

VI-1

To calculate the force in Newtons Law, you would use the equation: $F = m_{kg} * a_g$

where

$$a_g = 9.80 \frac{m}{s^2}$$

VI-2 and VI-3

Measurements

We now need to convert grams to kilograms

since the equation stands for the total mass

exerted in kilograms.

		$m_t(g)$	$\theta(deg)$	F(N)
Trial 1	F ₁	30	112	0.294
	F ₂	55	198	0.539
	F ₃	64	349	0.627
Trial 2	F ₁	60	115	0.588
	F ₂	35	200	0.343
	F ₃	72	323	0.706
Trial 3	F ₁	65	118	0.637
	F ₂	45	222	0.441
	F ₃	80	328	0.784

So, for trial 1 we take m_1 from the grams and convert to kilograms: $\frac{m_1 + m_h}{1000} = m_{kg}$

m_h is already added into m_1 as it is the mass of the hanger.

Looking at m_1 , we can use the equation $\frac{m_1}{1000} = m_{kg}$ to find the kilograms: $\frac{30}{1000} = 0.03 \text{ kg}$

To calculate the force we use the equation, $F = m_{kg} * a_g$

$$F_1 = m_{kg} * a_g = 0.03 \text{ kg} * \left(9.80 \frac{m}{s^2} \right) = 0.294 \text{ N}.$$

VI-4 Measurements

		$m_t(g)$	$\theta(deg)$	F(N)
Trial 1	F ₁	55	0	0.539
	F ₂	45	80	0.441
	F ₃	20	160	0.196
	F ₄	69	229	0.676
Trial 2	F ₁	35	10	0.343
	F ₂	30	90	0.294
	F ₃	60	170	0.588
	F ₄	55	297	0.539
Trial 3	F ₁	70	20	0.686
	F ₂	25	100	0.245
	F ₃	55	180	0.539
	F ₄	49	262	0.480

The calculations for F (N) are carried out the same way as in table #1 with converting grams to kilograms and then multiplying by 9.8 m/s^2 to find the force.

VI-2

Scale for both graphs: $1\text{cm} = 0.05 \text{ N}$

Trial #3 for section VI-2 and VI-3

1. Force #1: $0.637 \text{ N} (1\text{cm} / 0.05 \text{ N}) = 12.74 \text{ cm}$
2. Force #2: $0.441 \text{ N} (1\text{cm} / 0.05 \text{ N}) = 8.82 \text{ cm}$
3. Force #3: $0.784 \text{ N} (1\text{cm} / 0.05 \text{ N}) = 15.68 \text{ cm}$

Trial #1 for section VI-4

1. Force #1: $0.539 \text{ N} (1\text{cm} / 0.05 \text{ N}) = 10.78 \text{ cm}$
2. Force #2: $0.441 \text{ N} (1\text{cm} / 0.05 \text{ N}) = 8.82 \text{ cm}$
3. Force #3: $0.196 \text{ N} (1\text{cm} / 0.05 \text{ N}) = 3.92 \text{ cm}$
4. Force #4: $0.676 \text{ N} (1\text{cm} / 0.05 \text{ N}) = 13.52 \text{ cm}$

VI-3

The resultant is drawn on both diagrams. It is way too small to obtain a measurement accurately.

The magnitude and direction of resultant is shown in VI-4 with some of the calculations shown.

VI-4

To find the X-component, the equation is $F_x = |F| \cos \theta$. Example calculation is as follows:

$$\text{For the three force case: } F_{1x} = |0.294 \text{ N}| \cos(112) = -0.110 \text{ N}.$$

The equation for F_y is the same as F_x except the trigonometric function is $\sin \theta$. The equation for this would look like: $F_y = |F| \sin \theta$. An example calculation is as follows:

$$F_y = |0.294 \text{ N}| \sin(112) = 0.273 \text{ N}$$

To find the x and y components of the resultant, you would add all of the x components of the vectors and add all of the y components of the vectors:

For the x component calculation in trial 1 for the three forces:

$$-0.110 \text{ N} + -0.513 \text{ N} + 0.615 \text{ N} = -.008 \text{ N}$$

For the calculation of the y component in trial 1 for the three forces:

$$0.273 \text{ N} + -0.176 \text{ N} + -0.120 \text{ N} = -0.023 \text{ N}$$

To find the magnitude of the resultant, we need to use the equation $|\vec{C}| = \sqrt{C_x^2 + C_y^2}$.

So, calculation would be: $|\vec{C}| = \sqrt{.008}$

To find the angle of the resultant, you would take the x and y component of the resultant and use

the equation $\theta = \tan^{-1} \frac{F_y}{F_x}$.

So, calculation would be: $\theta = \tan^{-1} \frac{-0.023}{-0.008} = 70.82^\circ$

3 Forces Data Table

Trial #1	xcomponent (N)	y component (N)	resultant x(N)	resultanty (N)	R (N)	θ (Degrees)
F_1	-0.110	0.273	-0.008	-0.023	0.024	70.82
F_2	-0.513	-0.167				
F_3	0.615	-0.120				