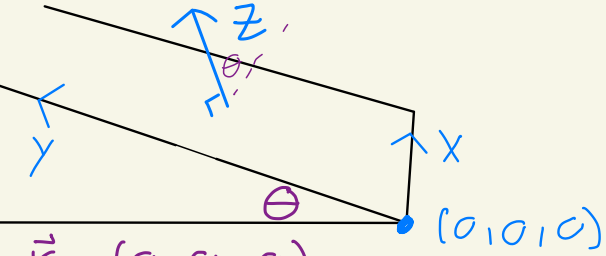
HW2 Q5 Setup

Steps

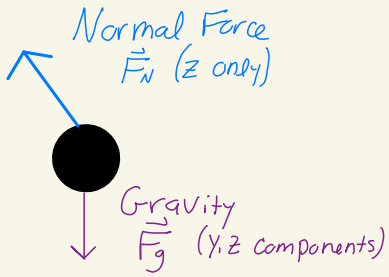
1) Draw a picture with axes
2) Draw a free body diagram with all forces
3) Write Newton's Law equation for each component
4) Write equation for acceleration for each component
5) Write equation for velocity for each component
6) Write equation for position for each component



$\vec{r}_0 = (0, 0, 0)$

$\vec{V}_0 = (V_{ox}, V_{oy}, 0)$

Initial Conditions



What directions have a net force?

Newton's Laws

$F_x = ma_x = m\ddot{x} = 0$

$F_y = ma_y = m\ddot{y} = -mg\sin\theta$

$F_z = ma_z = m\ddot{z} = F_N - mg\cos\theta = 0$

Position

$r_x = x = \int V_x dt = V_{ox}t + \not{C} = V_{ox}t$

$r_y = y = \int V_y dt = -\frac{g}{2}t^2\sin\theta + V_{oy}t + \not{C} = -\frac{g}{2}t^2\sin\theta + V_{oy}t$

$r_z = z = \int V_z dt = 0 + \not{C} = 0$

Acceleration

$a_x = \ddot{x} = F_x/m = 0$

$a_y = \ddot{y} = F_y/m = -g\sin\theta$

$a_z = \ddot{z} = F_z/m = 0$

Velocity

Constants of integration are usually initial conditions

$V_x = \dot{x} = \int a_x dt = 0 + \not{C} = V_{ox}$

$V_y = \dot{y} = \int a_y dt = -gt\sin\theta + \not{C} = -gt\sin\theta + V_{oy}$

$V_z = \dot{z} = \int a_z dt = 0 + \not{C} = 0$