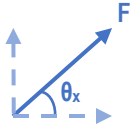


CONCEPT: INCLINED PLANES OR RAMPS

- 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 $\mathbf{mg}$ are _____ from the usual component EQs for Forces: $\mathbf{mg}_x$ goes with [**SIN** | **COS**]
 $\mathbf{mg}_y$ goes with [**SIN** | **COS**]



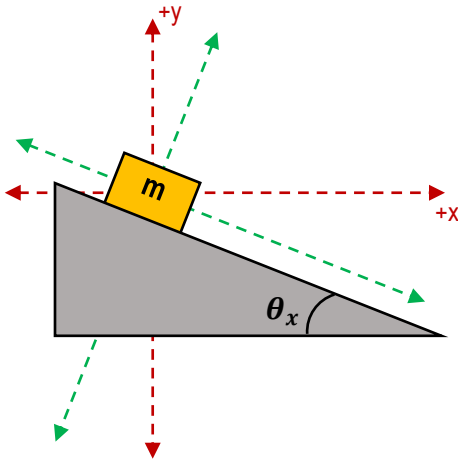
$$F_x = F \cos(\theta_x)$$

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

$$mg_x = \underline{\hspace{2cm}}$$

$$mg_y = \underline{\hspace{2cm}}$$

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 $a_y = \underline{\hspace{1cm}}$ ($\Sigma F_y = \underline{\hspace{1cm}}$)

- If no other forces act on an object on an inclined plane, its acceleration depends only on θ :

$$a = \underline{\hspace{2cm}}$$

[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 $\Sigma F = ma$
- 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

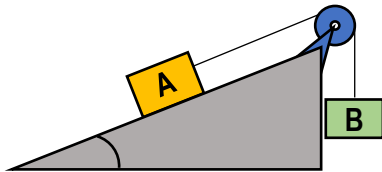
- 1) Draw FBD
- 2) Tilt X & Y axes
- 3) Write $\Sigma F = ma$
- 4) Solve

- When incline angles are given as %, always convert it to a decimal and then to degrees:

$$\theta_x(^{\circ}) = \underline{\hspace{2cm}}$$

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 $\theta=53^\circ$. 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

- | |
|--|
| <ul style="list-style-type: none">1) Draw FBD (tilt x&y axes on inclines)2) Choose direction of +3) Write $\Sigma F = ma$, start with simplest obj.4) Solve a (EQ addition / substitution)5) Plug a into EQs, solve other targets |
|--|