac{1}{2} a t^2$$

$$a = \frac{v_f - v_i}{\Delta t} \qquad \frac{50\,m/s - 0\,m/s}{2.5\,s} = 20\,m/s$$

$$\Delta d = \frac{1}{2} a t^2$$

$$\boxed{= 62.5\,m}$$

What path will the positively charged particle take when it enters the magnetic field?



A 20,000kg jet on an aircraft carrier can be launched from 0 to 40 m/s in 2 seconds. How much power is required to launch the plane?

$$a = \frac{v_f - v_i}{\Delta t} = 20\,m/s^2$$

$$\Delta d = \cancel{v_i t} + \tfrac{1}{2}at^2$$

$$\Delta d = \tfrac{1}{2}at^2 \qquad \Delta d = 40\,m$$

$$F = m \times a \qquad F = 400{,}000\,N$$

$$W = F \times d = 16{,}000{,}000\,J$$

$$P = \frac{W}{t} \qquad P = 8{,}000{,}000 \text{ watts} = \boxed{8 \times 10^6 \text{ watts}}$$

A 1000 kg Indy race car traveling with an initial velocity of 10 m/s, accelerates at 2 m/s², for 5 seconds. What is the car's final velocity?

$V_f = V_i + at$

$\boxed{20\ m/s} = 10\ m/s + (2\ m/s^2 \times 5\ s)$