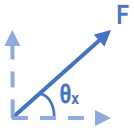
CONCEPT: INCLINED PLANES OR RAMPS

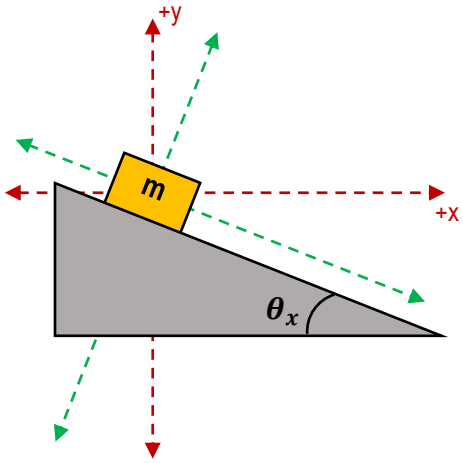
- When objects are on Inclined Planes, we "tilt" the X-Y plane to line up the new X-axis _____ to the incline's slope.
  - After "tilting", ____ MUST be decomposed.
  - Components of **mg** are _____ from the usual component EQs for Forces: **mg_x** goes with **[SIN | COS]**
    mg_y goes with **[SIN | COS]**



$F_x = F\cos(\theta_x)$
$F_y = F\sin(\theta_x)$

mg_x = _____
mg_y = _____

EXAMPLE: You release a 5kg block on a frictionless incline which is angled at 37° above the horizontal. **(a)** Draw the FBD. **(b)** Calculate the block's acceleration down the incline. **(c)** Write an expression for the Normal force.



INCLINED PLANES
1) Draw FBD
2) Tilt X & Y axes
3) Write $\Sigma F = ma$
4) Solve

- Acceleration on inclined planes *always* happens *only* on the ___ axis, since a_y = ___ (ΣF_y = ___)
  - If no other forces act on an object on an inclined plane, its acceleration depends *only* on **θ**:

a = _____
[No other Forces]

PROBLEM: A 4.0-kg box sits on a frictionless inclined plane that makes a 21° angle with the horizontal. It is held in place by a cord parallel to the plane. Calculate the tension in the cord.

A) 14 N
B) 37 N
C) 33 N
D) 21 N

INCLINED PLANES
1) Draw FBD
2) Tilt X & Y axes
3) Write $\boldsymbol{\Sigma F = ma}$
4) Solve

PROBLEM: Mountain highways sometimes have "runaway ramps" for large trucks whose brakes fail. If a truck is moving at 18 m/s, and the escape ramp has a 20% uphill grade, how long should the ramp be to bring the truck to a stop?

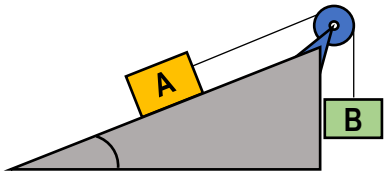
A) 338 m
B) 169 m
C) 84 m
D) 17 m

INCLINED PLANES
1) Draw FBD
2) Tilt X & Y axes
3) Write $\boldsymbol{\Sigma F = ma}$
4) Solve

● When incline angles are given as %, always convert it to a decimal and then to degrees: $\boldsymbol{\theta_x}(°)$ = _____

PROBLEM**:** In the figure, block A hangs from a cord that passes over a pulley and connects it to block B, sitting on a frictionless ramp**.** m_A=2 kg, m_B=5 kg, and θ=53°**.** What is the magnitude of the blocks' acceleration?

A) 4.8 m/s^2
B) 2.8 m/s^2
C) 6.5 m/s^2
D) 8.4 m/s^2



CONNECTED SYSTEMS ON INC. PLANES

1) Draw FBD (tilt x&y axes on inclines)
2) Choose direction of **+**
3) Write $\boldsymbol{\Sigma F = ma}$**,** start with simplest obj.
4) Solve $\boldsymbol{a}$ (EQ addition / substitution)
5) Plug $\boldsymbol{a}$ into EQs, solve other targets