_____ tells you how **quickly** something is moving.
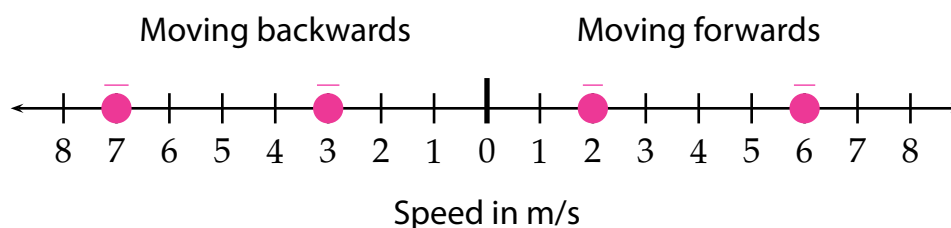
Sometimes you also need to know which way it is moving.

If you know the speed _____ the direction, then you know the **velocity**.
If something is _____ the velocity is _ m/s and the direction doesn't matter.

I ran away from the bear at 4 m/s.

4 **m/s** is the _____,
away from the bear is the _____,
away from the bear at 4 **m/s** is the _____.

1   Tick or cross to show in each case whether you know the speed, the direction and/or the velocity. In some rows you will need to make more than one tick.

Description	Speed	Direction	Velocity
The athlete ran at 8 m/s.			
The seagull flew west.			
The bus goes at 30 mph into town.			
We walked 500 m further along the road.			
The skydiver fell at 140 mph.			
The rounders player waited at third base.		—	

Moving backwards   Moving forwards

$$\overset{\text{A}}{\bullet}\ \ \ \ \ \overset{\text{B}}{\bullet}\ \ \ \ \ \ \ \ \overset{\text{C}}{\bullet}\ \ \ \ \ \overset{\text{D}}{\bullet}$$

8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8

Speed in m/s

2   Complete the table to show the speeds, directions and velocities labelled on the scale.

Label	Speed	Direction	Velocity
A	_____	_____	_____
B			
C			
D			

3 A dog runs at 5 m/s towards a cat. The cat scratches the dog and the dog turns and runs away at 5 m/s.

(a) Has the dog's speed changed?

(b) Has the dog's velocity changed?

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4 A roller coaster begins by moving backwards at 2 m/s. It then moves at 7 m/s forwards. The velocities are shown on this scale. The arrow shows the velocity change.

Moving backwards   Moving forwards

8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8

Speed in m/s
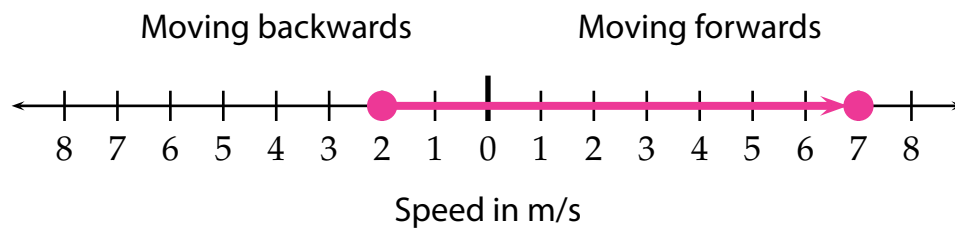
The velocity change is _____ forwards (the length of the arrow).

(a) What was the old speed?   (b) What is the new speed?

(c) How much has the speed changed?

(d) Is the speed change the same as the velocity change?
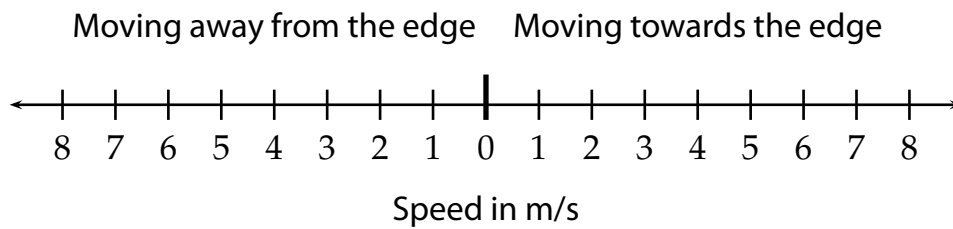
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5 A squash ball is hit forwards at 8 m/s. It bounces off a wall and then moves at 4 m/s backwards. The velocities are shown on this scale. The arrow shows the velocity change.

Moving backwards   Moving forwards

8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8

Speed in m/s
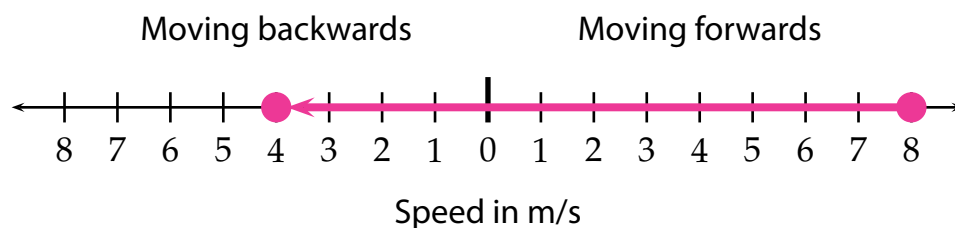
(a) What is the velocity change?

(b) How much has the speed changed?

6   An swimmer swims towards the edge of a pool at 3 m/s. They reach the edge, turn round and swim back at the same speed.

Moving away from the edge   Moving towards the edge

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←—+——+——+——+——+——+——+——+——|——+——+——+——+——+——+——+——+——→
   8   7   6   5   4   3   2   1   0   1   2   3   4   5   6   7   8
```

Speed in m/s

(a) Mark the old and new velocities on the scale.

(b) Mark the velocity change on the scale.

(c) What is the velocity change?

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7   Calculate the velocity change in each case.

(a) A cyclist speeds up from 2 m/s to 10 m/s on a straight road.

(b) A truck slows down from 15 m/s to 5 m/s on a straight road.

(c) A ball hits the floor at 7 m/s and bounces upwards at 5 m/s.

(d) A trolley is pushed up a ramp at 2 m/s but later rolls back down it at 3 m/s.

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8   A player throws a netball upwards at 6 m/s. Just before it is caught it is falling at 6 m/s.

(a) What is the velocity change?

(b) What is the change in speed?

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9   A TV satellite orbits the Earth in a circle at a steady speed. Does its velocity change as it goes round the Earth? Explain your answer.