Name...Section Number.........

USEFUL INFORMATION

$$If \quad f(x) = kx^n \qquad \frac{df}{dx} = nkx^{n-1}$$

$$If \quad f(x) = kx^n \qquad \int f(x)dx = \frac{1}{n+1}kx^{n+1} + C$$

For the **SPECIAL CASE:**
 CONSTANT ACCELERATION IN ONE DIMENSION

$$v(t) = a_c t + v(0)$$

$$x(t) = \frac{1}{2}a_c t^2 + v(0)t + x(0).$$

$$v^2(t_2) - v^2(t_1) = 2a_c \left[x(t_2) - x(t_1) \right]$$

Please Note: The symbol g stands for the magnitude of the acceleration vector due to gravity and, as such, it is a positive quantity.

   Free Body Diagrams are very important
   Do Not Spend Too Much Time on Algebra!

1.

2.

3.

4.

1. (25 Points) A car is moving along a straight line defined to be the positive x direction. Its velocity is measured and found to be a function of time given by

$$v_x(t) = \alpha t^2$$

where α is a known constant. The car was at the point $x = A$ at the time $t = 2sec$. Find the car's position as a function of time. How fast would the car be going just before it hits a wall located at $x = L$?

**Law or Definition**

Application

Result

2. (25 Points) A block of mass m is moving on a horizontal surface. At $t = 0$ it is placed at the point $x = C$, $y = D$ and given the initial velocity of magnitude W and direction indicated by the angle θ. The forces on the block are such that the block's acceleration is

$$\vec{a} = \alpha \vec{i} + \beta t \vec{j}$$

where α and β are known constants. Obtain an equation for T, the time when $x(T) = y(T)$. Do not attempt to solve the equation.
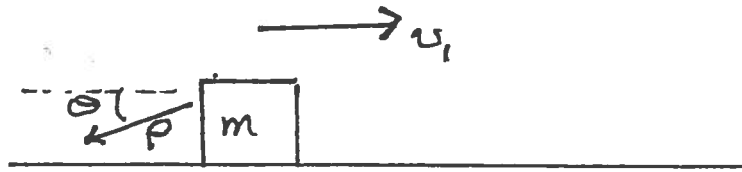
Law or Definition
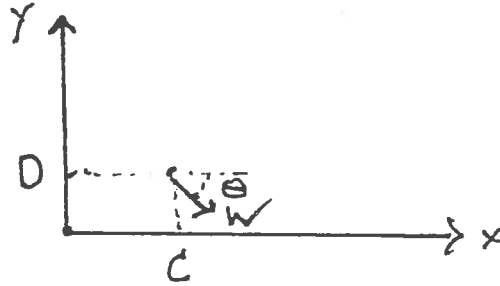
Application

Result

3. (25 Points) A block of mass m is moving on a frictionless surface with a constant velocity of magnitude v_1. A constant force $\vec{P}$ is then applied to the block at the known angle θ. How far will the block move before its velocity has magnitude $\frac{v_1}{2}$?
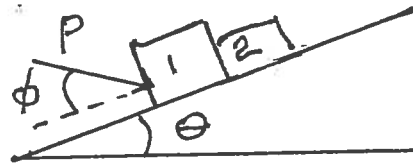

Free Body Diagram and Law or Definition

Application

Result

4. (25 Points) Two blocks, masses m_1 and m_2, are being pushed up an inclined plane by a force of magnitude P directed at the angle ϕ as shown. The plane is inclined at the angle θ. Find the force that block 1 exerts on block 2 assuming that the only friction is between block 1 and the plane with coefficient of friction μ.

Free Body Diagrams and Law or Definition

Application

Result