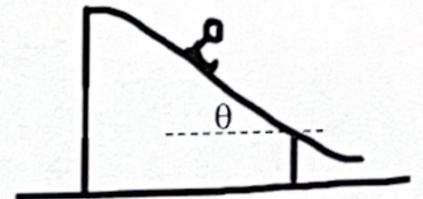


Inclines and Propulsion

As stated on the syllabus:

- You may consult posted solutions for help. If doing so, first write a * at the point in your work where you look at the solutions (every time). After looking at the solutions, close them or move to another room to continue your work.
- You must use the solutions to check your completed work for correctness. Correctly re-do anything you missed.
- No writing of any kind is ever allowed while the solutions are visible to you.

1) A child (m_c) is going down a playground slide. The slide is at an angle θ as shown. Simplify the situation with the assumption that friction is negligible. Complete the steps below to derive expressions for the acceleration of the child a_{cx} and the magnitude of the normal force n in terms of given variables and fundamental constants.

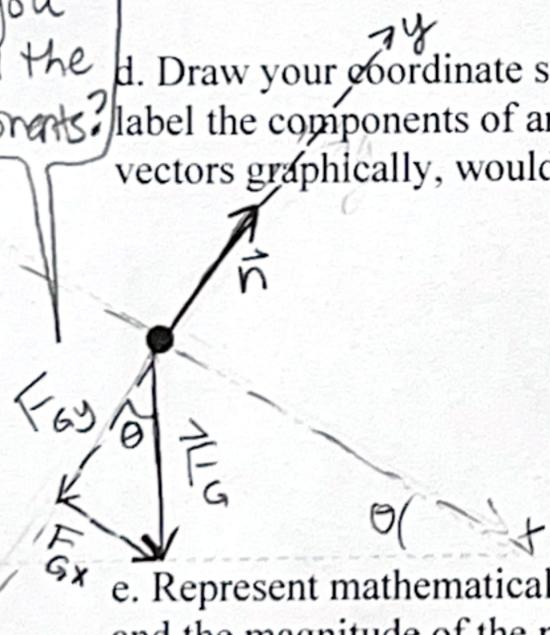


a. Draw a coordinate system on the picture.

b. Sort the cards. Draw a motion diagram on the picture above.

d. Draw your coordinate system on the dot below. Then draw a force diagram. Clearly draw and label the components of any force vectors that are not aligned with an axis. If you added up the force vectors graphically, would the sum of the forces point down the incline? yes

Did you label the components?



\vec{F}	by ___ on ___	F_x	F_y
\vec{n}	slide on child	$n_x = 0$	$n_y = +n$
\vec{F}_g	Earth on child	$F_{gx} = F_g \sin \theta$	$F_{gy} = -F_g \cos \theta$

e. Represent mathematically and derive the symbolic expressions for the acceleration of the child and the magnitude of the normal force.

also: $F_g = m_c g$

Write Newton's Second Law

$$a_{cx} = \frac{\sum F_{oncx}}{m_c}$$

Put in components from organizer

$$a_{cx} = \frac{+F_g \sin \theta}{m_c}$$

$F_g = m_c g$, so put this in for F_g

$$a_{cx} = \frac{m_c g \sin \theta}{m_c}$$

Simplify. Mass doesn't matter!

$$a_{cx} = g \sin \theta$$

$$a_{cy} = \frac{\sum F_{oncy}}{m_c}$$

$$0 = \frac{+n + (-F_g \cos \theta)}{m_c}$$

$$F_g \cos \theta = n$$

$$m_c g \cos \theta = n$$

f. Check extreme cases:

- If $\theta = 0^\circ$ (no incline at all), what do you get for n and a_{cx} ?
- If $\theta = 90^\circ$, what do you get for n and a_{cx} ?

$$a_{cx} = g \sin(0) = 0$$

$$n = m_c g \cos 0 = m_c g$$

$$a_{cx} = g \sin(90) = g$$

$$n = m_c g \cos 90 = 0$$

Do you know why the accel came out to be $+g$ and not $-g$?

2. In your textbook, read and comprehend "Example 7.1" and "Propulsion" on pp.161-163.

3. A car is initially at rest. The car is the system. You push on the gas pedal, causing the car to accelerate to the right. While the car is accelerating,

- a. What object in the environment is exerting the force on the car that is causing it to accelerate to the right? the Road (or you could say the ground or earth)
- b. What is the direction of this force? right
- c. Is this force static friction or kinetic friction? static friction