LESSON MAKER PRO

Forces in Motion

Find net force and predict acceleration.

HIGH SCHOOL · PHY.2

PHY.2 "Students will develop an understanding of concepts related to Newtonian dynamics. Identify forces acting on a system by applying Newton's laws mathematically and graphically (e.g., vector and scalar quantities)..."

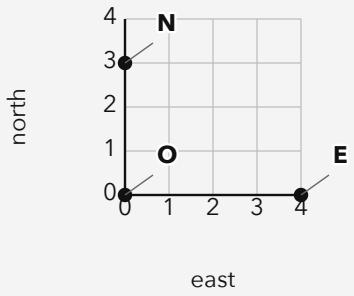
NAME _____ DATE _____

ADD FORCES FIRST

Subtract forces that point in opposite directions. For perpendicular forces, find the net force with $F_{net} = \text{sqrt}(F_x^2 + F_y^2)$, then find acceleration with $a = F_{net}/m$.

WORKED EXAMPLE

A 10 kg cart has one force pointing from O toward E and another from O toward N. Each grid unit represents 1 N. Find the cart's acceleration.



1. Read the forces: 4 N east and 3 N north.
2. $F_{net} = \text{sqrt}(4^2 + 3^2) = 5$ N northeast.
3. $a = F_{net}/m = 5$ N/10 kg = 0.5 m/s^2 northeast.

Answer: 0.5 m/s^2 northeast

PRACTICE 4 problems

1 An 11 N force acts east and a 6 N force acts west on a 5 kg cart. Find its acceleration and direction.

ANSWER _____

2 An 18 N force acts north and a 6 N force acts south on a 6 kg sled. Find its acceleration and direction.

ANSWER _____

3 Forces of 12 N east and 16 N north act on a 5 kg object. Find its acceleration and direction.

ANSWER _____

4 Forces of 9 N west and 12 N south act on a 5 kg object. Find its acceleration and direction.

ANSWER _____

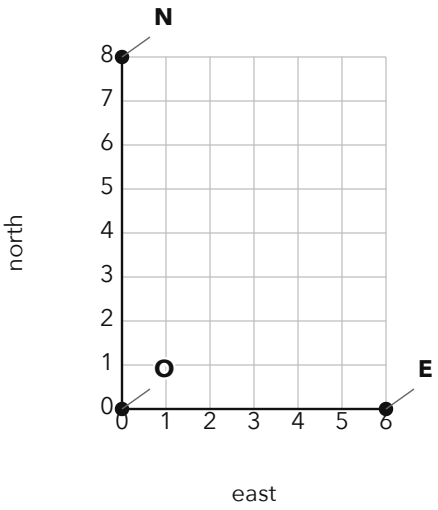
APPLY IT Show your work

1 A rider pushes a 20 kg scooter east with 70 N. Friction pushes west with 30 N. Find the scooter's acceleration and direction.

WORK SPACE

ANSWER _____

2 A 25 kg skater feels two forces, one from O toward E and one from O toward N. Each grid unit represents 5 N. Find the skater's acceleration and direction.



ANSWER _____

CHALLENGE One step up

A 17 kg robot has forces of 26 N east, 11 N west, 20 N north, and 12 N south. Find the net force and the robot's acceleration, including directions.

WORK SPACE AND ANSWER

Forces in Motion

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	An 11 N force acts east and a 6 N force acts west on a 5 kg cart. Find its acceleration and direction.	**1 m/s^2 east**
2	An 18 N force acts north and a 6 N force acts south on a 6 kg sled. Find its acceleration and direction.	**2 m/s^2 north**
3	Forces of 12 N east and 16 N north act on a 5 kg object. Find its acceleration and direction.	**4 m/s^2 northeast**
4	Forces of 9 N west and 12 N south act on a 5 kg object. Find its acceleration and direction.	**3 m/s^2 southwest**

PART 2 · APPLY IT

1. **2 m/s^2 east** The net force is 70 N − 30 N = 40 N east. Divide by 20 kg.
2. **2 m/s^2 northeast** The forces are 30 N east and 40 N north, giving a net force of 50 N northeast. Divide by 25 kg.

CHALLENGE

Net force: 17 N northeast; acceleration: 1 m/s^2 northeast.

For diagonal answers, accept a direction in the correct quadrant. In the challenge, the net force components are 15 N east and 8 N north.