Resolving forces

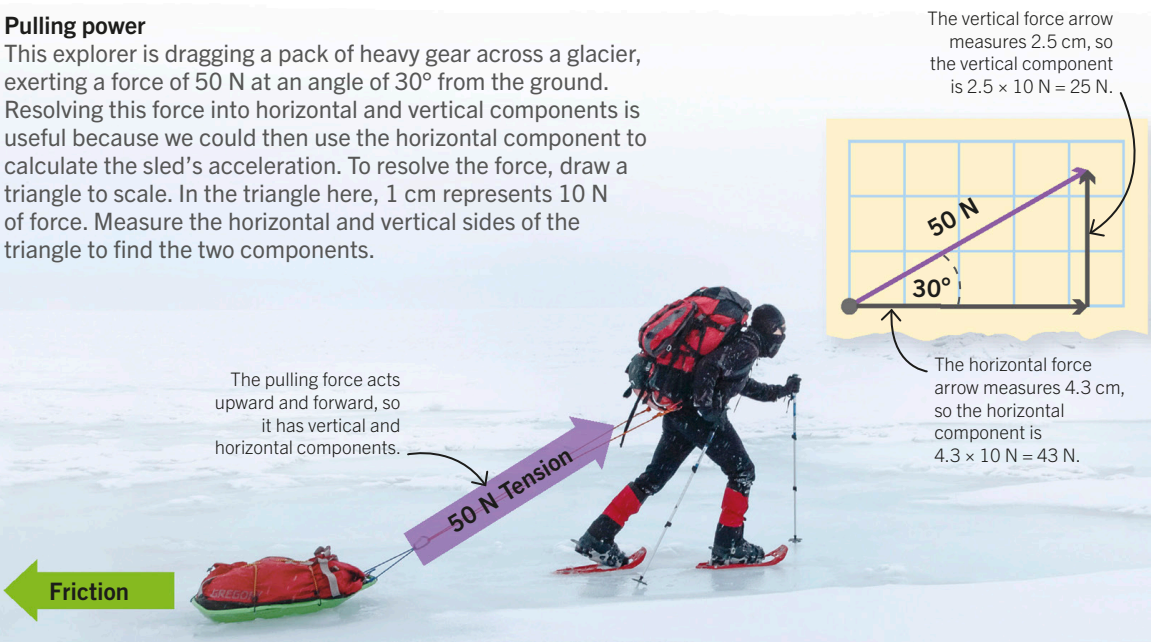
The effects of forces are easiest to understand when they act at right angles to each other, but a force can act at any angle. To get around the problem, it can help to break down a force into two components that are at right angles but have the same combined effect as the single force. This is known as resolving forces.

Key facts

- ✓ **A single force can be resolved into component forces acting at right angles to each other.**
- ✓ **Resolve forces by drawing a scale diagram or by using trigonometry.**

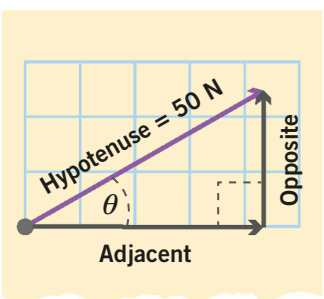
Pulling power

This explorer is dragging a pack of heavy gear across a glacier, exerting a force of 50 N at an angle of 30° from the ground. Resolving this force into horizontal and vertical components is useful because we could then use the horizontal component to calculate the sled's acceleration. To resolve the force, draw a triangle to scale. In the triangle here, 1 cm represents 10 N of force. Measure the horizontal and vertical sides of the triangle to find the two components.



Resolving forces with math

Although forces can be resolved using scale drawings, it's faster and more accurate to use trigonometry. For instance, to find the vertical component of tension in the rope, we can use the sine formula on the right. This allows us to calculate the height of a right-angled triangle if we know the angle of the slope (θ) and the length of the slope (the hypotenuse).



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

Rearrange the formula to make "opposite" the subject:

opposite = hypotenuse × sin θ

= 50 N × sin 30°

= 25 N

Use a calculator to find the sine of 30°.