Forces in Pairs

Use force data to identify two-body interactions.

P.2.e "Analyze data to identify the pair of equal and opposite forces between two interacting bodies and relate their magnitudes and directions using Newton's third law."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB In the table, underline the two rows for each complete interaction, circle their force values, and connect equal values with a pencil line to help you check their directions.

Reading a Force Record

1. When two bodies interact, each exerts a force on the other. A force record should name the body receiving the force and the body exerting it. It should also give a magnitude in newtons and a direction. Two forces pointing opposite ways are not enough to identify a pair unless they involve the same two bodies.

2. The table records three brief interactions along a straight line. A force sensor on each body recorded the horizontal push when possible. For the last interaction, only one sensor returned a reading. The words left and right describe opposite directions along that line. The force values describe one instant during each interaction.

HORIZONTAL FORCE READINGS

Interaction	Body receiving force	Body exerting force	Measured force
Carts	Cart A	Cart B	36 N left
Carts	Cart B	Cart A	36 N right
Skater and rail	Rail	Skater	24 N left
Skater and rail	Skater	Rail	24 N right
Shoe and track	Track	Shoe	80 N left

3. Newton's third law states that when one body pushes another, the second body pushes back with an equal-magnitude force in the opposite direction. The two forces act on different bodies, so they do not cancel each other on one body. To match a pair in a data set, check the names of both bodies before comparing the numbers and directions.

2 ANSWER WITH EVIDENCE

Use the passage

1. Identify the two forces in the carts interaction. Give the body receiving each force, its magnitude, and its direction.

2. Identify the third-law pair in the skater and rail interaction. How do the magnitudes and directions compare?

3. The shoe and track interaction has one missing reading. Predict the force on the shoe, including which body exerts it, its magnitude, and its direction.

4. A student pairs the force on cart A with the force on the rail because both point left. Use the data to explain why these are not a third-law pair.

3 YOUR TURN

Your own words

Invent an interaction not shown in the table. Give one force with a magnitude and direction, then give its matching third-law force, naming both bodies; explain why the forces form a pair.

Forces in Pairs

PART 1 · READ AND MARK

In the table, underline the two rows for each complete interaction, circle their force values, and connect equal values with a pencil line to help you check their directions. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Identify the two forces in the carts interaction. Give the body receiving each force, its magnitude, and its direction.	**Cart B pushes cart A with 36 N left. Cart A pushes cart B with 36 N right.**
2	Identify the third-law pair in the skater and rail interaction. How do the magnitudes and directions compare?	**The skater pushes the rail with 24 N left, and the rail pushes the skater with 24 N right. The magnitudes are equal and the directions are opposite.**
3	The shoe and track interaction has one missing reading. Predict the force on the shoe, including which body exerts it, its magnitude, and its direction.	**The track exerts 80 N right on the shoe.**
4	A student pairs the force on cart A with the force on the rail because both point left. Use the data to explain why these are not a third-law pair.	**They come from different interactions and act between different pairs of bodies. Their magnitudes also differ, 36 N and 24 N.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A paddle pushes water backward with 15 N. The water pushes the paddle forward with 15 N. These forces form a pair because they act on different bodies in the same interaction, with equal magnitudes and opposite directions.

Accept any new interaction in which each body exerts a force on the other. The two forces must have equal magnitudes and opposite directions.