You can draw here

GET READY: Go here and make sure you see the "Are you Ready" Sli.do Q
Canvas -> Course Content -> Lecture (under Week 4 - Chapter 4)

Physics 111 - Lecture 5

October 8, 2020

Do not draw in/on this box!

You can draw here

You can draw here

Reminders/Announcements

- Test 2 starts today from 6PM - Saturday at 6 PM
- Next week there will be no new content
  - Lecture will be an office hour …
  - Tutorials and labs will go on …
- You should:
  - Catch your breath, breathe, relax
  - Focus on midterms for other courses
  - Review any material that was confusing
  - Start looking ahead to HW06 and beyond (if you have time)

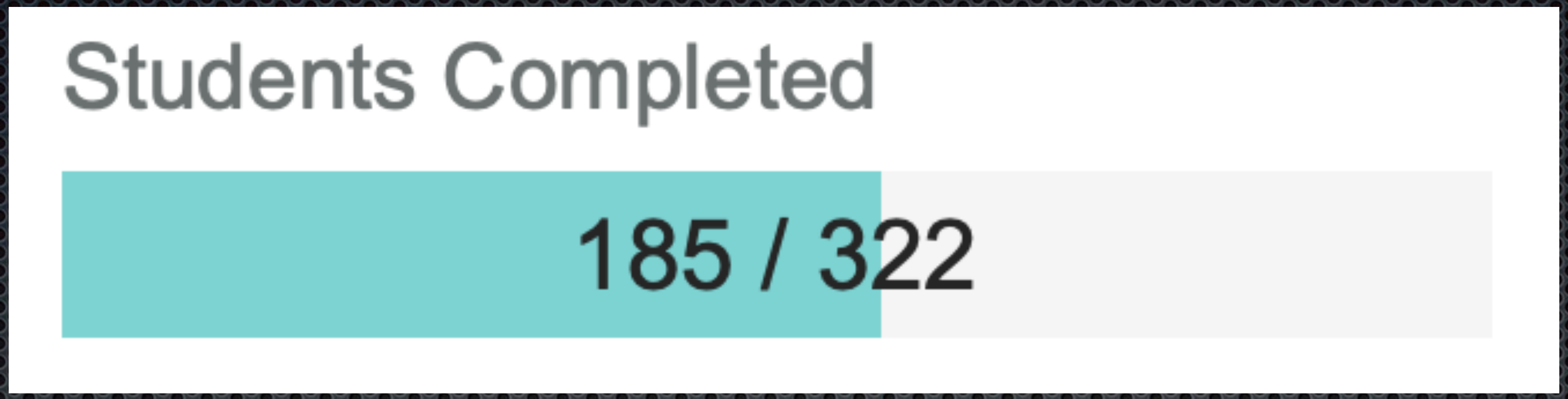
Course Schedule

Week #	Week	Readings	Homework	Test	Bonus Test (Optional)
1	September 7-13	About this course	Math Diagnostic		
2	September 14-20	Chapter 2: Kinematics in 1 D	Chapter 2 HW	Test 0: Course policies	
3	September 21-27	Chapter 3: Vectors and Coordinate Systems	Chapter 3 HW	Test 1: Chapters 2 & 3	
4	September 28 - Oct 4	Chapter 4: Kinematics in 2D	Chapter 4 HW		Bonus Test 1
5	October 5 - 11	Chapter 5: Force and Motion	Chapter 5 HW	Test 2: Chapters 4 & 5	
6	October 12 - 18	Rest and Catchup (no new material)	No HW		
7	October 19 - 25	Chapter 6: Dynamics I: Motion along a line	Chapter 6 HW		Bonus Test 2

Reminders/Announcements

	Homework (due Wed 6 pm)	Test/Bonus Test (Thurs 6pm - Sat 6pm)	Learning Log (Fri 6pm)
Week 1	-	-	-
Week 2	HW01 - Intro to Mastering Physics	Test 0 **(not for marks)**	Learning Log 1 **(yes for marks!)**
Week 3	HW02 - Chapter 2 HW03 - Chapter 3	Test 1 (on Chapters 2 & 3)	Learning Log 2
Week 4 (this week!)	HW04 - Chapter 4	Bonus Test 1	Learning Log 3
Week 5	HW05 - Chapter 5	Test 2 (on Chapters 4 and 5)	Learning Log 4
Week 6	N/A	N/A	Learning Log 5
Week 7	HW06 - Chapter 6	Bonus Test 2	Learning Log 6

Summary of comments from Homework 5 (Chapter 5)



Well done! A new record! 😊

- Mostly straight forward stuff, most errors were from not reading question carefully

- Graphs related to object motion are confusing

- Drawing free body diagrams

- Direction of friction and drag forces

- Scales in elevators are VERY confusing

Summary of comments from Homework 5 (Chapter 5)

- Mostly straight forward stuff, most errors were from not reading question carefully
- Graphs related to object motion are confusing
- Drawing free body diagrams
- Direction of Friction
- Scales in elevators are VERY confusing

“Quote of the week” QOTW

(anonymous)
Submitted at 10/04/20 11:56 pm

`Pearsons vector drawing is annoying` 😠😠😠

Chapter 5
Clicker Questions

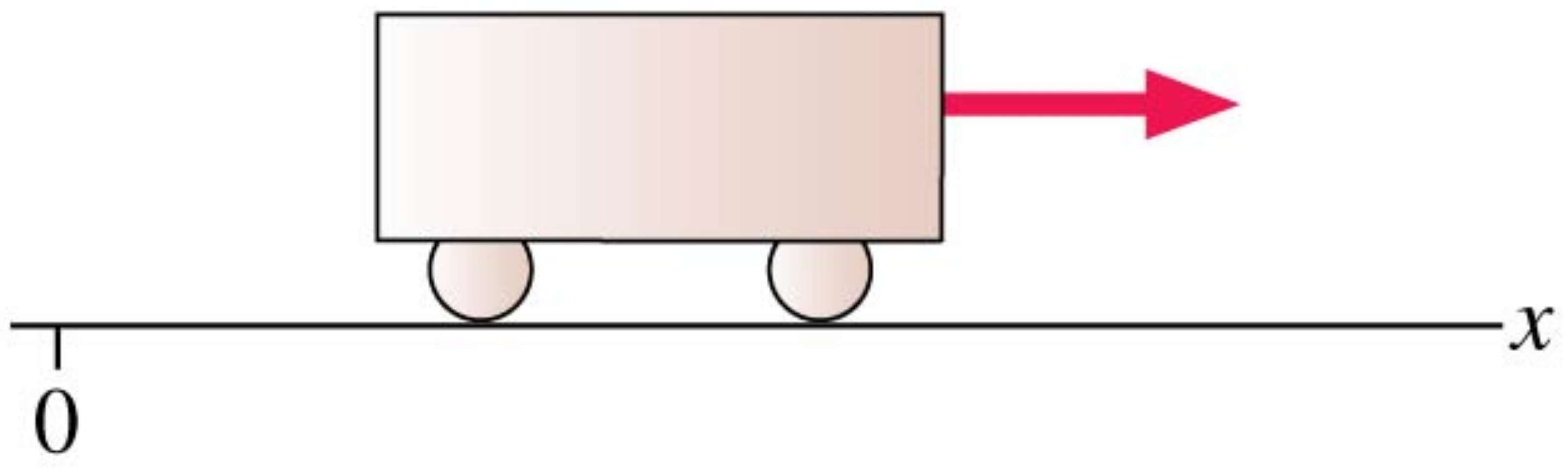
QuickCheck 5.4

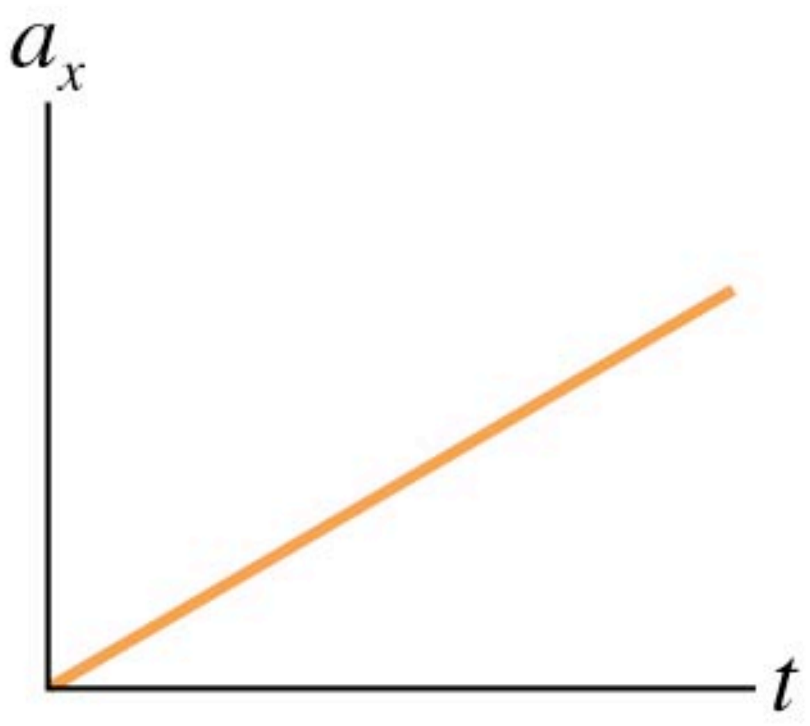
A book rests on a horizontal table. Gravity pulls down on the book. You may have learned something in a previous physics class about an upward force called the “normal force.” Deep in your heart, do you really believe the table is exerting an upward force on the book?

A. Yes, I’m quite confident the table exerts an upward force on the book.
B. No, I don’t see how the table can exert such a force.
C. I really don’t know.

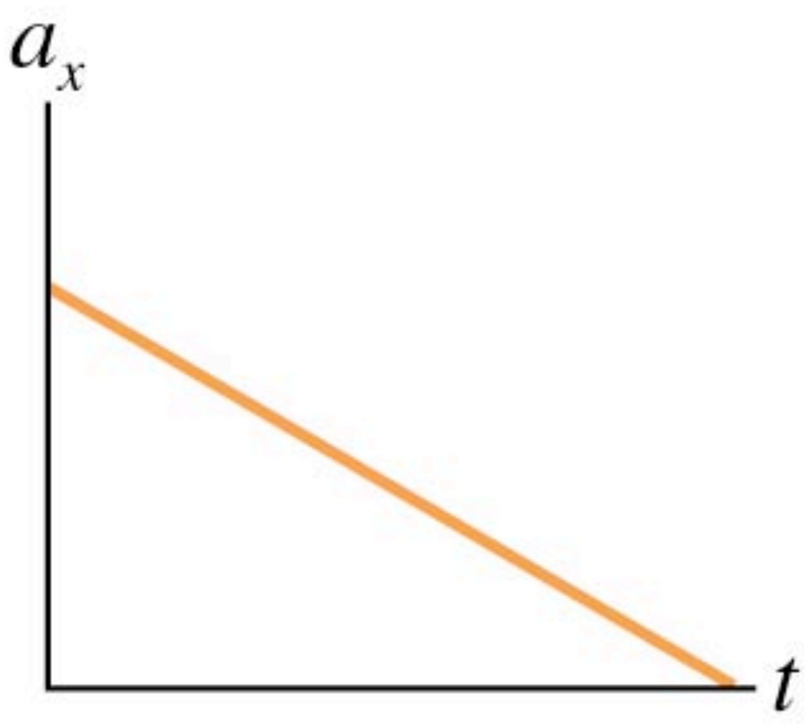
QuickCheck 5.6

A cart is pulled to the right with a constant, steady force. How will its acceleration graph look?

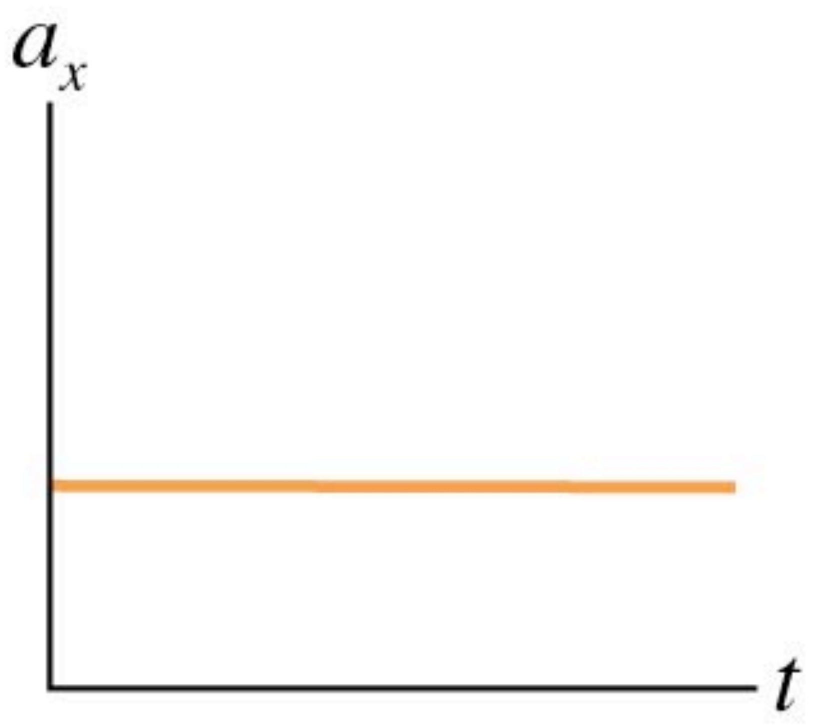




A.



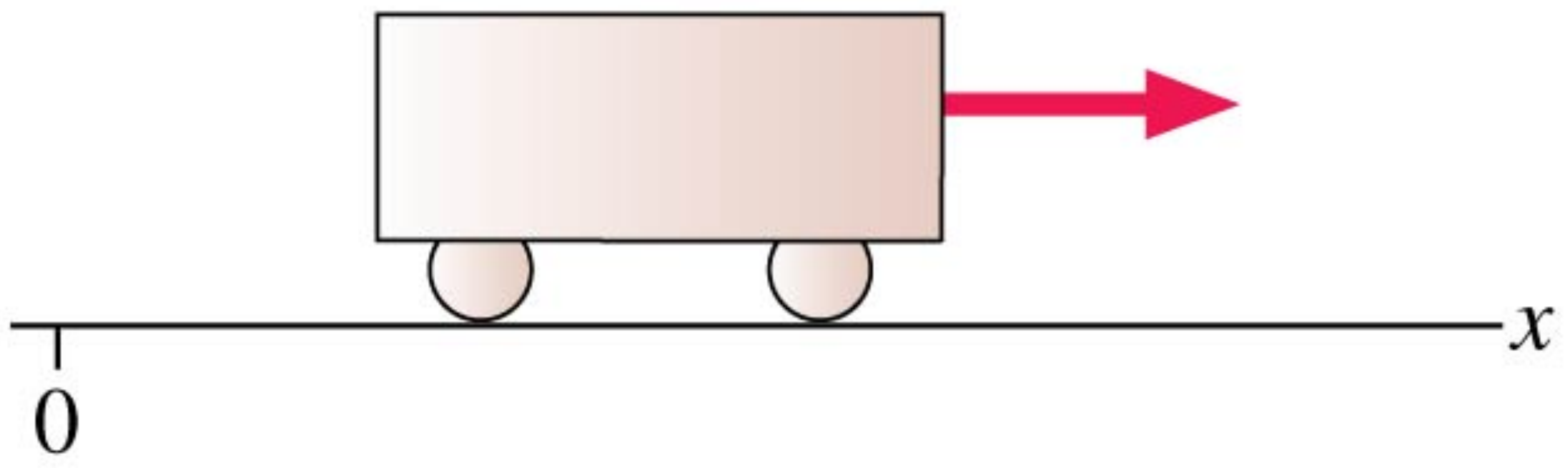
B.

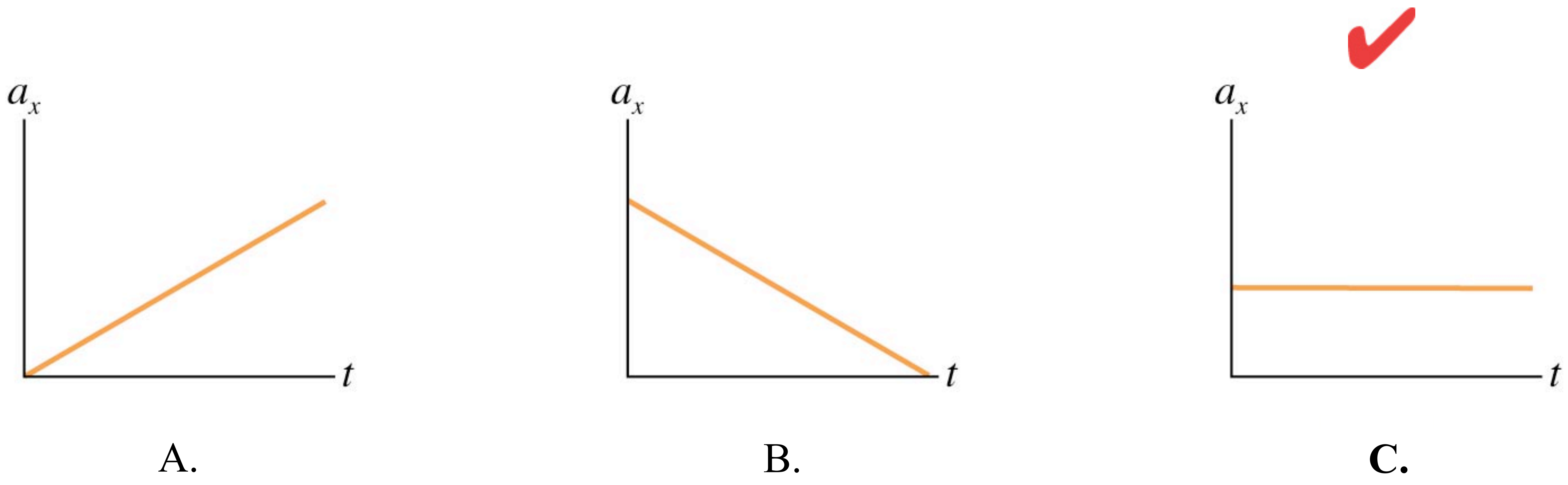


C.

QuickCheck 5.6

A cart is pulled to the right with a constant, steady force. How will its acceleration graph look?

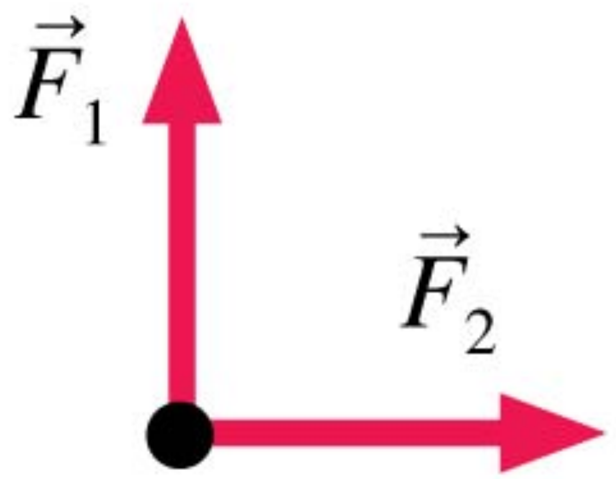




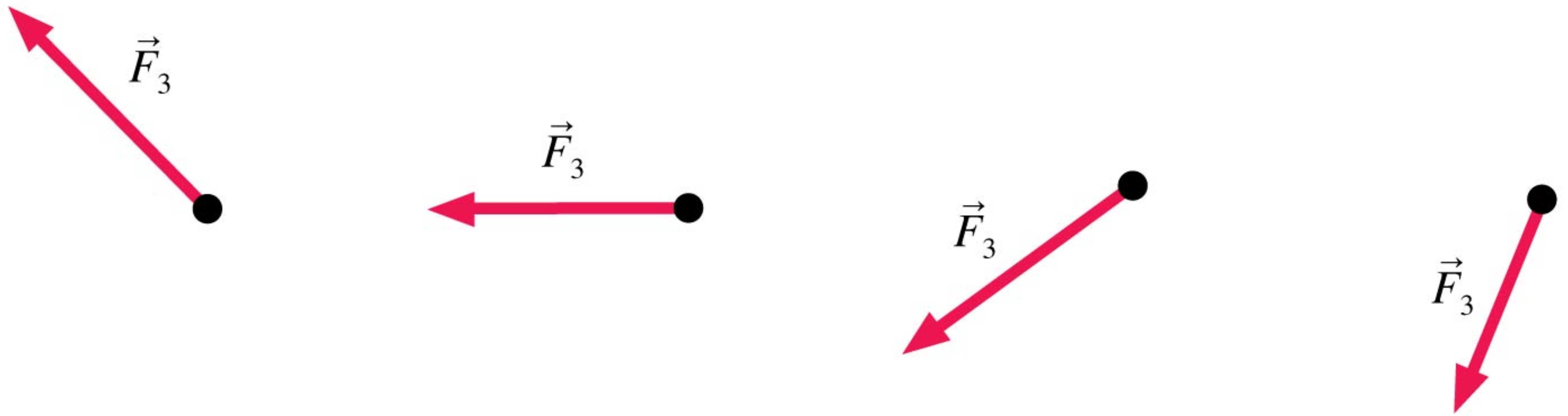
A constant force produces a <u>constant</u> acceleration.

QuickCheck 5.2

The net force on an object points to the left. Two of three forces are shown. Which is the missing third force?



Two of the three forces exerted on an object



A. B. C. D.

QuickCheck 5.2

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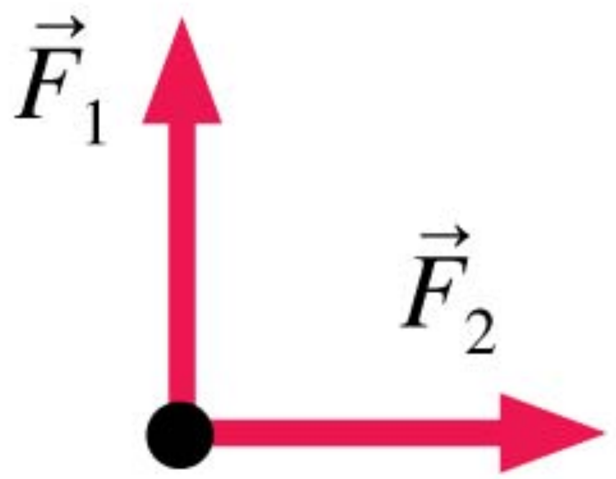
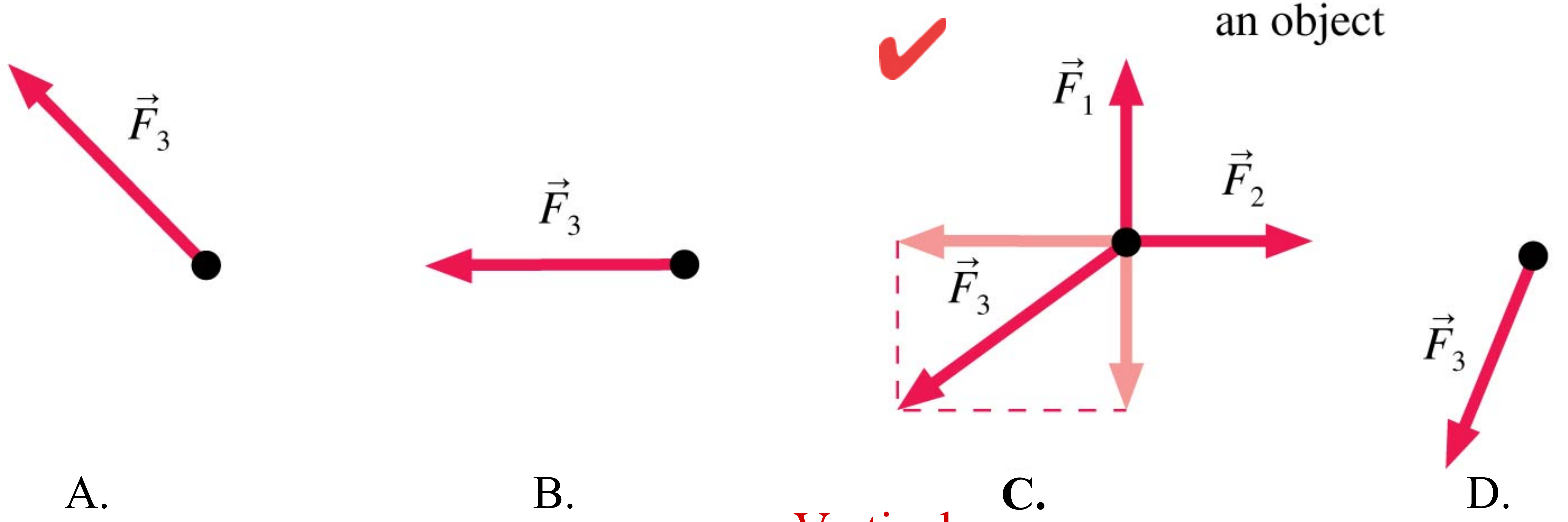


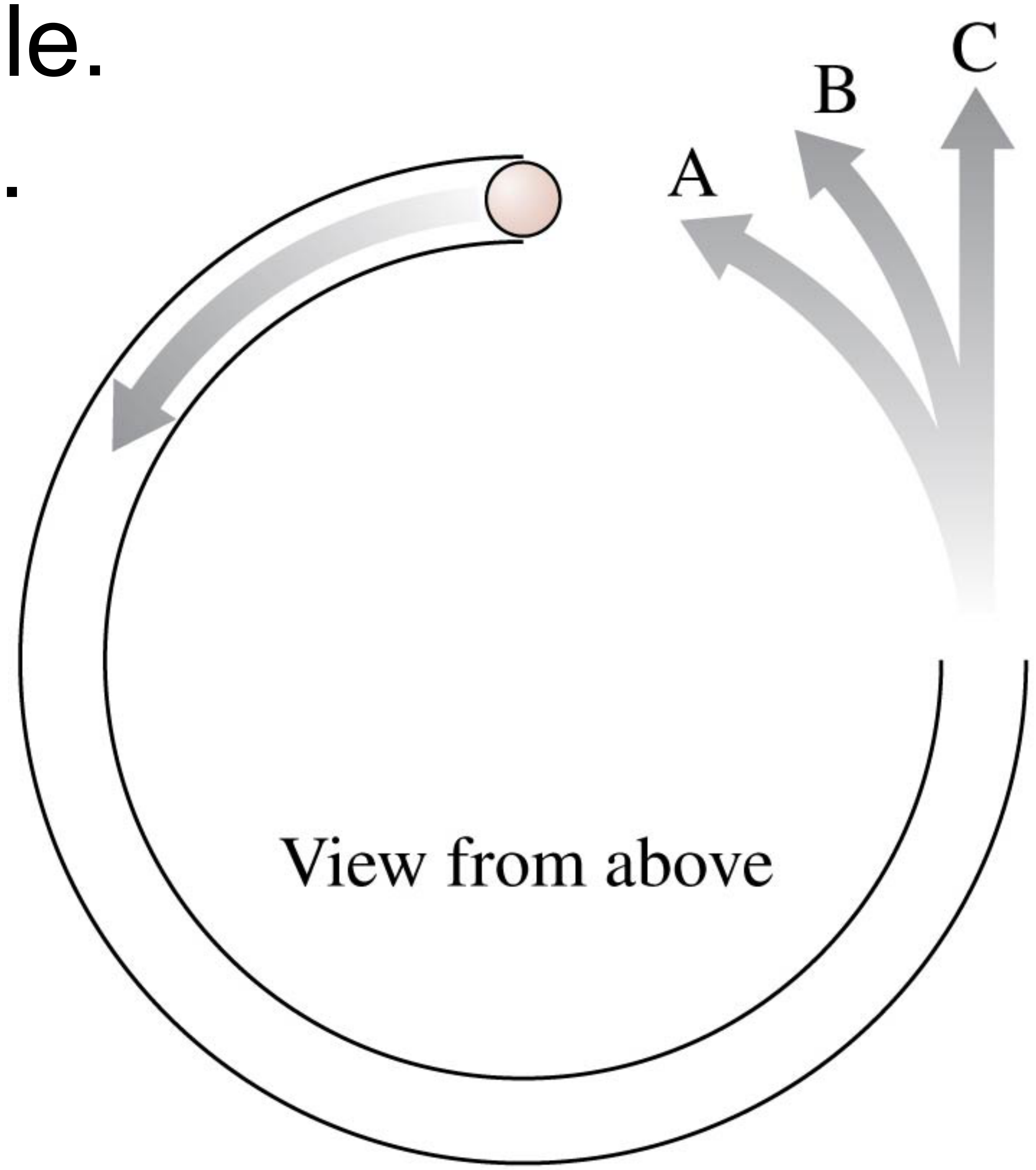
Two of the three forces exerted on an object



Vertical components cancel

QuickCheck 5.10

A hollow tube lies flat on a table. A ball is shot through the tube. As the ball emerges from the other end, which path does it follow?



QuickCheck 5.10

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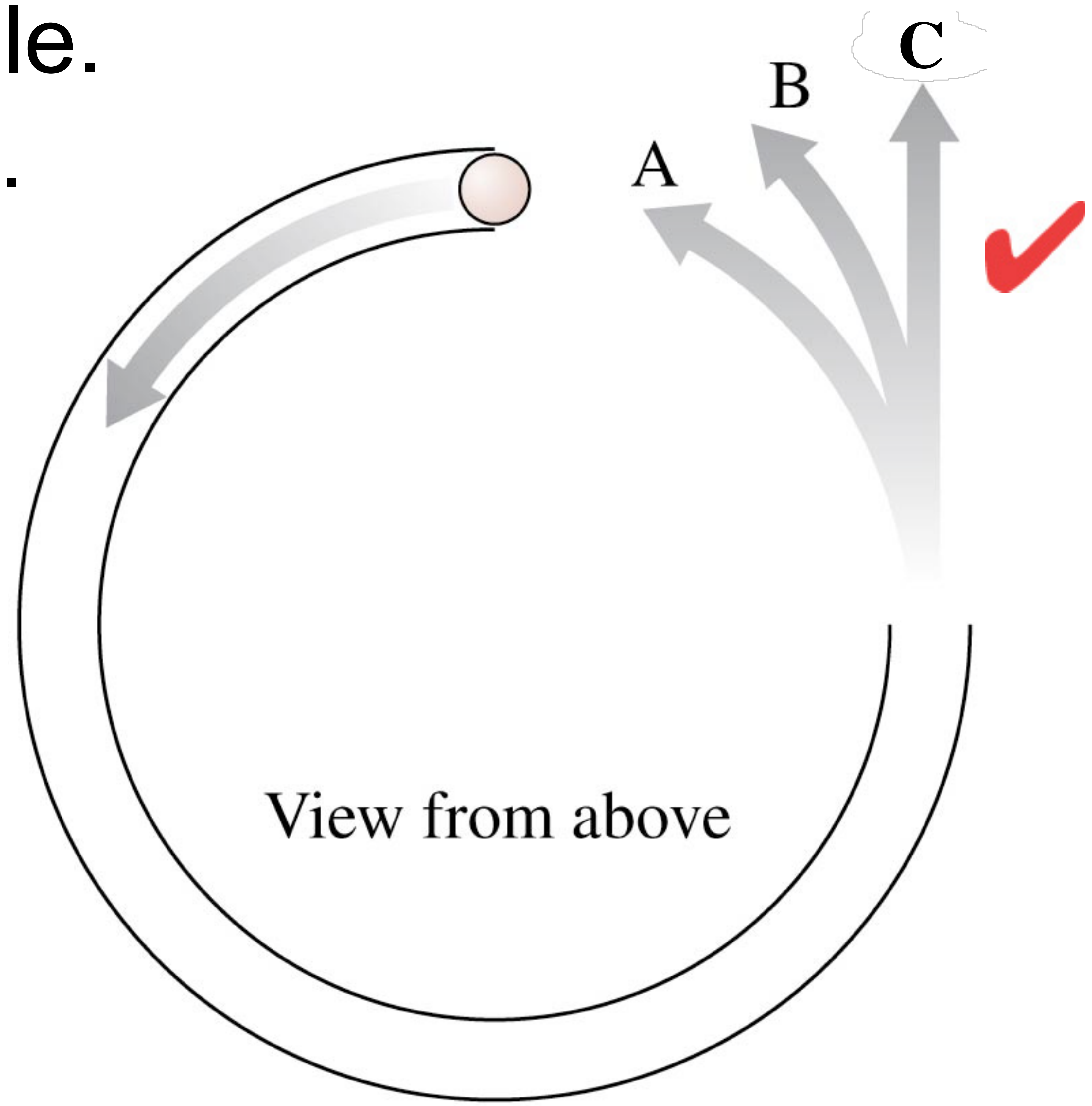


QuickCheck E1

A person is standing in an elevator on top of a weighing scale. The person has a mass of 60kg.

What is the reading on the scale?

A) 710 N

B) 590 N

C) 470 N

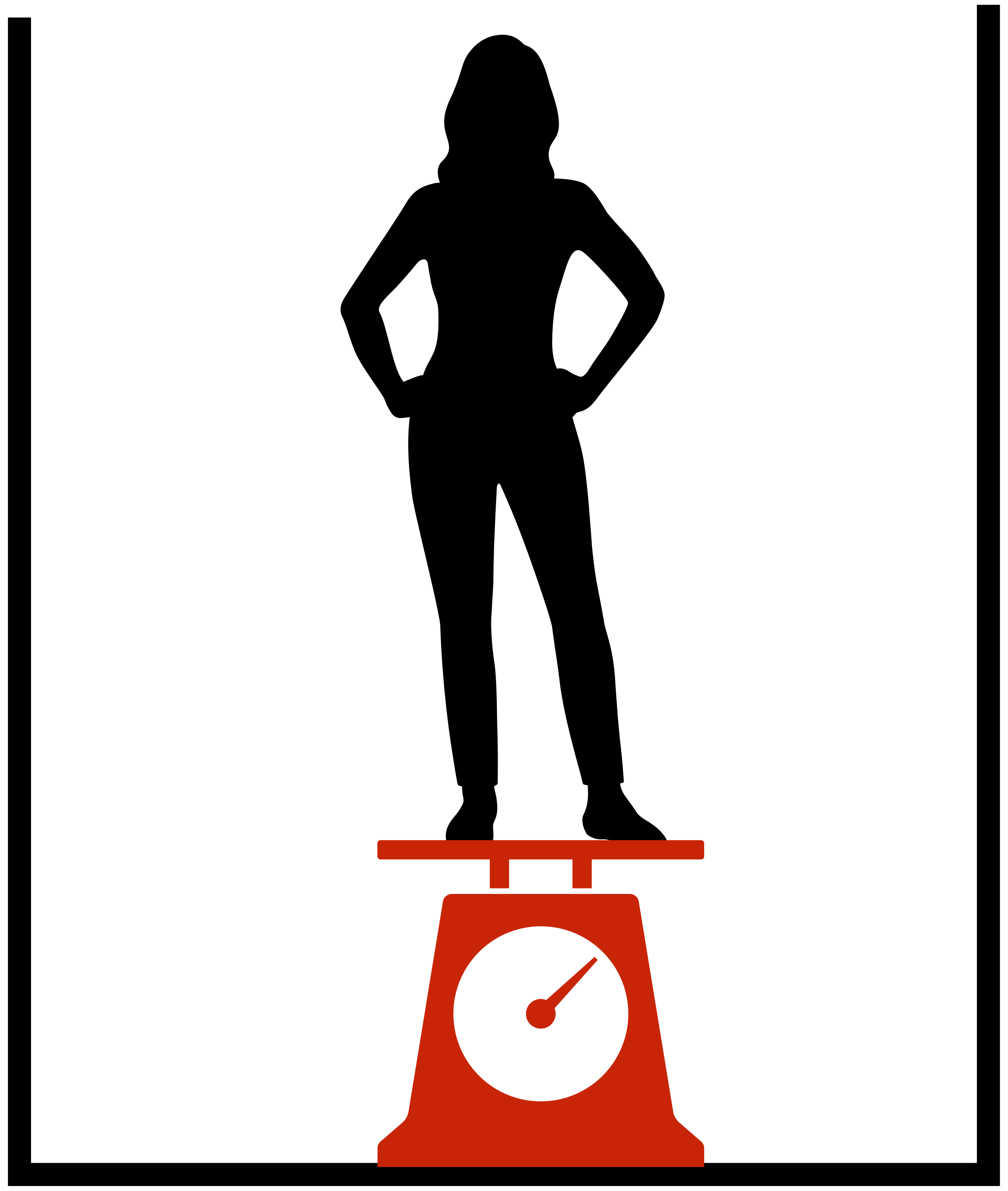
D) 440 N

E) 0 N or I don't know

Elevator at rest

$$\vec{a} = 0$$

$$\vec{v} = 0$$



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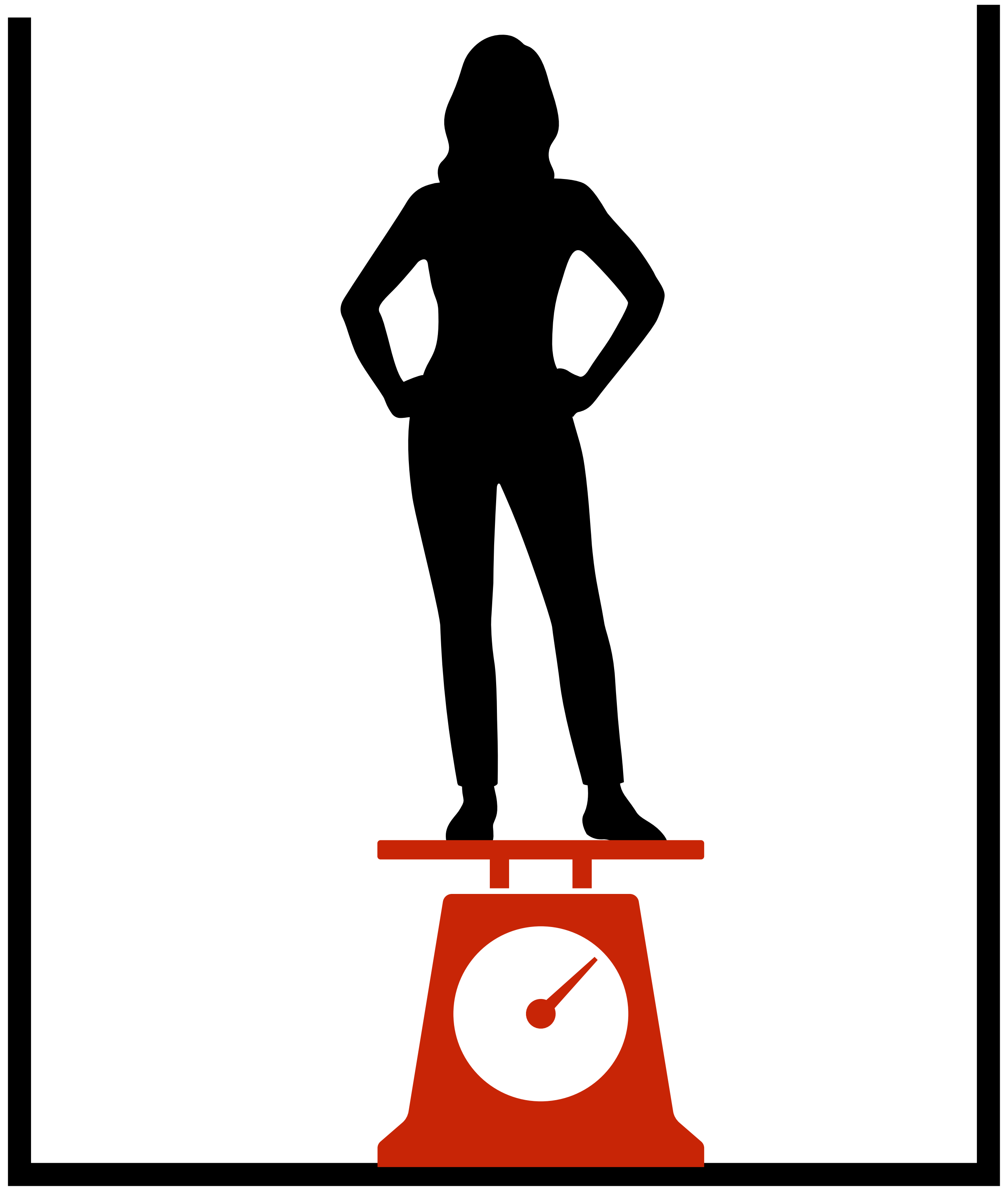


QuickCheck E2

A person is standing in an elevator on top of a weighing scale. The person has a mass of 60kg.

What is the reading on the scale?

A) 710 N

B) 590 N

C) 470 N

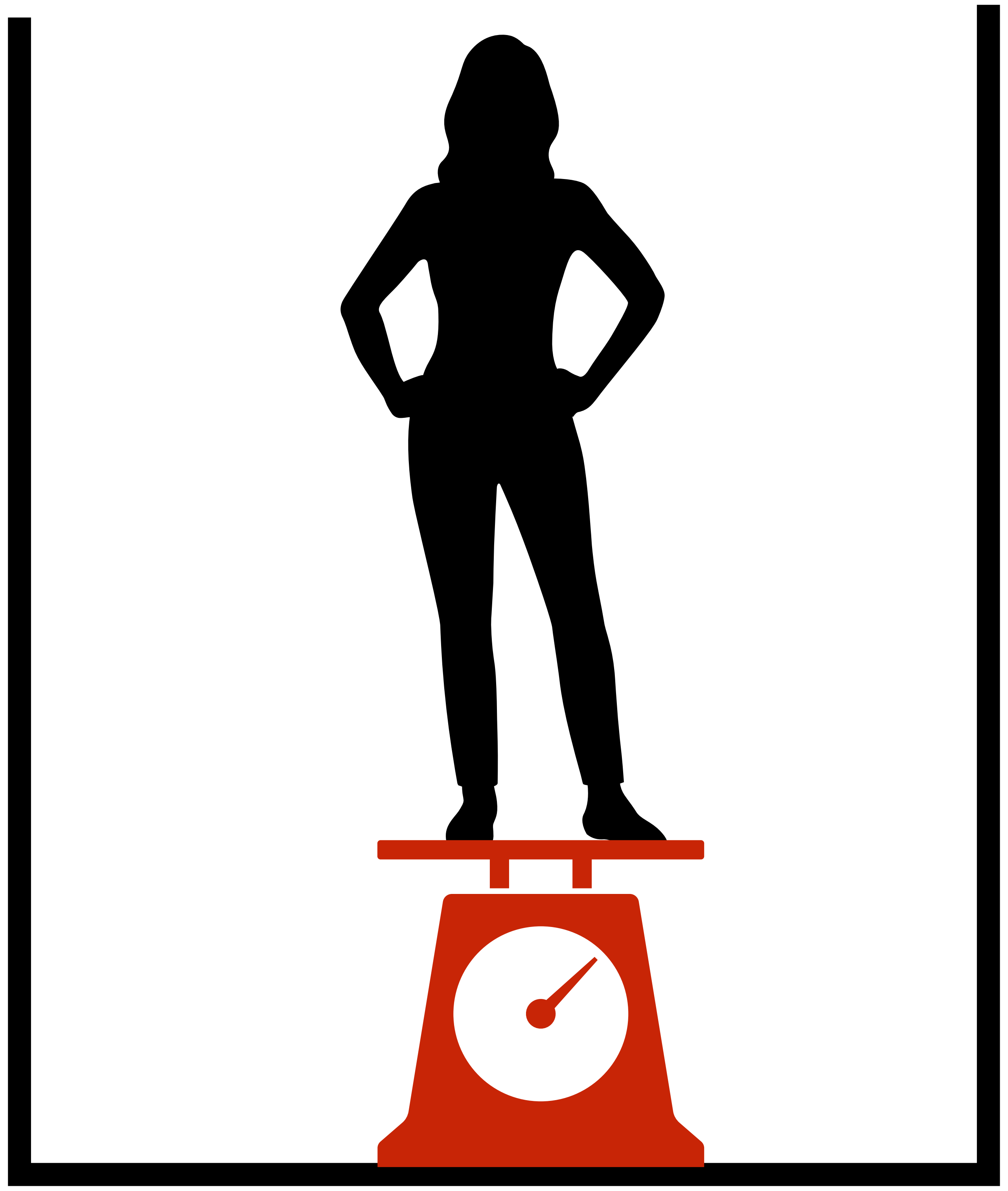
D) 440 N

E) 0 N or I don't know

Elevator moving up

$$\vec{a} = 0$$

$$\vec{v} = +3m/s$$



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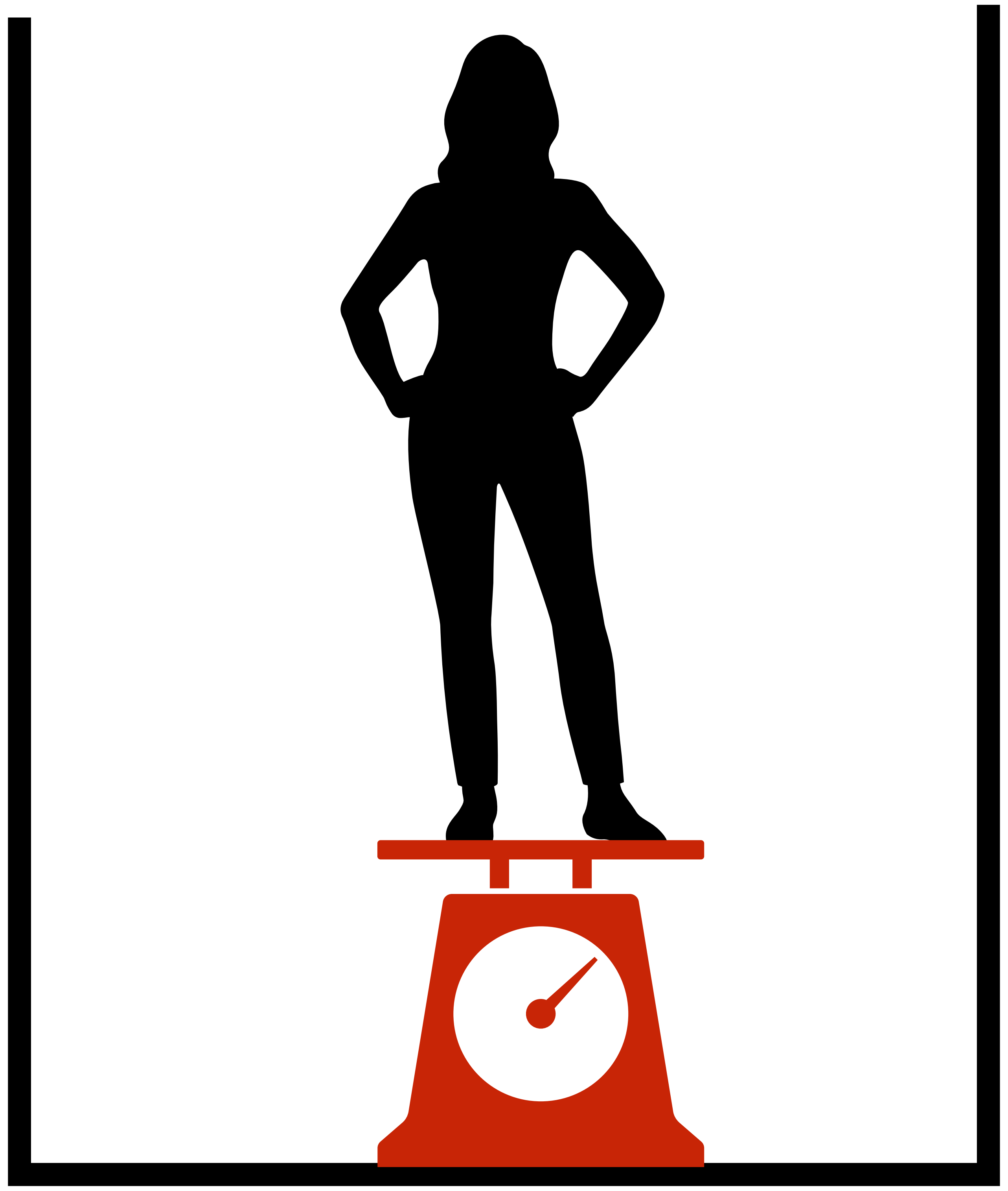


QuickCheck E3

A person is standing in an elevator on top of a force scale. The person has a mass of 60kg.

What is the reading on the scale (in N)?

A) 710 N

B) 590 N

C) 470 N

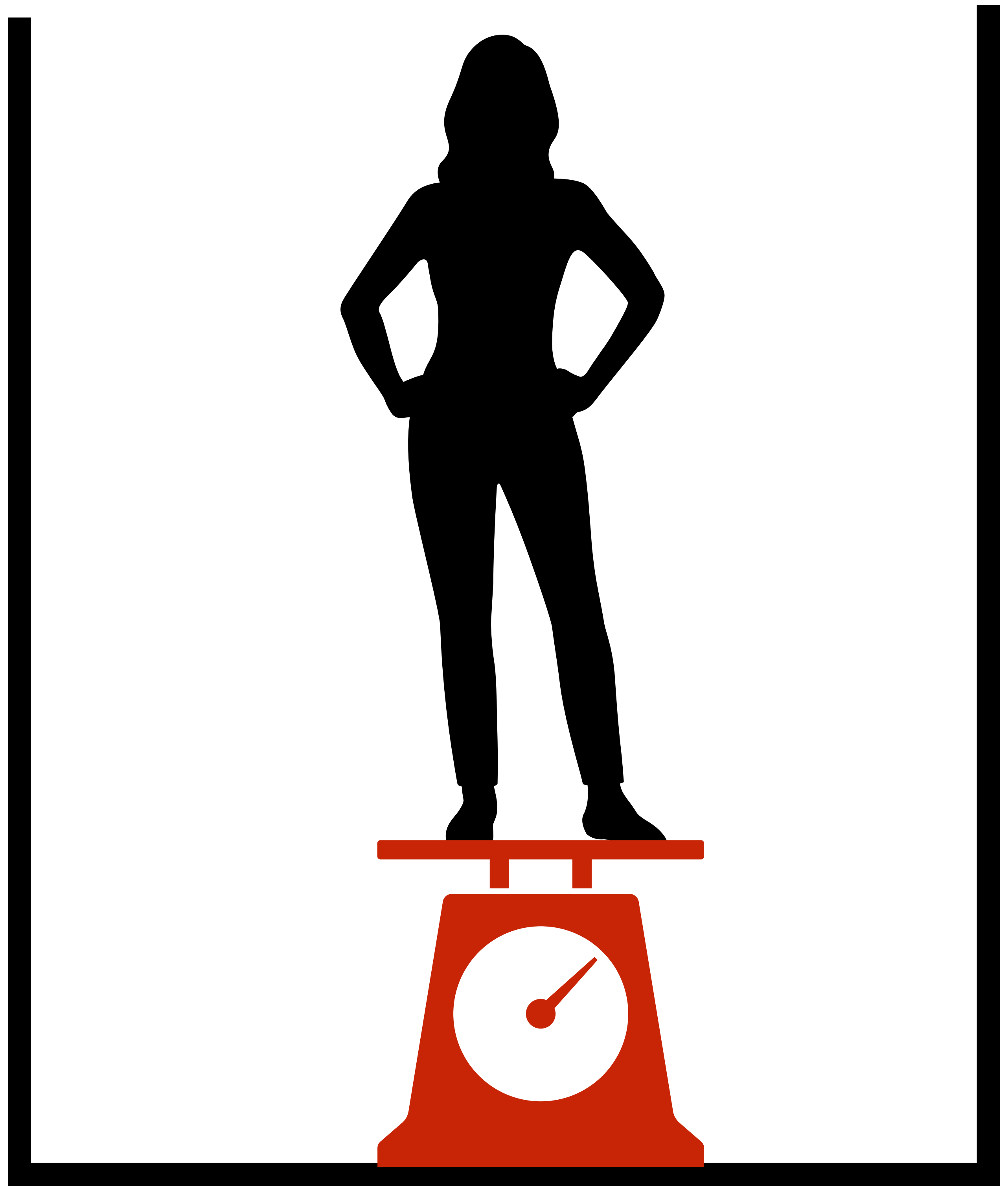
D) 440 N

E) 0 N or I don't know

Elevator accelerating UP

$$\vec{a} = 2m/s^2$$

$$\vec{v} = \text{variable}$$



QuickCheck E3

A person is standing in an elevator on top of a force scale. The person has a mass of 60kg.

What is the reading on the scale (in N)?

- A) 710 N
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- C) 470 N
- D) 440 N
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Elevator accelerating UP

$$\vec{a} = 2m/s^2$$

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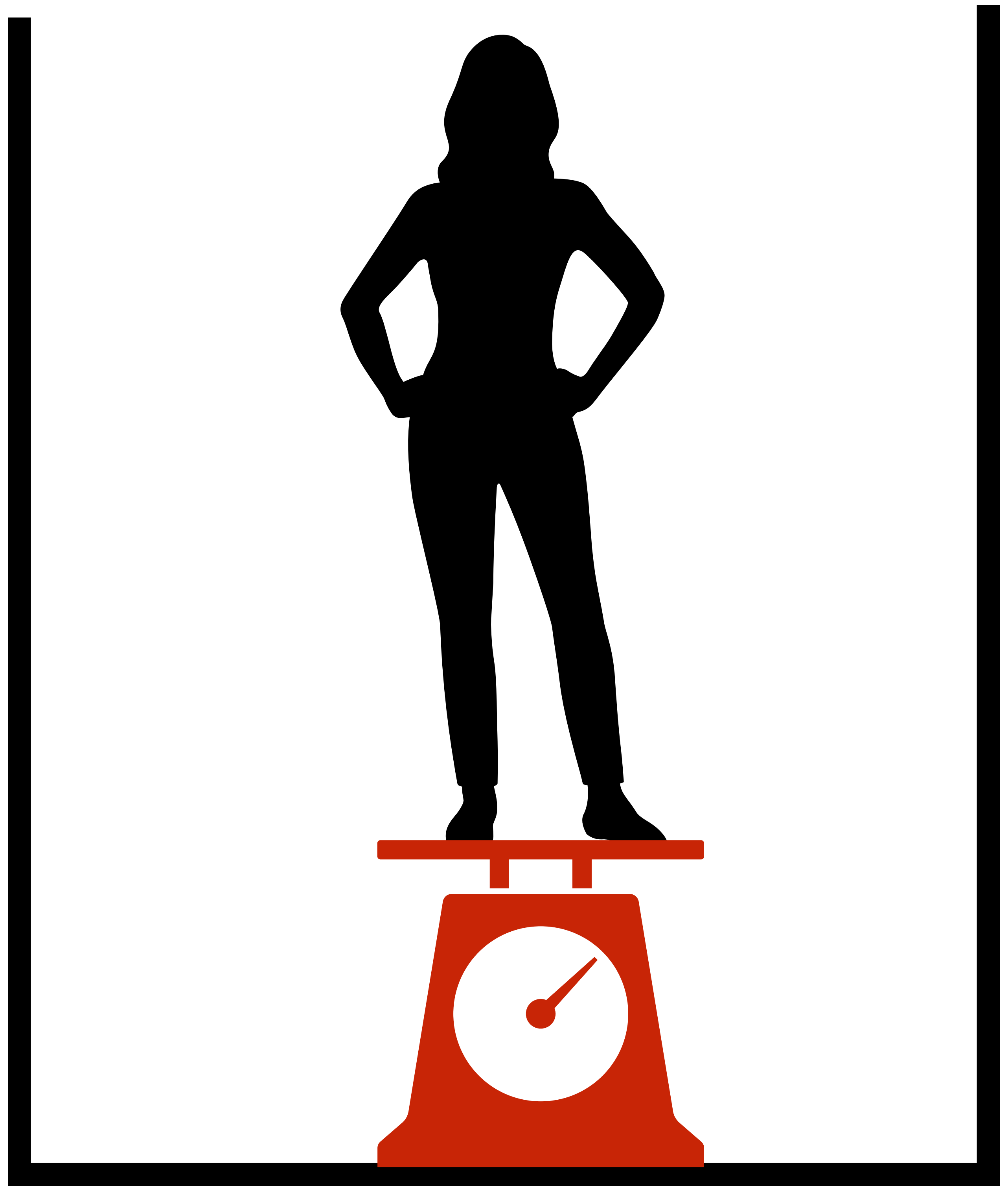


QuickCheck E4

A person is standing in an elevator on top of a force scale. The person has a mass of 60kg.

What is the reading on the scale (in N)?

A) 710 N

B) 590 N

C) 470 N

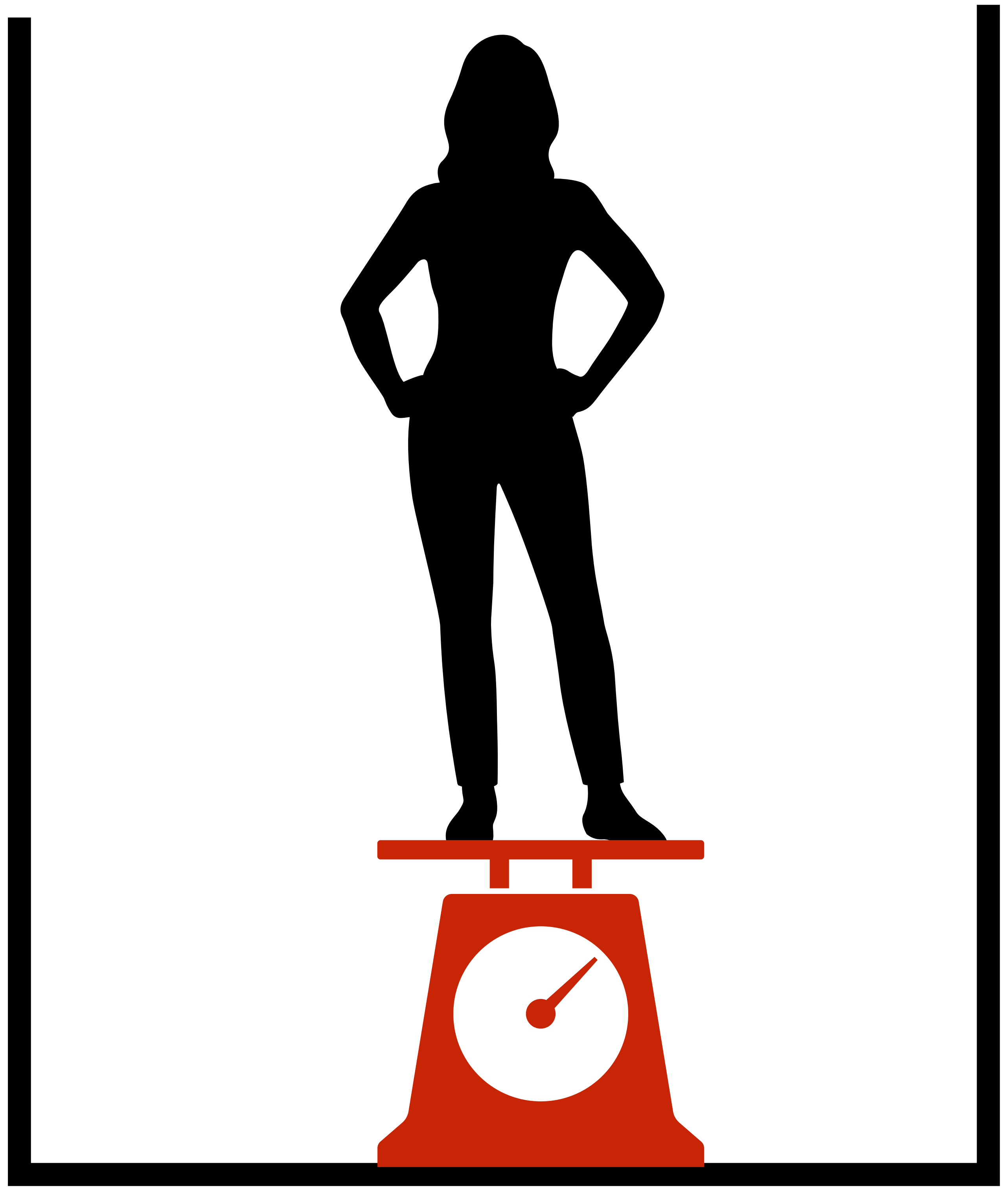
D) 440 N

E) 0 N or I don't know

Elevator accelerating down

$$\vec{a} = -2m/s^2$$

$$\vec{v} = \text{variable}$$



QuickCheck E4

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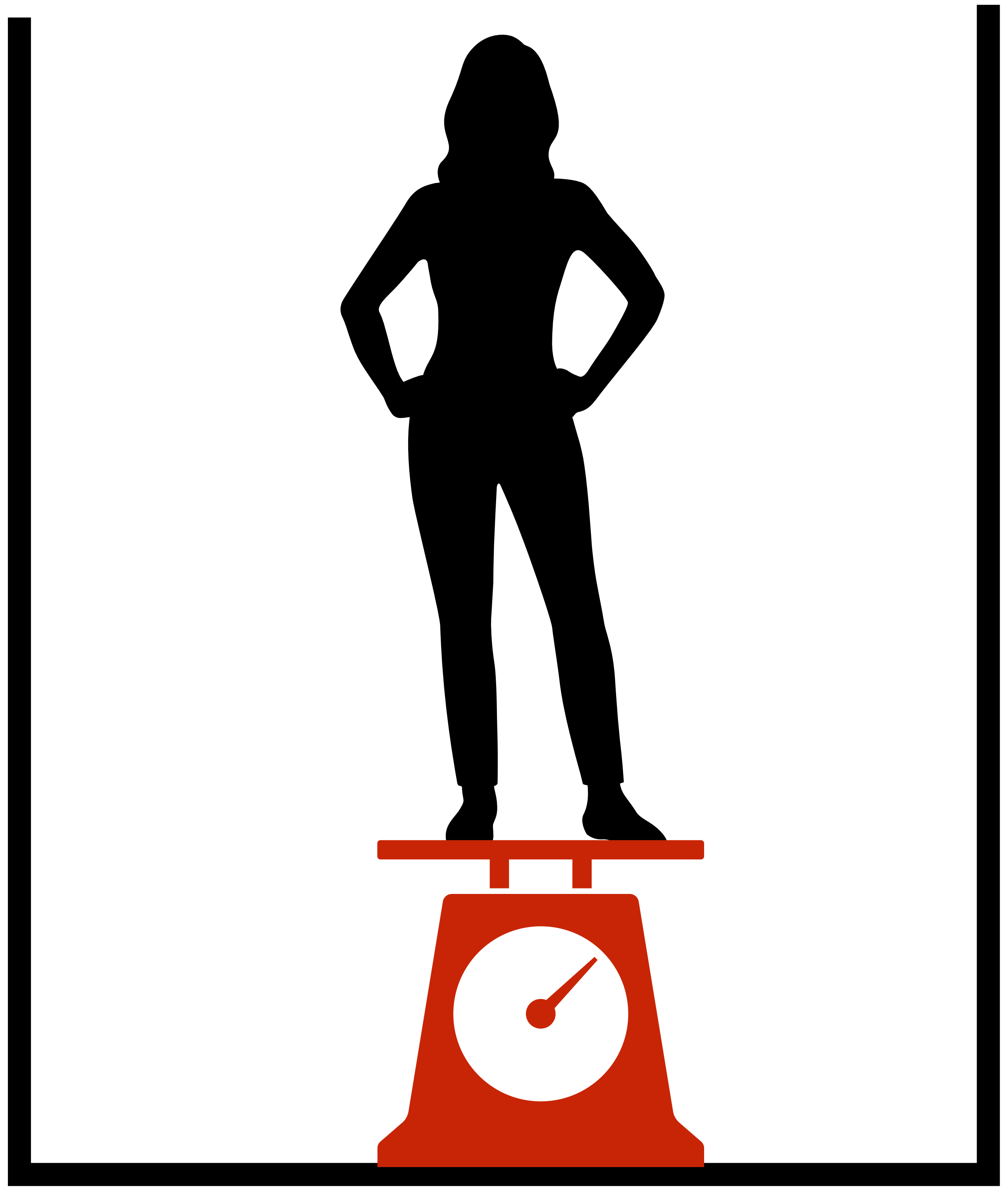


QuickCheck E5

A person is standing in an elevator on top of a force scale. The person has a mass of 60kg.

What is the reading on the scale (in N)?

A) 710 N

B) 590 N

C) 470 N

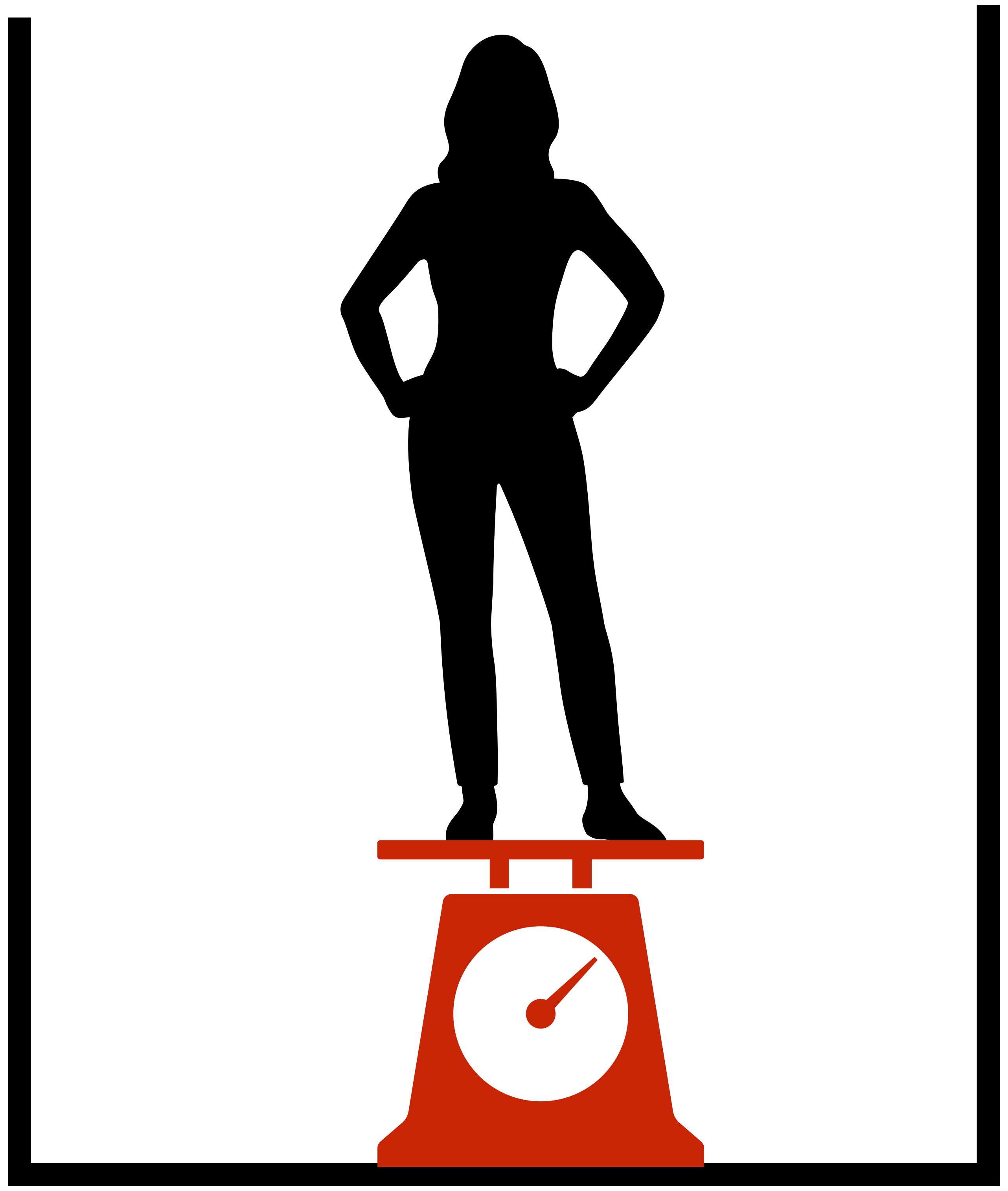
D) 440 N

E) 0 N or I don't know

Elevator cable is cut!

$\vec{a}$ = pain

$\vec{v}$ = fast



QuickCheck E5

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What is the reading on the scale (in N)?

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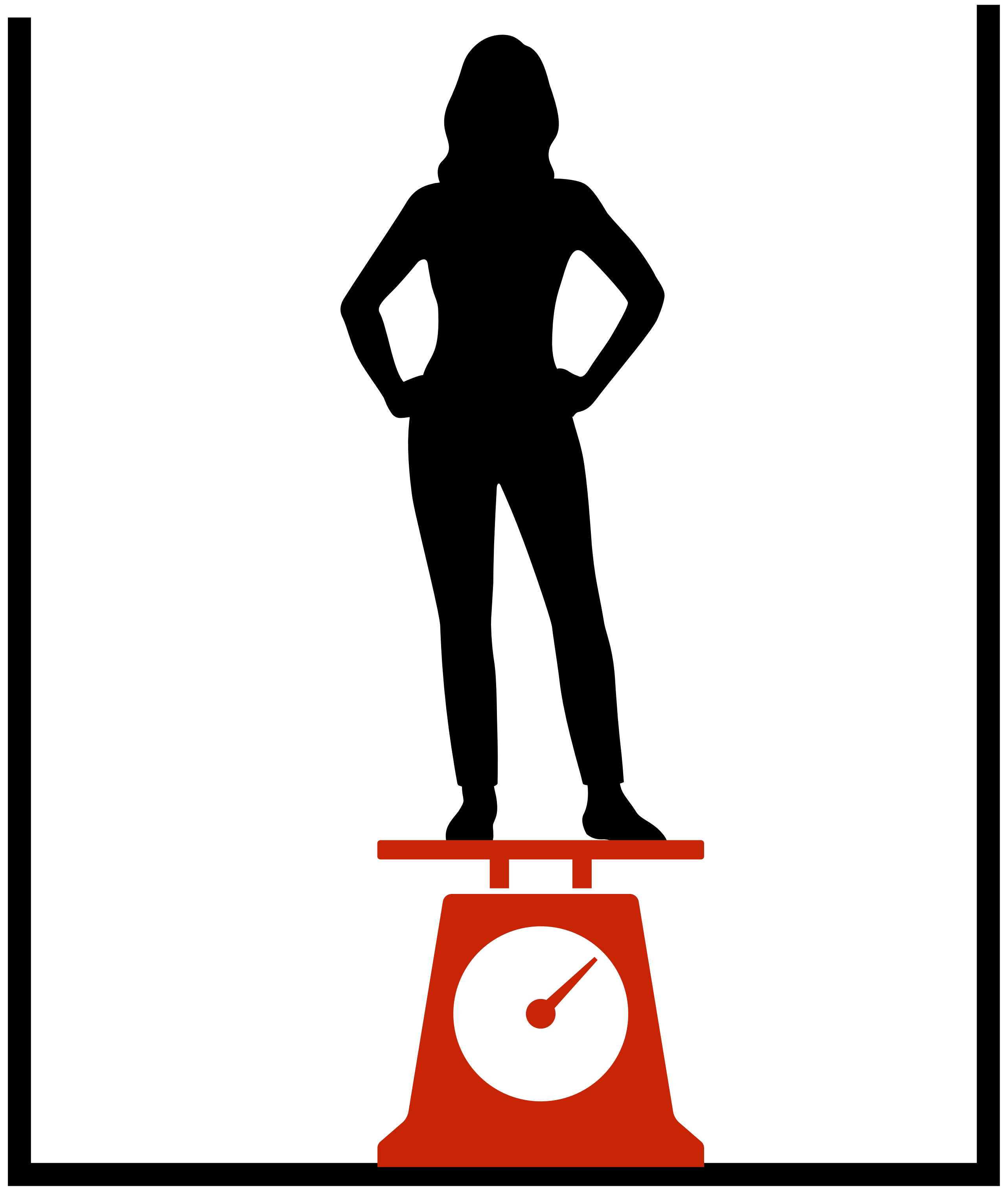


Chapter 5
Important Concepts

General Principles

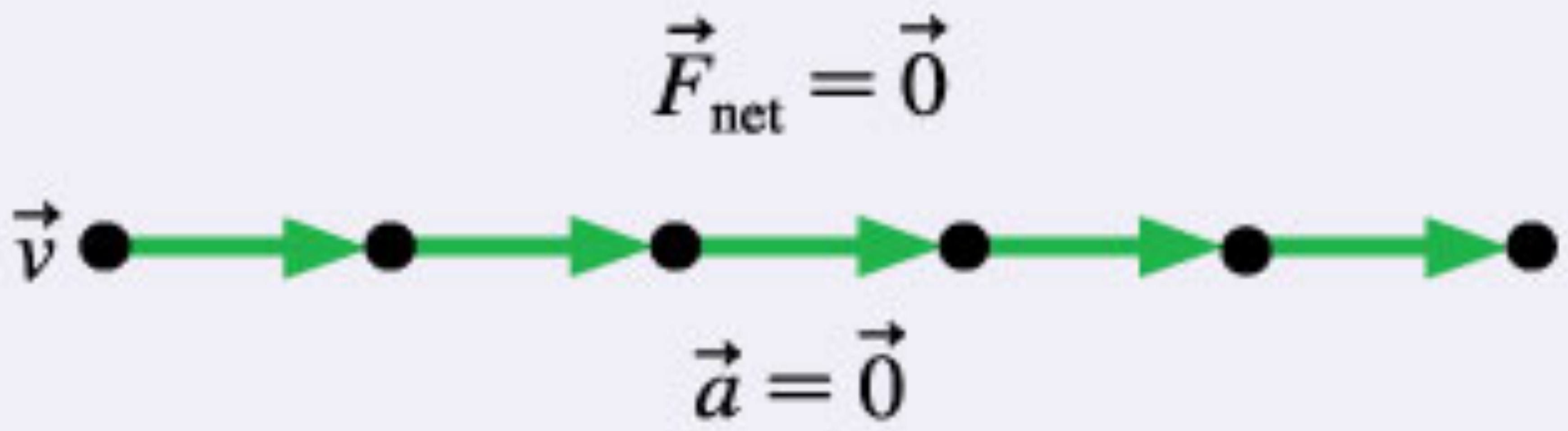
Newton's Zeroth Law

An object responds only to forces acting on it *at this instant*.

General Principles

Newton's First Law

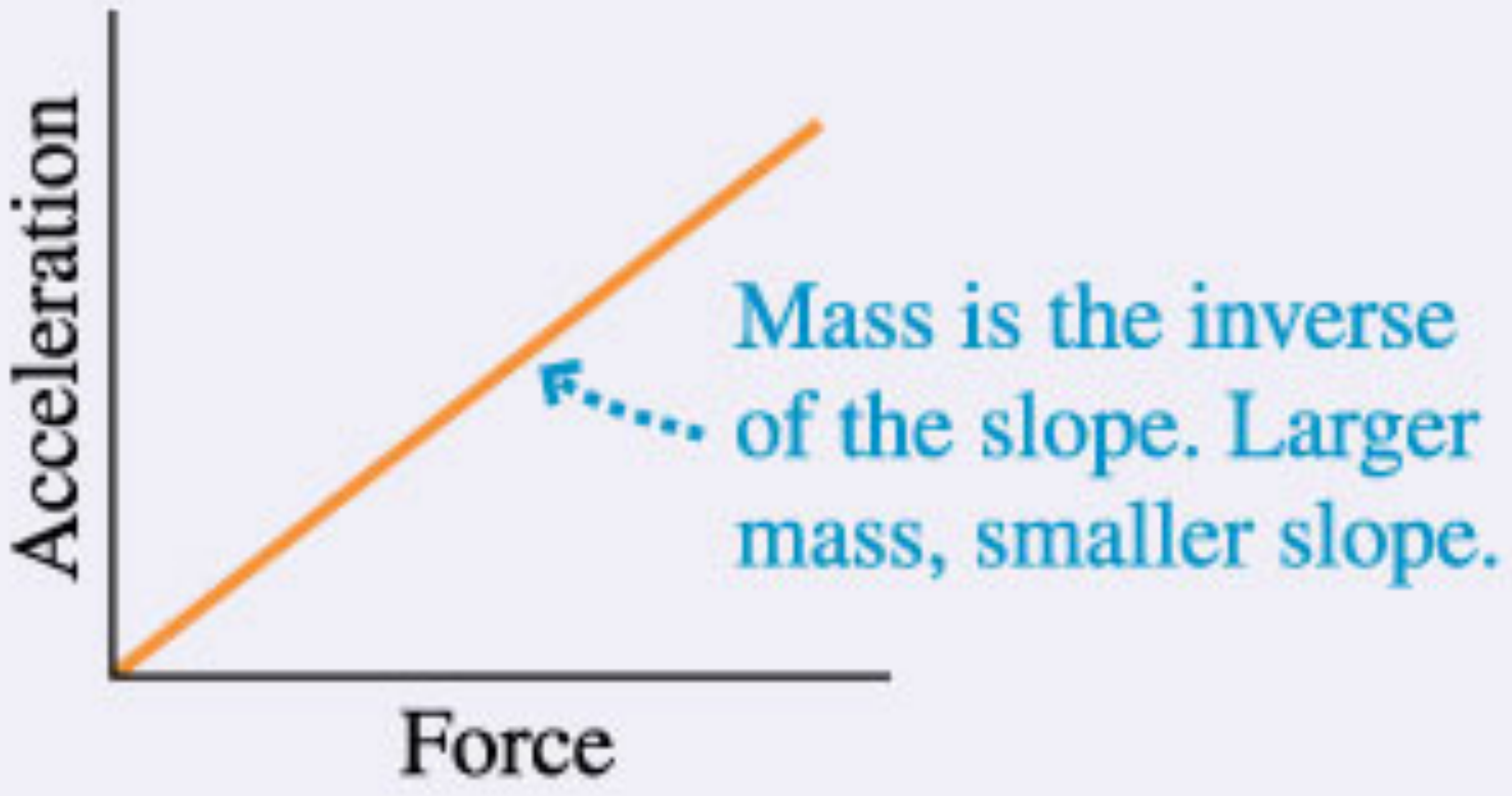
An object at rest will remain at rest, or an object that is moving will continue to move in a straight line with constant velocity, if and only if the net force on the object is zero.



The first law tells us that no "cause" is needed for motion. Uniform motion is the "natural state" of an object.

Important Concepts

Mass is the resistance of an object to acceleration. It is an intrinsic property of an object.



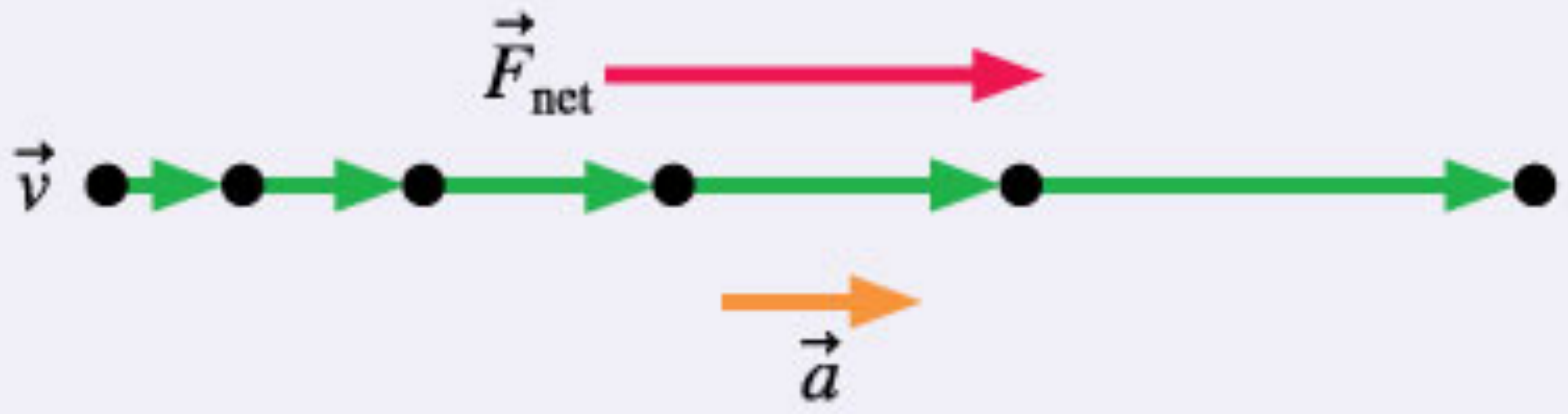
General Principles

Newton's Second Law

An object with mass m has acceleration

$$\vec{a} = \frac{1}{m}\vec{F}_{net}$$

where $\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \cdots$ is the vector sum of all the individual forces acting on the object.



The second law tells us that a net force causes an object to accelerate. This is the connection between force and motion.

Important Concepts

Force is a push or a pull on an object.

- Force is a vector, with a magnitude and a direction.
- Force requires an agent.
- Force is either a contact force or a long-range force.

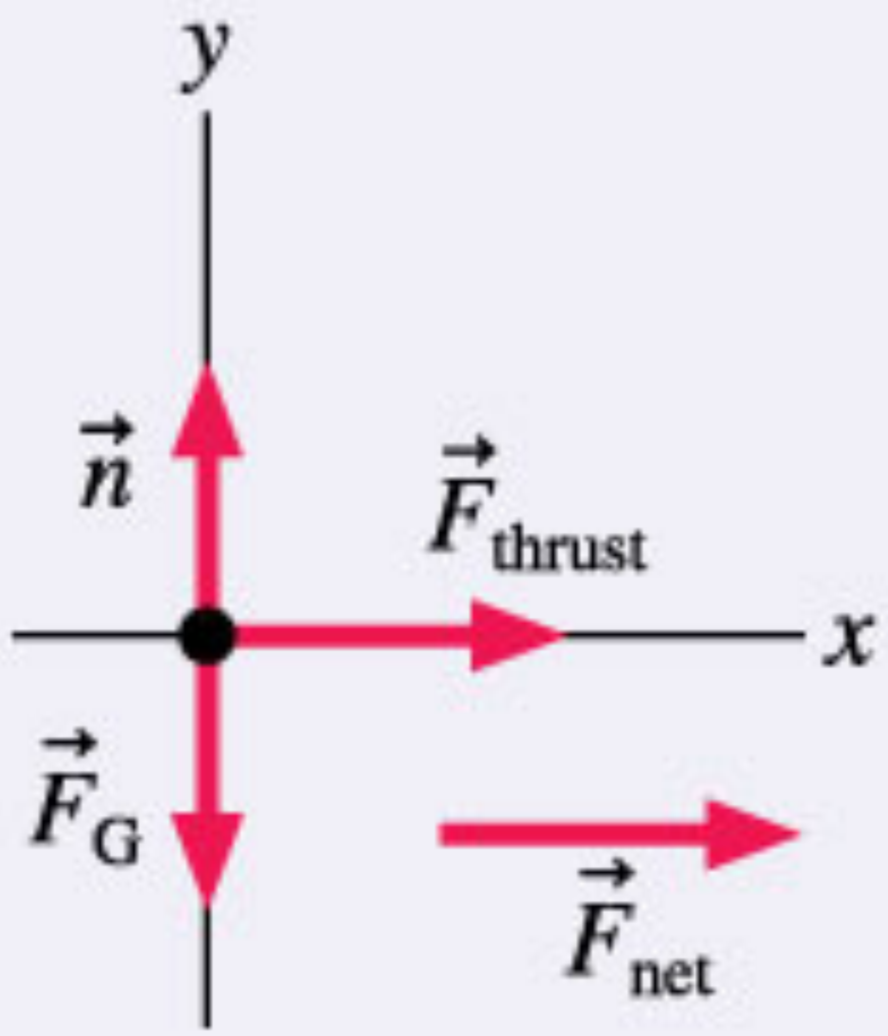
Symbols for Forces

Force	Notation
General force	$\vec{F}$
Gravitational force	$\vec{F}_G$
Spring force	$\vec{F}_{Sp}$
Tension	$\vec{T}$
Normal force	$\vec{n}$
Static friction	$\vec{f}_s$
Kinetic friction	$\vec{f}_k$
Drag	$\vec{F}_{drag}$
Thrust	$\vec{F}_{thrust}$

Key Skills

Free-Body Diagrams

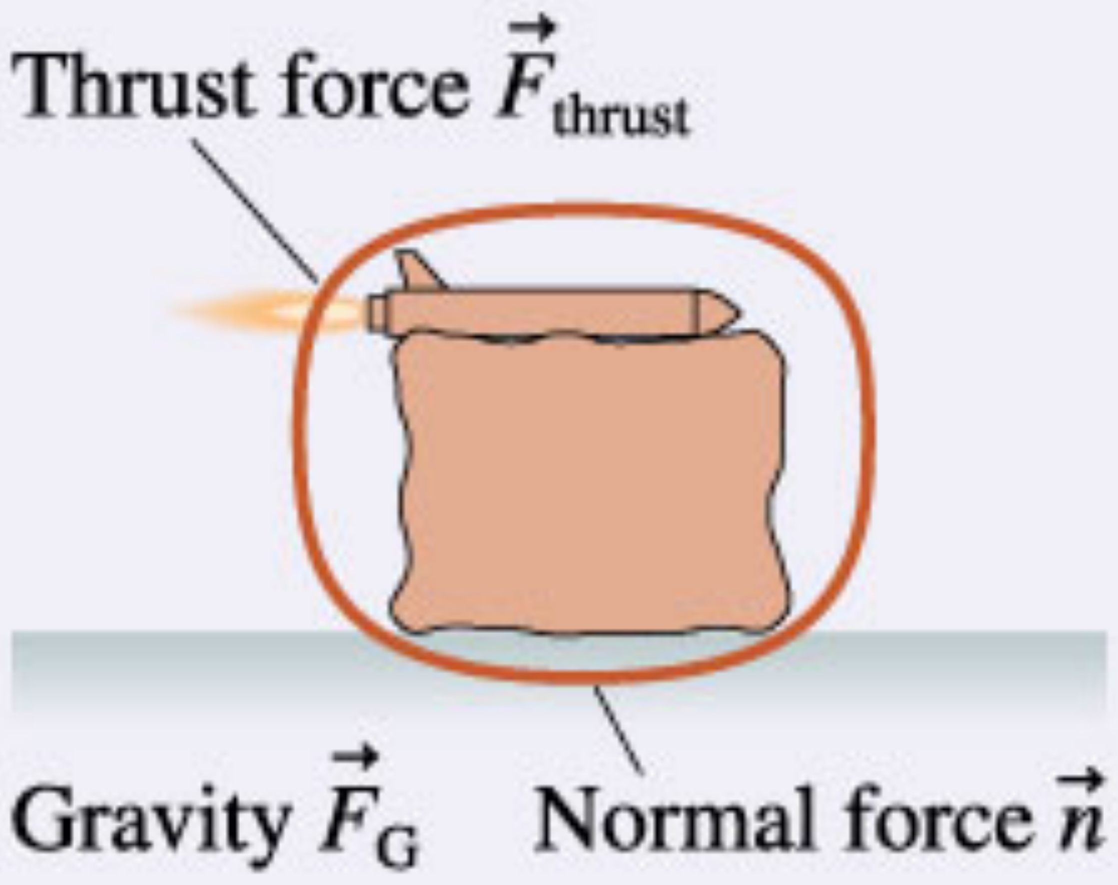
A free-body diagram represents the object as a particle at the origin of a coordinate system. Force vectors are drawn with their tails on the particle. The net force vector is drawn beside the diagram.



Key Skills

Identifying Forces

Forces are identified by locating the points where other objects touch the object of interest. These are points where contact forces are exerted. In addition, objects with mass feel a long-range gravitational force.



Important Concepts

Acceleration is the link to kinematics.

From $\vec{F}_{net}$, find $\vec{a}$.

From a, find v and x.

$\vec{a} = \vec{0}$ is the condition for **equilibrium**.

An object **at rest** is in equilibrium.

So is an object with **constant velocity**.

Equilibrium occurs if and only if $\vec{F}_{net} = \vec{0}$.