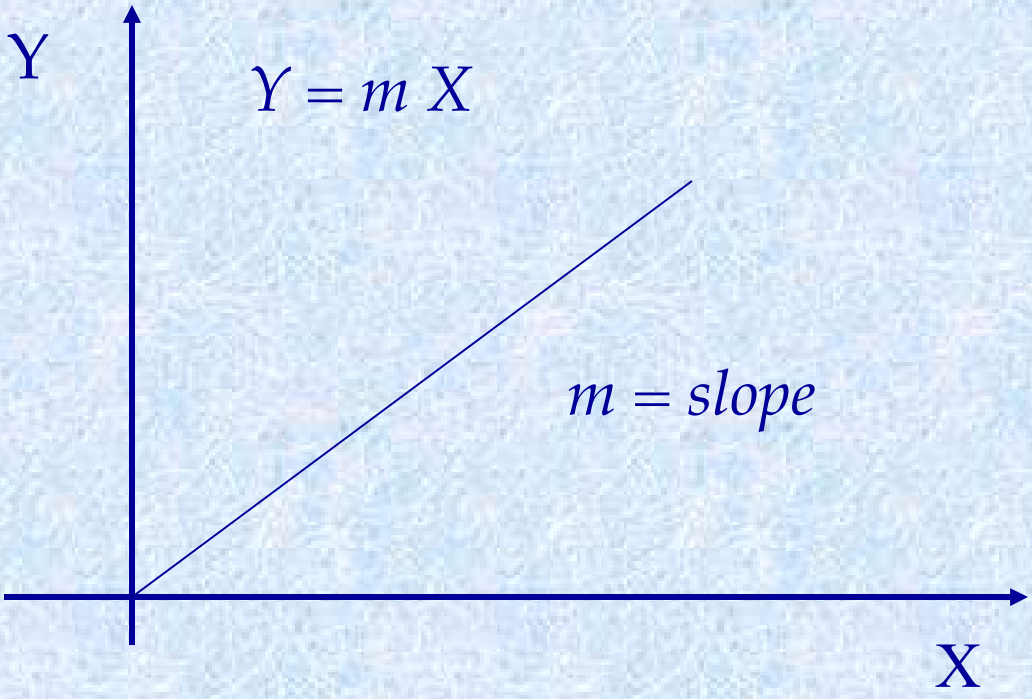
Empowering Math in Physics

- Linear Equations
- Quadratic Equations
- Systems of linear equations
- Vectors
- Trigonometry

Mat 1033: The linear equation

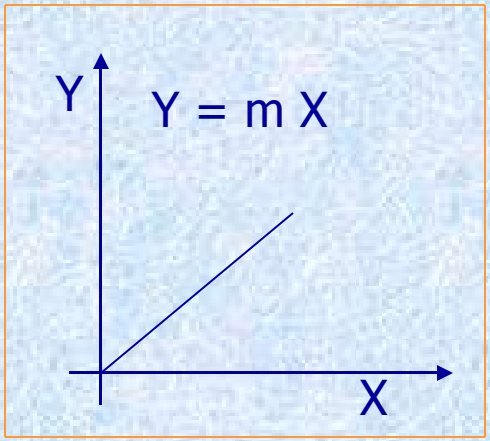
$Y = m\,X + b$, m: slope ; b: y-intercept

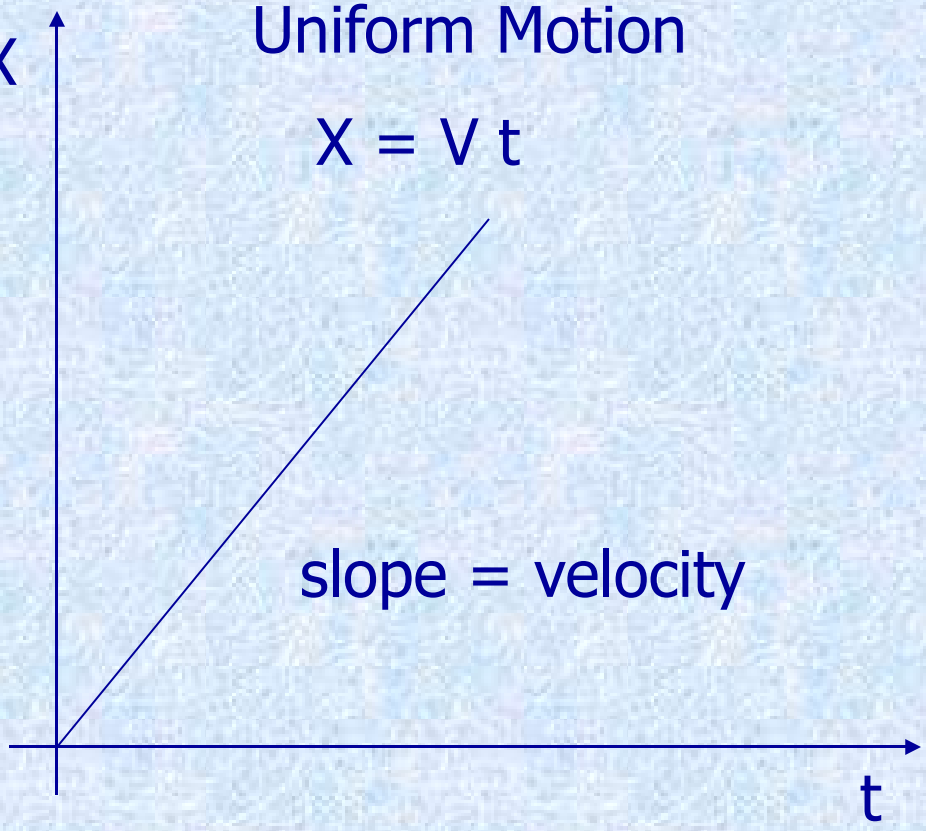
Case I : $b = 0$

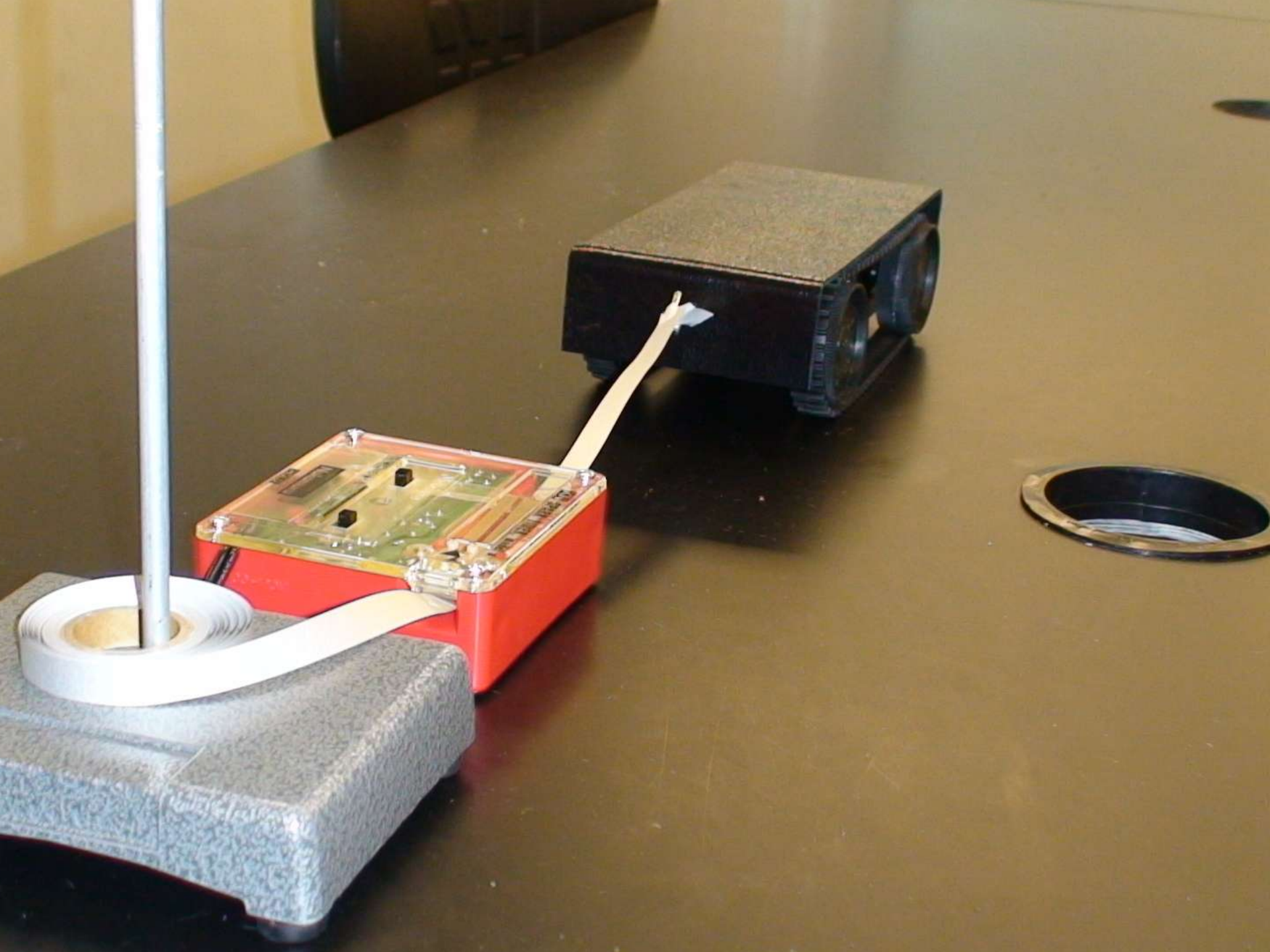


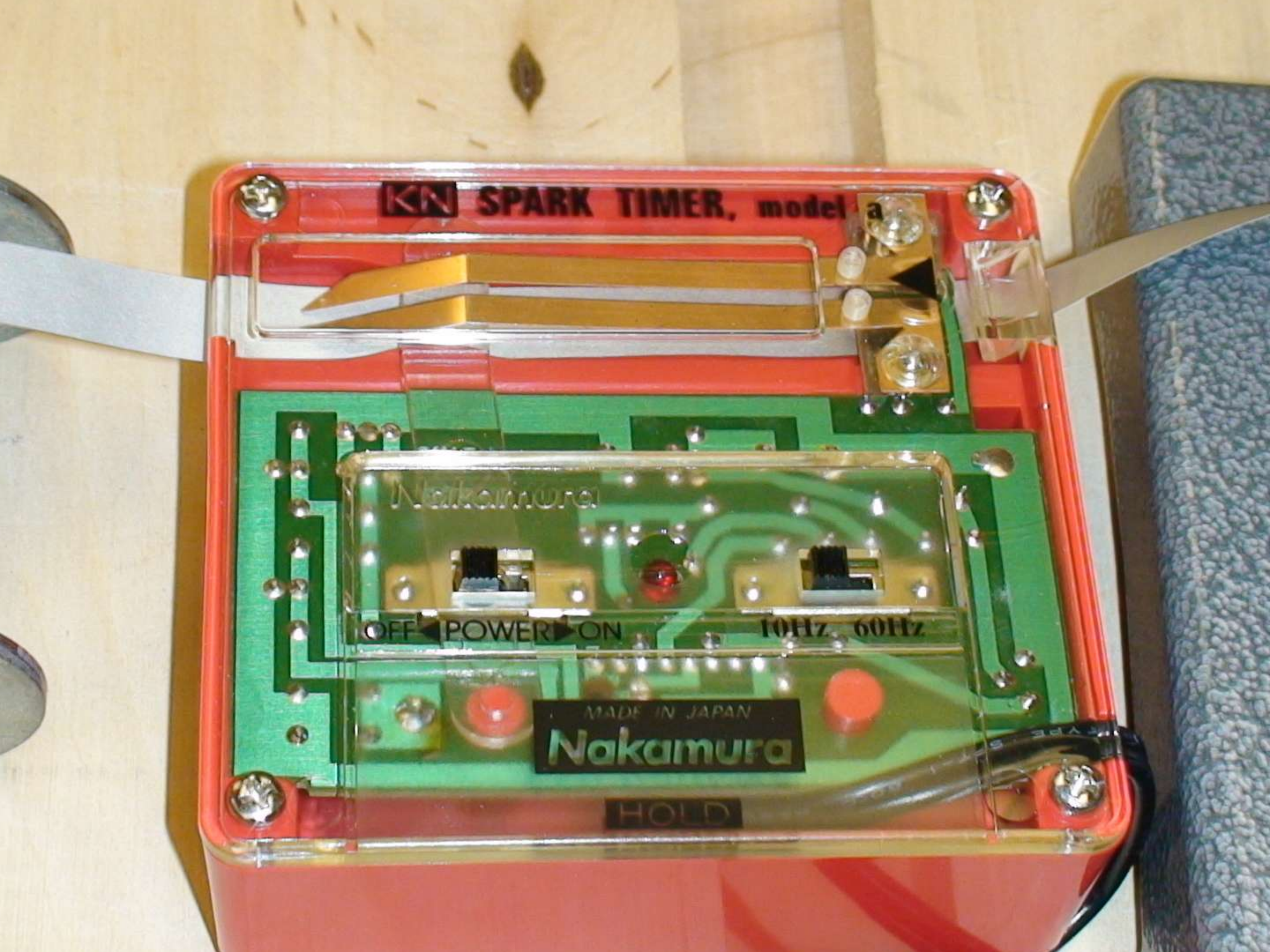
PHY 1004: Applications of the Linear Equation

$Y = m\,x$ m: slope ; b = 0

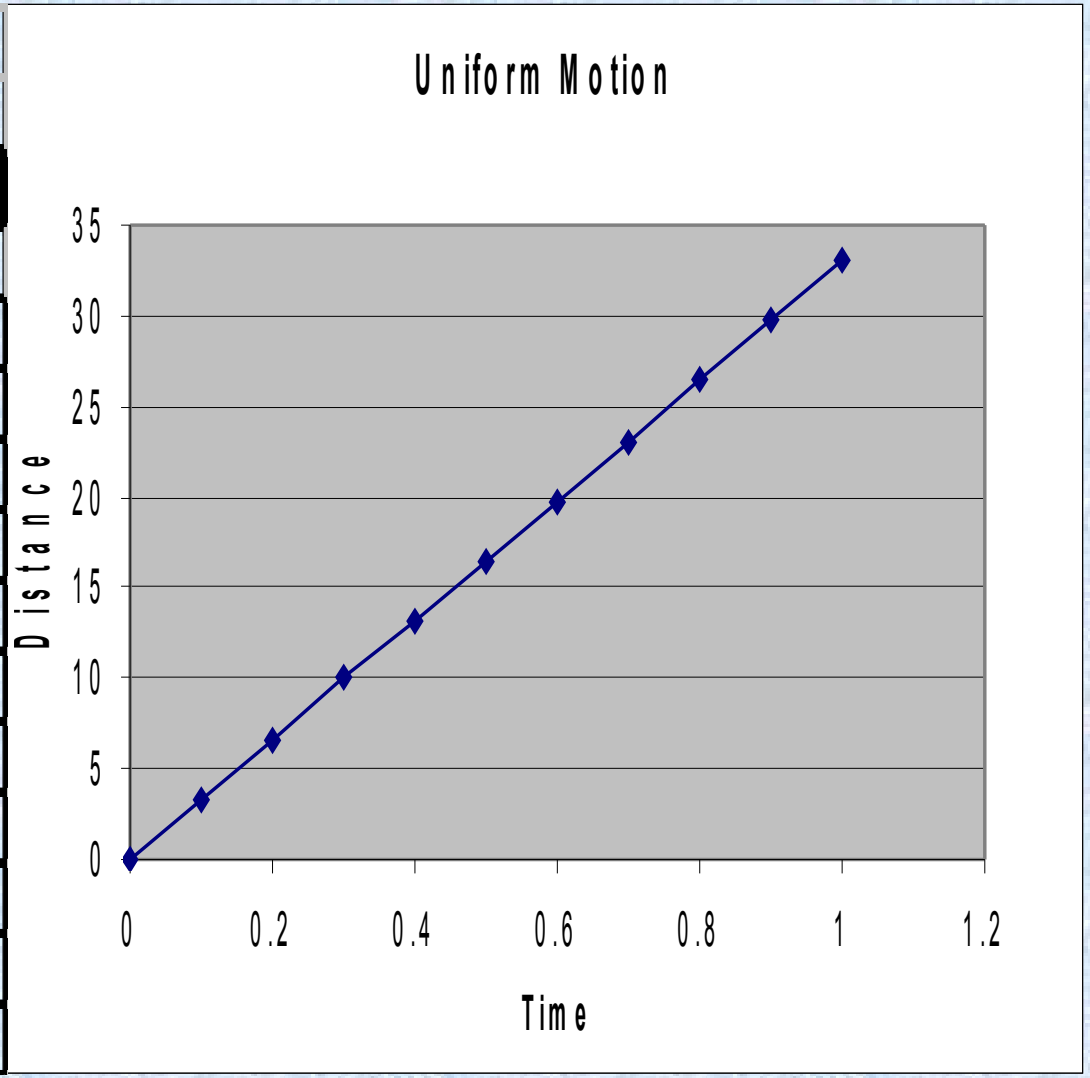






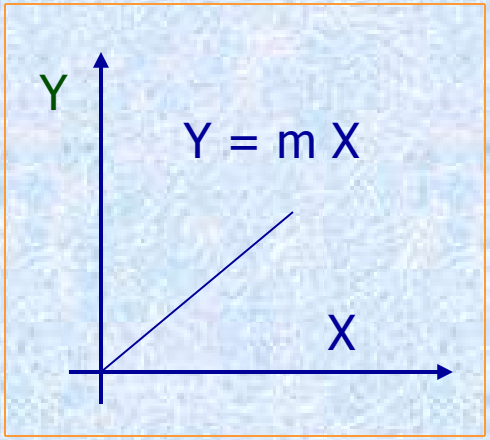

KN SPARK TIMER, model a
Nakamura
OFF POWER ON
10Hz 60Hz
MADE IN JAPAN
Nakamura
HOLD

Uniform Motion	
Time	**Distance**
(s)	(cm)
0	0
0.1	3.2
0.2	6.6
0.3	10.0
0.4	13.2
0.5	16.5
0.6	19.7
0.7	23.1
0.8	26.4
0.9	29.7
1.0	33.0



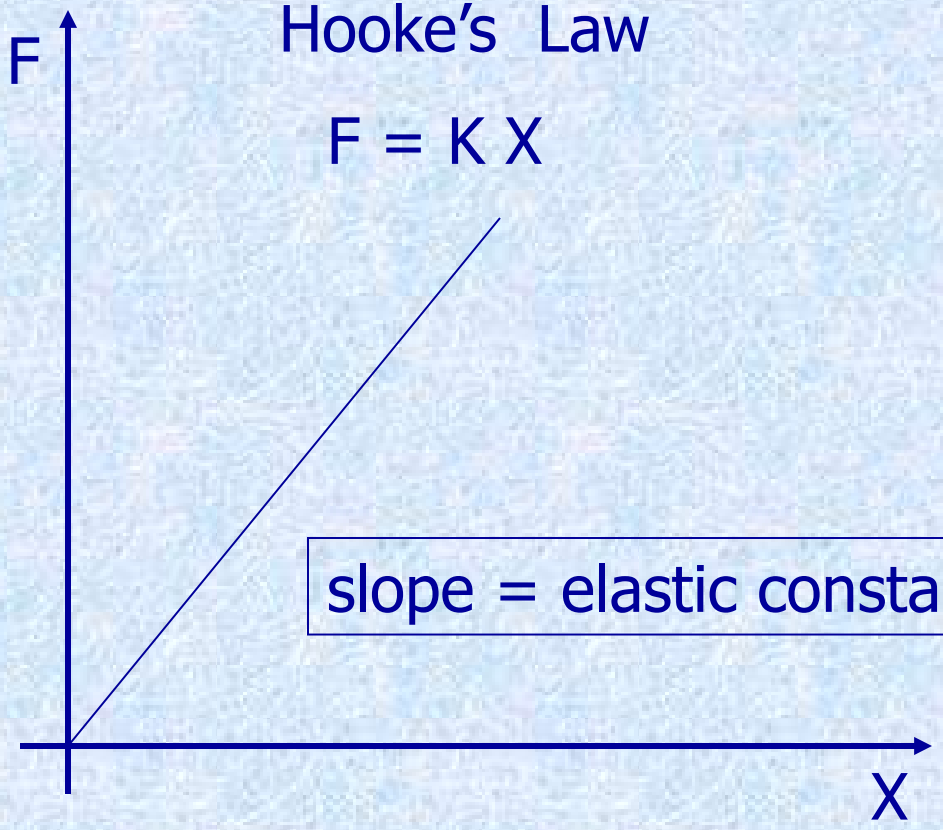
PHY 1004: Applications of the Linear Equation

$Y = m\,x$ m: slope ; b = 0

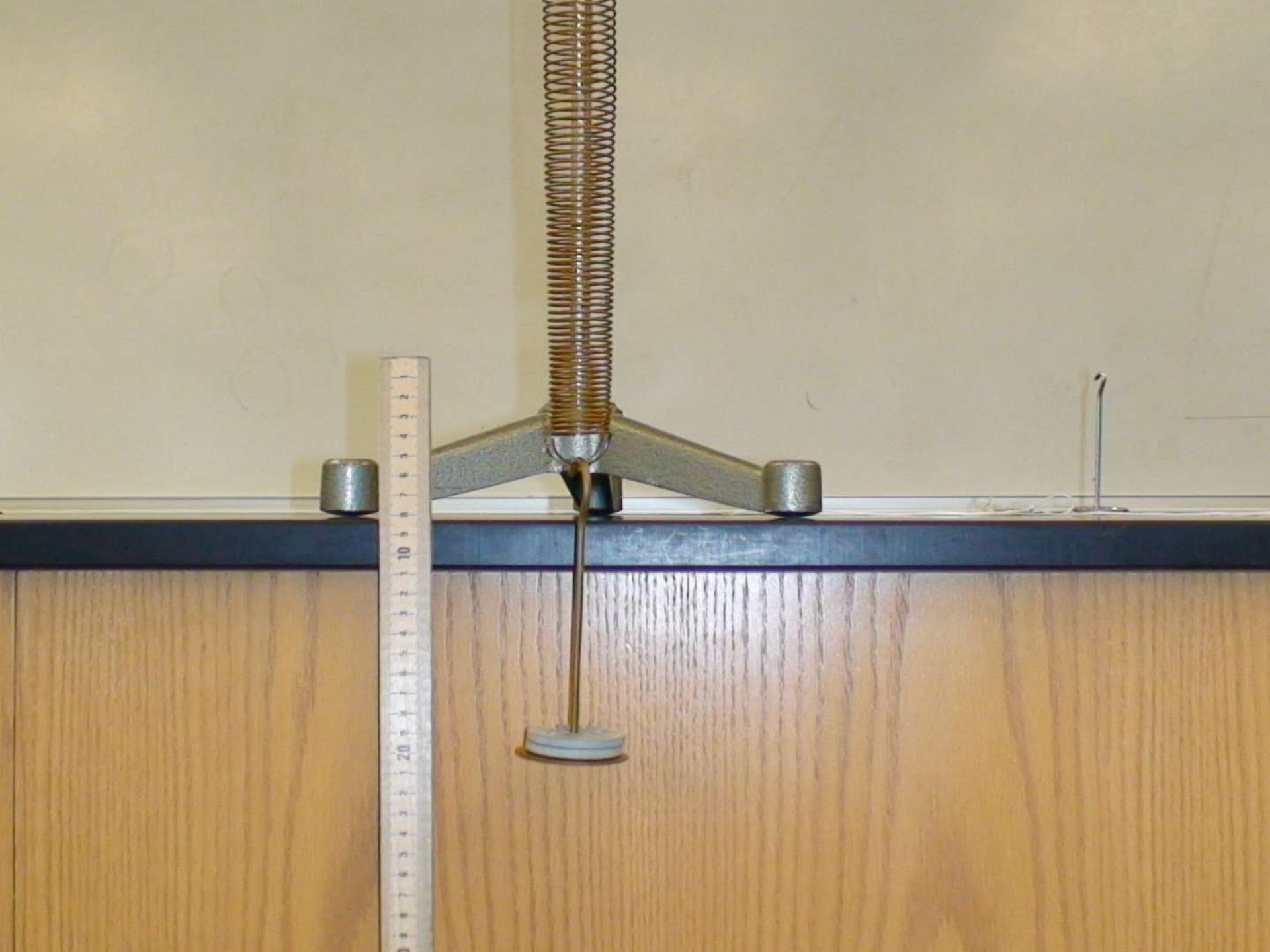


Hooke's Law

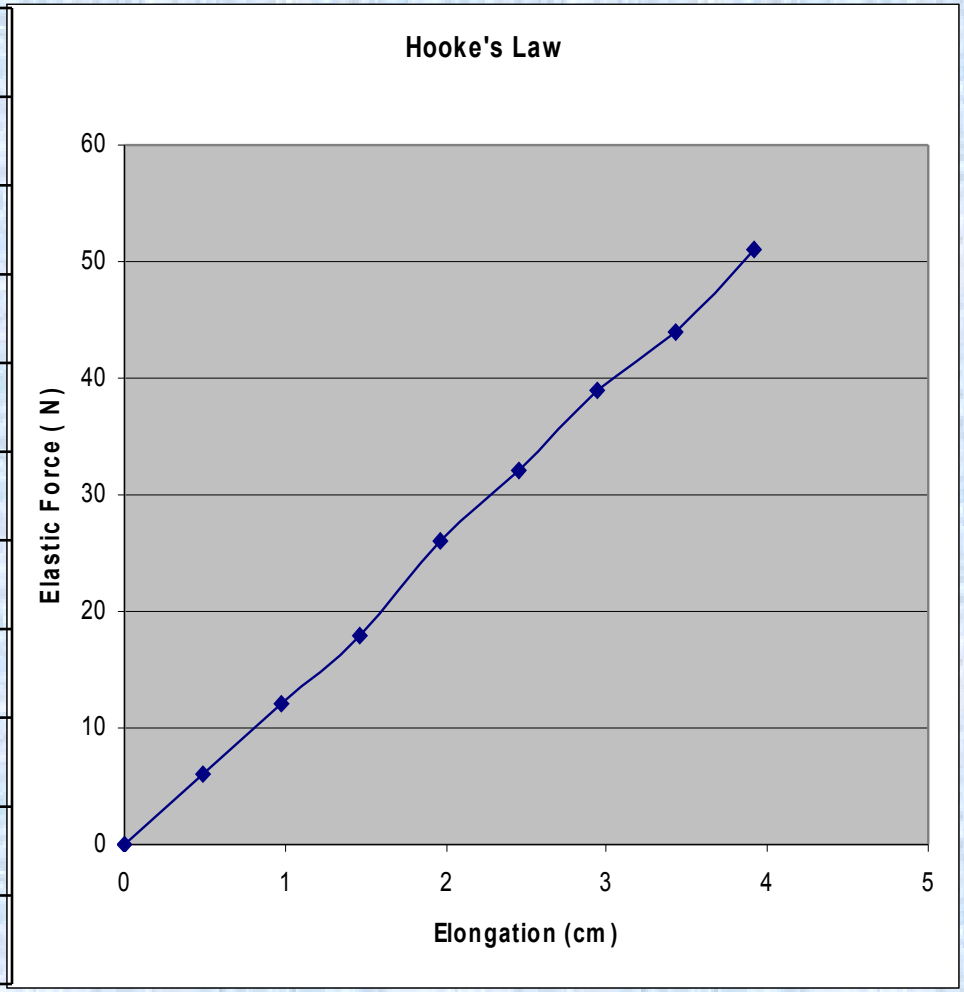
$F = K\,X$



slope = elastic constant

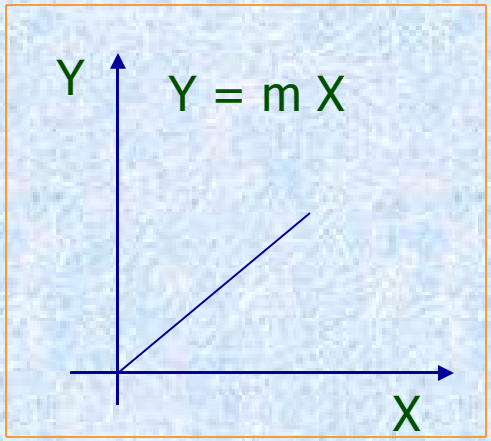


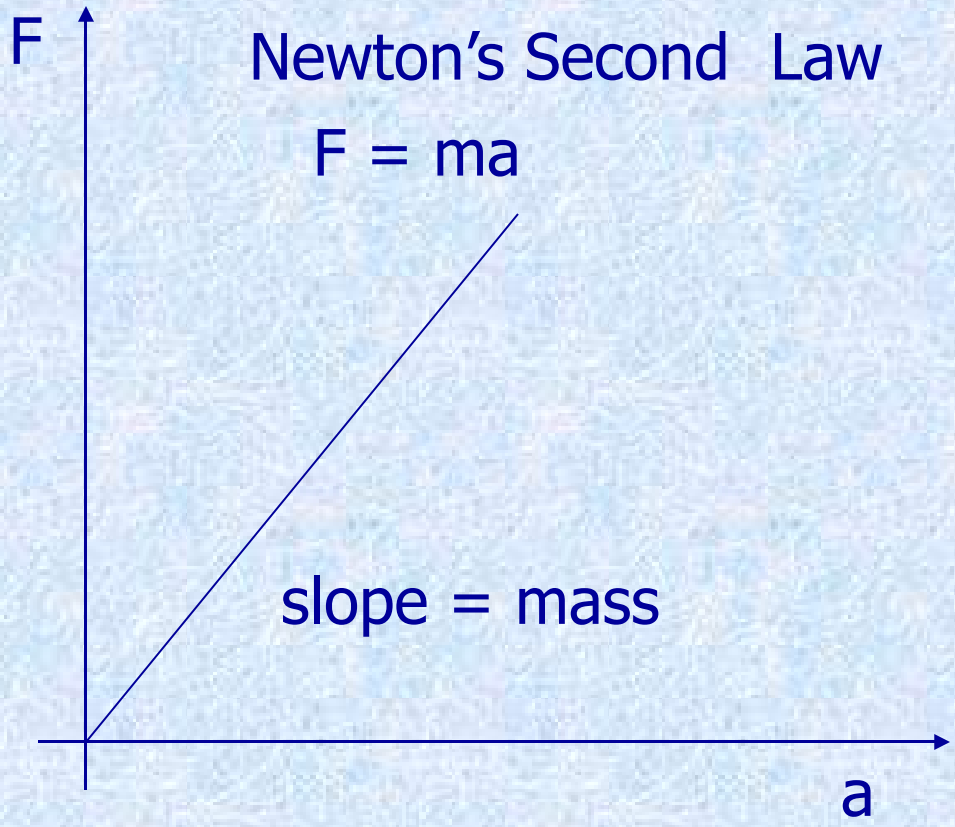
Force (N)	ΔX (cm)
0	0
0.49	6
0.98	12
1.47	18
1.96	26
2.45	32
2.94	39
3.43	44
3.92	51



PHY 1004: Applications of the Linear Equation

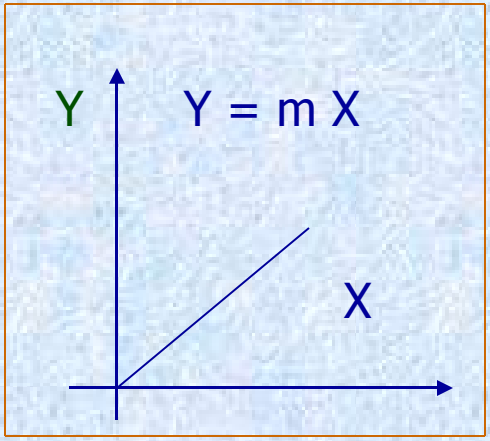
$Y = m x$ m: slope ; b = 0





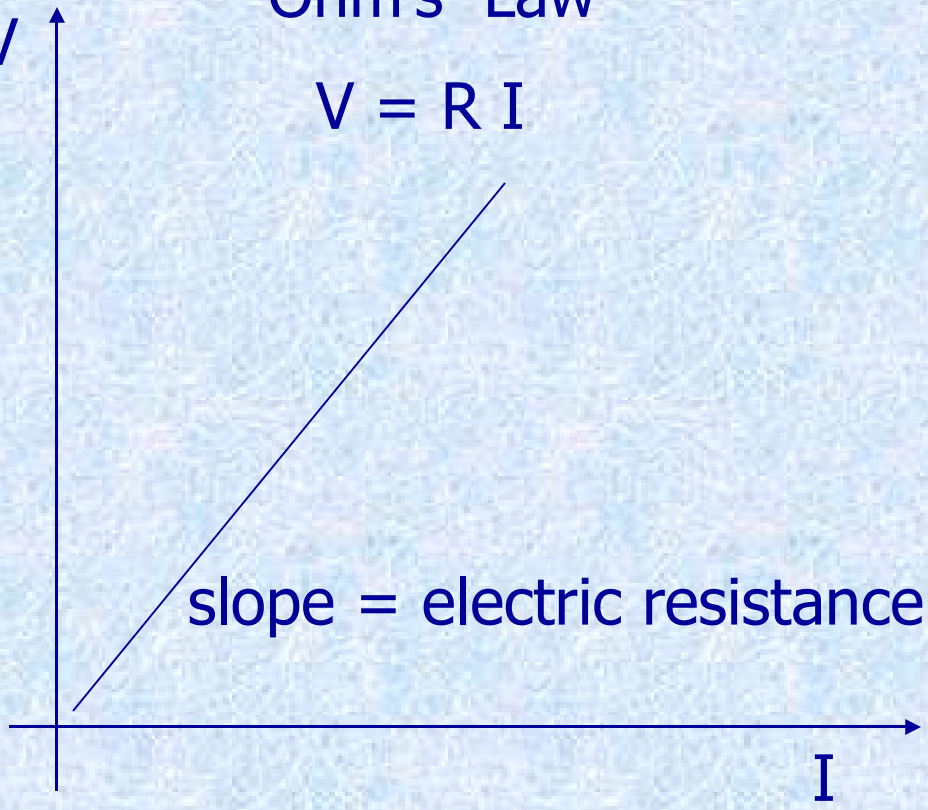
PHY 1004: Applications of the Linear Equation

$Y = m\,x$ m: slope ; b = 0



Ohm's Law

$V = R\,I$

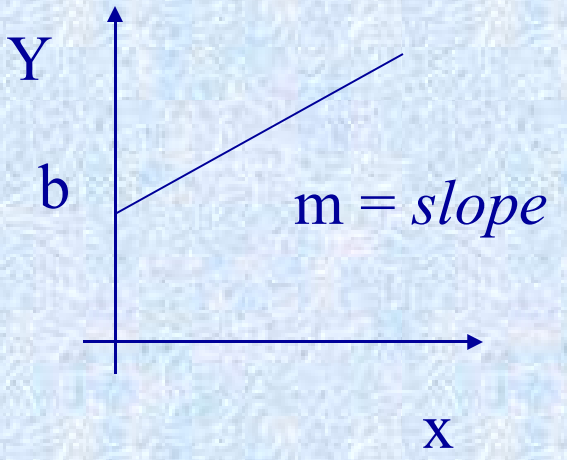


Graph of the Linear Equation

Case II : b ≠ 0

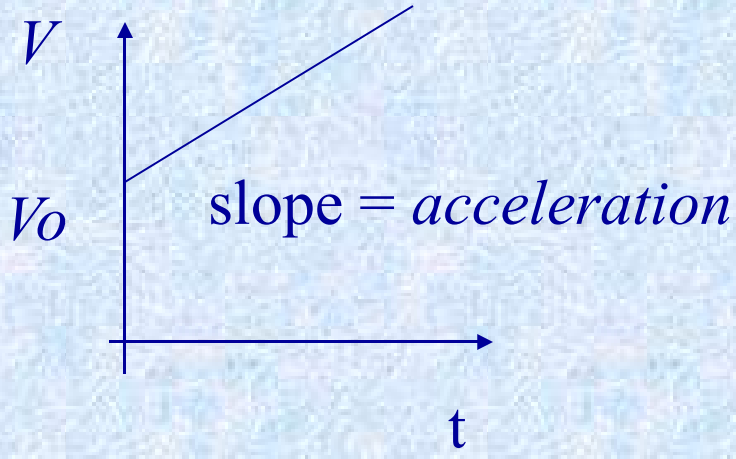
MAC 1033

$Y = m\,x + b$



PHY 1004

$V = a\,t + Vo$

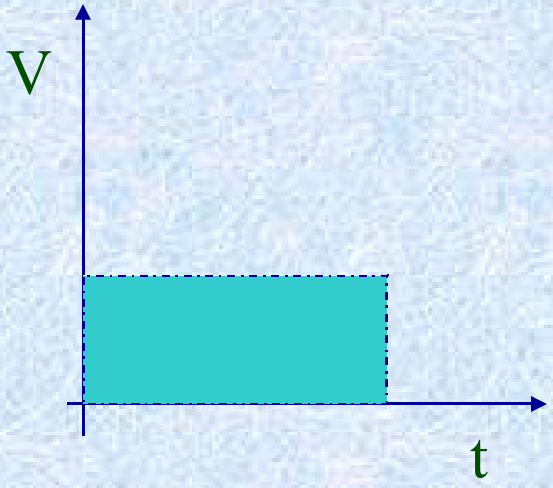


Uniform Motion

(Constant velocity)

$X = V\,t$

$X = \text{Area} = V_x\,t$



Uniformly Accelerated Motion

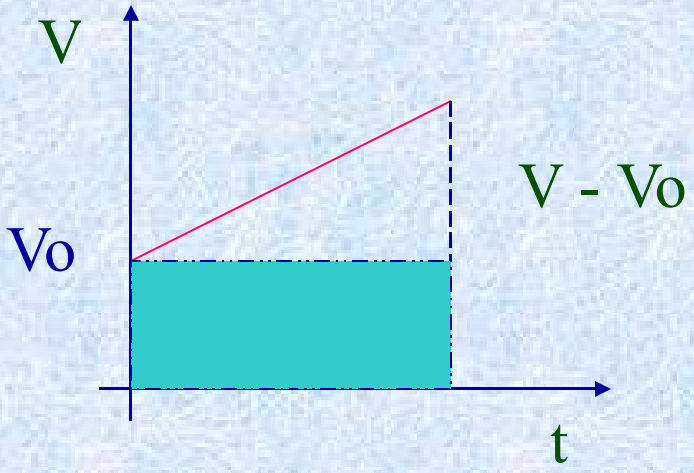
(Constant acceleration)

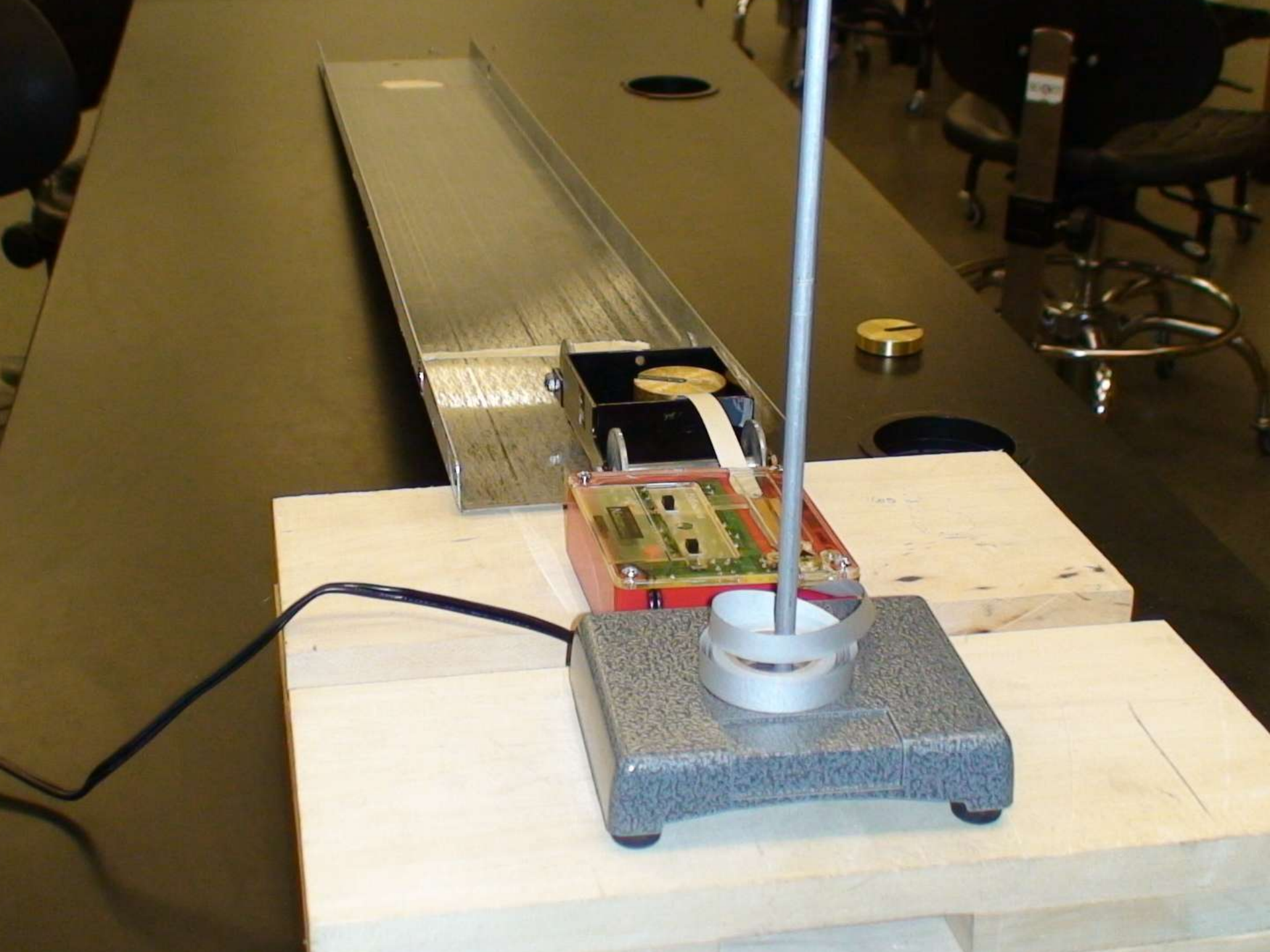
$V = V_o + a\,t$

$X = \text{Area1} + \text{Area2}$

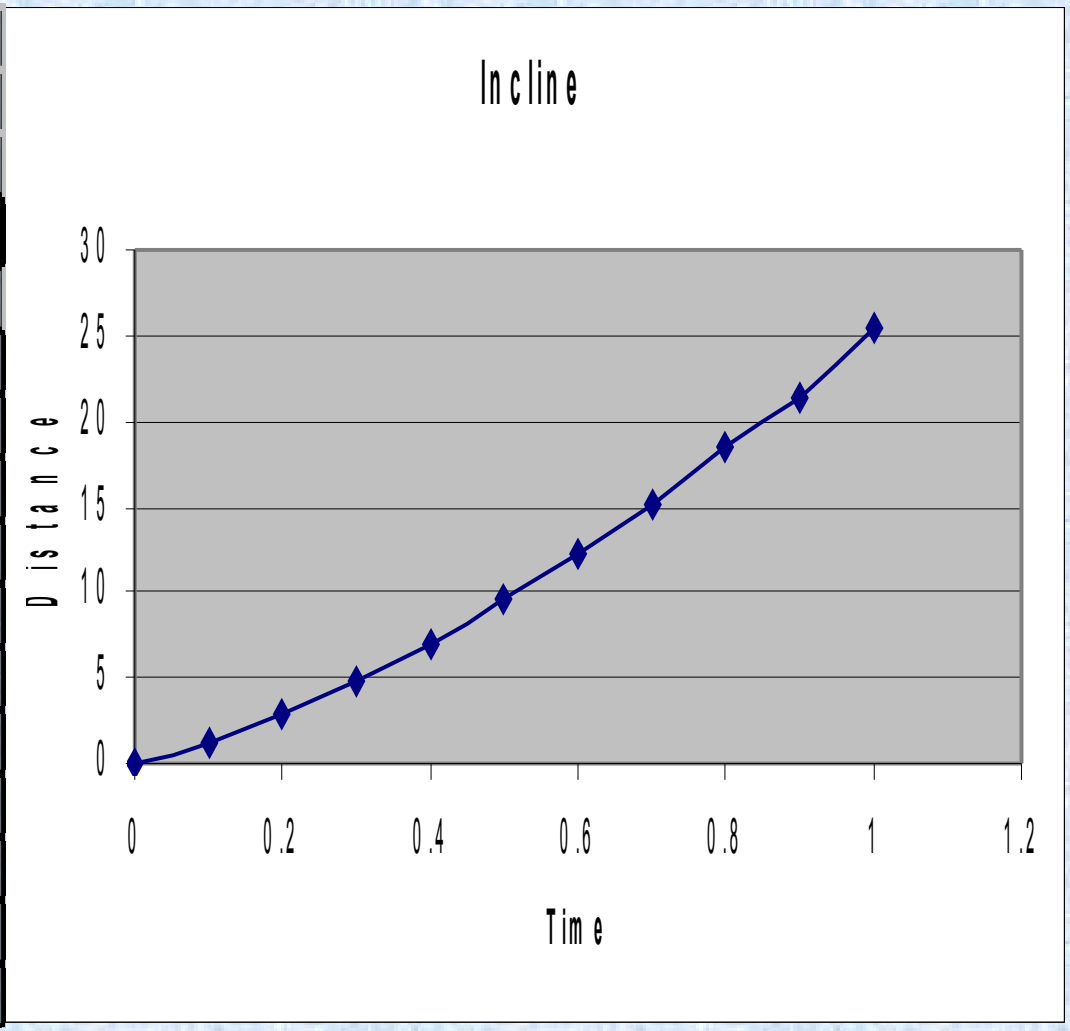
$X = V_o\,t + \tfrac{1}{2}\,(V - V_o)\,t$

$X = V_o\,t + 1/2\,a\,t^2$





INCLINE	
Time	**Distance**
(s)	(cm)
0	0
0.1	1.3
0.2	2.9
0.3	4.8
0.4	7.0
0.5	9.5
0.6	12.2
0.7	15.2
0.8	18.4
0.9	21.3
1.0	25.5



Mathematics

- $Y = m X + b$
- $Y = m X$
- $aX^2 + b X + c = 0$

Physics

- $V = at + Vo$
- $X = V t$
- $F = k X$
- $F = m a$
- $V = R I$
- $X = V_o t + 1/2 a t^2$

MAT 1033 : Systems of Linear Equations in two Equations and two variables

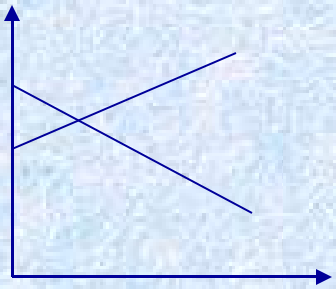
Solve

$ax + by = c$

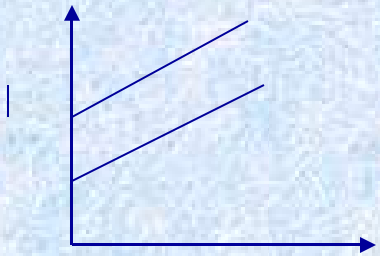
$dx + ey = f$

where x and y are variables and a, b, c, d, e, f are constant

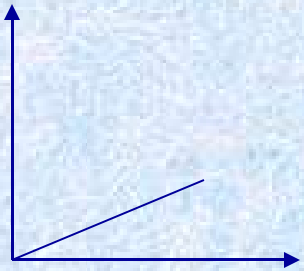
Cases



One solution



No solution

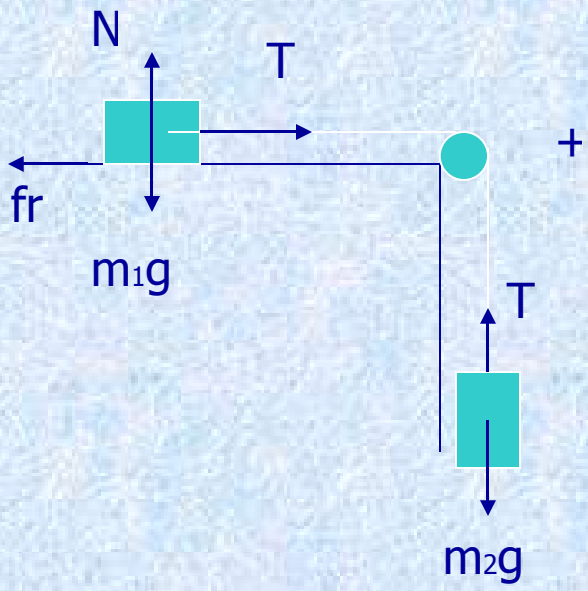


Infinitely many solutions

Solution of a system of two equations

where T and a are variables and μ_k , m_1, m_2 , g, are constants.

Dynamics Problem



Newton's Second Law

$$\Sigma F = m a$$

PHY 1004:

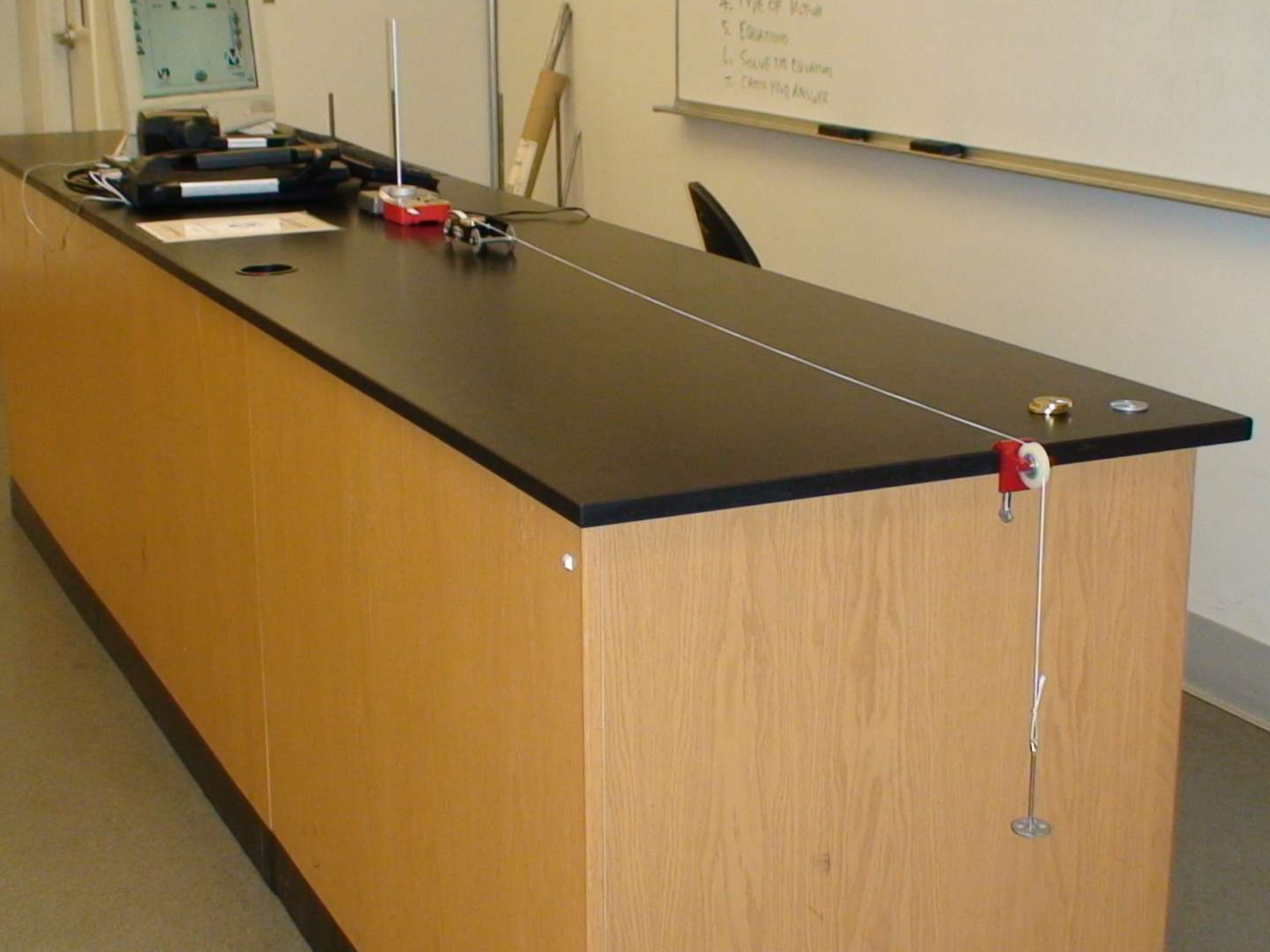
$$T - \mu_k m_1 g = m_1 a$$

$$+ \quad m_2 g - T = m_2 a$$

Addition Method

$$m_2 - \mu_k m_1 g = m_1 a + m_2 a$$

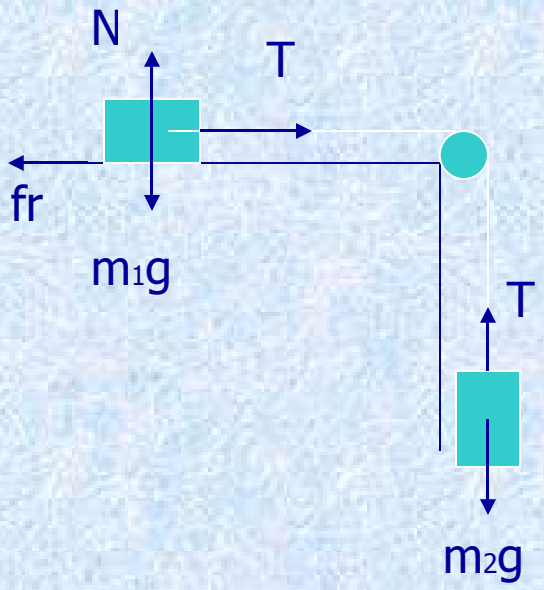
$$a = \frac{m_2 - \mu_k m_1 g}{m_1 + m_2}$$



Solution of a system of two equations

where T and a are variables and μ_k, m1, m2, g, are constant

Dynamics Problems



Newton's Second Law

$\sum F = m\,a$

PHY 1004:

Substitution Method

$$T - \mu_k m_1 g = m_1 a \longrightarrow T = m_1 a + \mu_k m_1 g$$

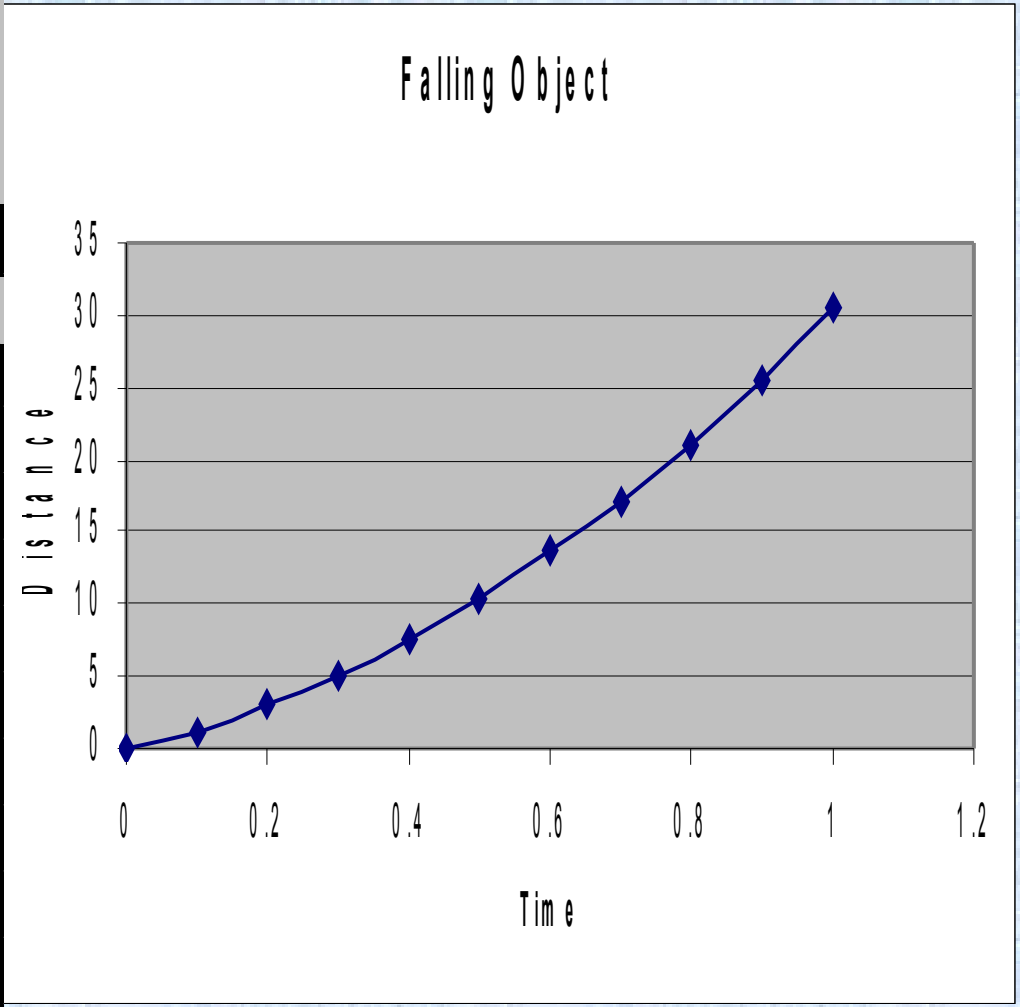
$$m_2 g - T = m_2 a$$

$$m_2 g - (m_1 a + \mu_k m_1 g) = m_2 a$$

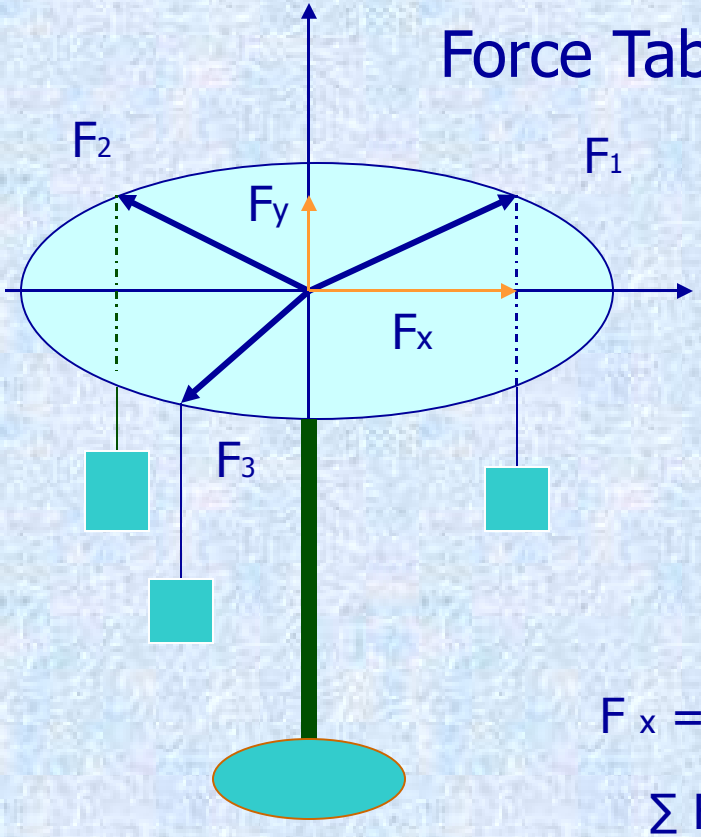
$$-\mu_k m_1 g = m_2 a - m_2 g + m_1 a$$

$$a = \frac{m_2 - \mu_k m_1 g}{m_1 + m_2}$$

Falling Object	
TIME	**DISTANCE**
(s)	(cm)
0	0
0.1	1.2
0.2	3
0.3	5.1
0.4	7.6
0.5	10.4
0.6	13.6
0.7	17.1
0.8	21.1
0.9	25.6



Vectors



Force Table

$$\sum \vec{F} = m\,\vec{a}$$

Equilibrium Condition

V = 0 m/s or V = constant

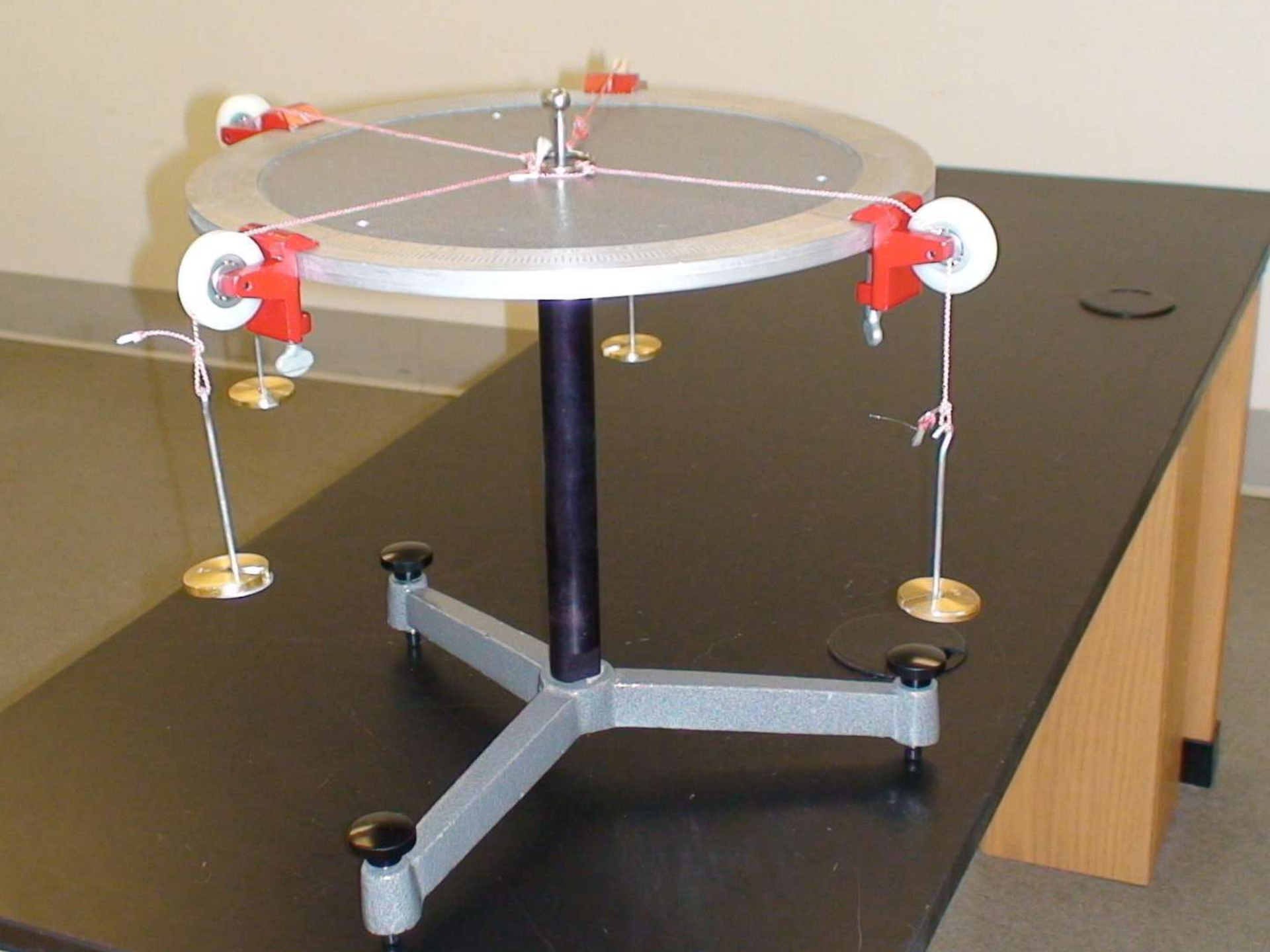
$$\vec{a} = \vec{0}\ m/s^2 \rightarrow \sum \vec{F} = \vec{0}$$

$$\vec{F} = \vec{F}_1 + \vec{F}_2 + \ldots\ldots = 0$$

$$\vec{F} = \vec{F}x + \vec{F}y$$

$$F_x = F\cos\phi \qquad F_y = F\sin\phi$$

$$\sum Fx = 0 \qquad \sum Fy = 0$$



Learning Outcomes at MDC

1. Communication
2. Quantitative Analysis
3. Critical/Creative Thinking and Scientific Reasoning
4. Information Literacy
5. Global, Cultural, and Historical Perspectives
6. Personal, Civic, and Social Responsibility
7. Ethical Thinking
8. Computer and Technology Usage
9. Aesthetic Appreciation
10. Natural Systems and the Environment