Cart Force Check

Use force components to find a cart's net force.

PHY.2.3 "Use mathematical and graphical techniques to solve vector problems and find net forces acting on a body using free-body diagrams and/or online simulations."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle positive components and underline negative components in the table. Beside each row, draw a small arrow showing that force's direction so you can plan a free-body diagram.

Moving the Equipment Cart

1. A stage crew rolls a 2.5 kg equipment cart across a level floor. A rope pulls forward and slightly upward while the floor resists its motion. To find the cart's net force, treat the cart as a single object. Draw one arrow for each external force, starting every arrow at the cart's center.

2. The table lists the forces on the cart as horizontal and vertical components. Positive horizontal values point right, and positive vertical values point up. The rope's components form a right triangle, so its full pull is that triangle's hypotenuse. Each row represents one arrow in a free-body diagram, not an extra force.

FORCES ON THE EQUIPMENT CART

Force	Horizontal component (N)	Vertical component (N)
Rope	+12	+5
Floor resistance	-4	0
Weight	0	-25
Normal force	0	+20

3. To combine the forces, add horizontal components separately from vertical components. Opposite signs mean opposite directions, so some forces cancel. You can also add arrows head to tail using a consistent scale. The arrow from start to finish gives the net force. Acceleration equals net force divided by mass and points in the net force's direction.

2 ANSWER WITH EVIDENCE

Use the passage

1. What is the magnitude of the rope's pull? Use its two components.

2. Add the horizontal components. What is the cart's net horizontal force, including direction?

3. Add the vertical components. What does the result tell you about the cart's vertical acceleration?

4. Using the net force and the cart's mass, find its horizontal acceleration. Include direction.

3 YOUR TURN

Your own words

Invent four forces on a different cart: one right, one left, one up, and one down. Make the vertical forces balance but not the horizontal forces. Choose a scale, draw and label the four force arrows and a net force arrow in the box, then write the net force and explain how you found it.

ANSWER KEY

Cart Force Check

PART 1 · READ AND MARK

Circle positive components and underline negative components in the table. Beside each row, draw a small arrow showing that force's direction so you can plan a free-body diagram. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What is the magnitude of the rope's pull? Use its two components.	**13 N, because the magnitude is the square root of 12 squared plus 5 squared.**
2	Add the horizontal components. What is the cart's net horizontal force, including direction?	**+8 N, or 8 N right.**
3	Add the vertical components. What does the result tell you about the cart's vertical acceleration?	**The net vertical force is 0 N, so the cart has no vertical acceleration.**
4	Using the net force and the cart's mass, find its horizontal acceleration. Include direction.	**8 N divided by 2.5 kg gives 3.2 m/s^2 right.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Scale: 1 cm = 2 N. Free-body diagram: from the cart's center, draw a 3 cm arrow right labeled 6 N, a 1 cm arrow left labeled 2 N, and 2 cm arrows up and down labeled 4 N each. Draw a separate 2 cm net force arrow right. The vertical forces cancel, and 6 N right minus 2 N left gives a net force of 4 N right.

Accept equivalent force magnitudes and consistent scales in the open task. The four force arrows should start at the cart, and the net arrow should match the calculated magnitude and direction.