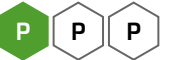


[Home](#) [Gameboard](#) [Maths](#) [Constant Acceleration 1ii](#)

Constant Acceleration 1ii

A Level



A particle leaves a point A with speed 1 m s^{-1} and travels with constant acceleration in a straight line to a point B , taking 50 s . The distance AB is 200 m .

Part A Acceleration

Find the acceleration of the particle.

Part B Speed at mid-point

Find the speed of the particle as it passes through the mid-point of AB .

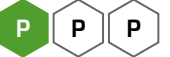
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Constant Acceleration 2ii

A Level



A particle P is projected vertically downwards from a fixed point O with initial speed 4.2 m s^{-1} , and takes 1.5 s to reach the ground.

Part A Speed at the ground

Calculate the speed of P when it reaches the ground. Give your answer to 3 significant figures.

Part B Height of O

Calculate the height of O above the ground to 3 significant figures

Part C Speed above the ground

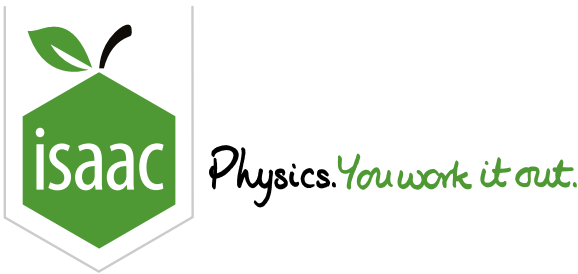
Calculate the speed of P when it is 5 m above the ground to 3 significant figures.

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General Kinematics 2ii

A Level
P P P

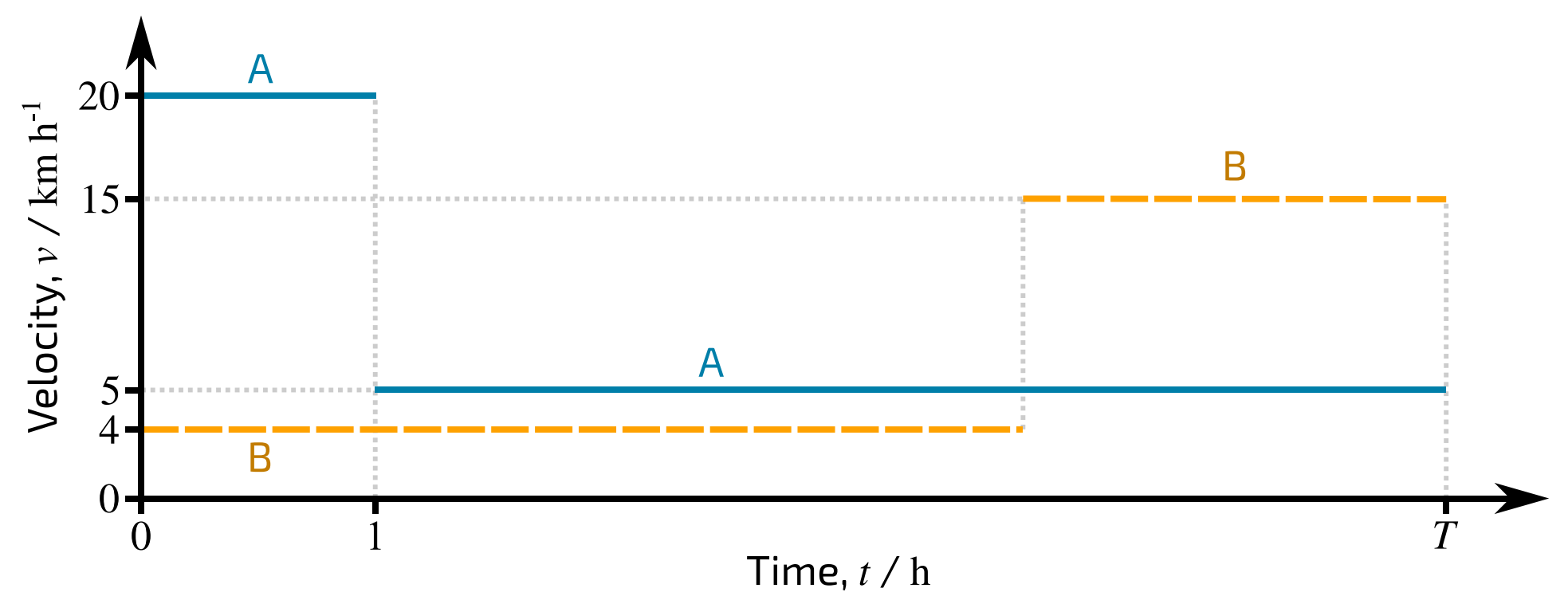


Figure 1: Velocity-time graph of two travellers A and B along a long straight road.

Two travellers A and B make the same journey on a long straight road. Each traveller walks for part of the journey and rides a bicycle for part of the journey. They start their journeys at the same instant, and they end their journeys simultaneously after travelling for T hours. A starts the journey cycling at a steady 20 km h^{-1} for 1 hour. A then leaves the bicycle at the side of the road, and completes the journey walking at 5 km h^{-1} . B begins the journey walking at a steady 4 km h^{-1} . When B finds the bicycle where A left it, B cycles at 15 km h^{-1} to complete the journey.

Part A Distance cycled and time

Calculate the distance A cycles.

Hence, find the period of time, in hours, for which B walks before finding the bicycle.

Part B **Completion time**

Find T in hours.

Part C **Total distance**

Calculate the distance A and B each travel.

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[Home](#) [Gameboard](#) [Maths](#) [Constant Acceleration 3ii](#)

Constant Acceleration 3ii

A Level

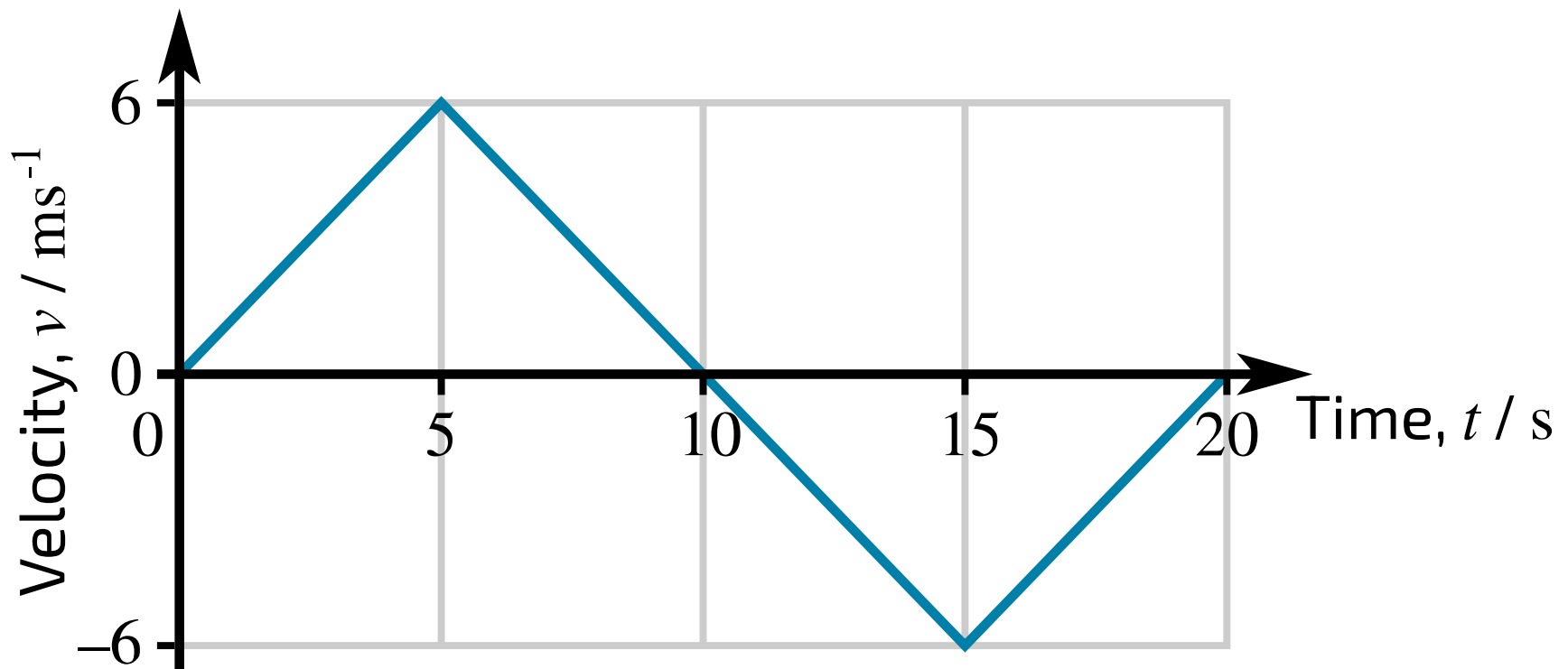
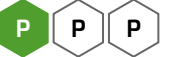


Figure 1: (t, v) graph for the motion of the athlete.

An athlete runs in a straight line from point A to point B , and back to point A . Figure 1 shows the (t, v) graph for the motion of the athlete.

Part A Initial acceleration

Calculate the initial acceleration of the athlete.

Part B Total distance

Calculate the total distance the athlete runs.

Part C Velocity at $t = 17$

Calculate the velocity of the athlete when $t = 17$.

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[Home](#) [Gameboard](#) [Maths](#) [General Kinematics 3i](#)

General Kinematics 3i

A Level

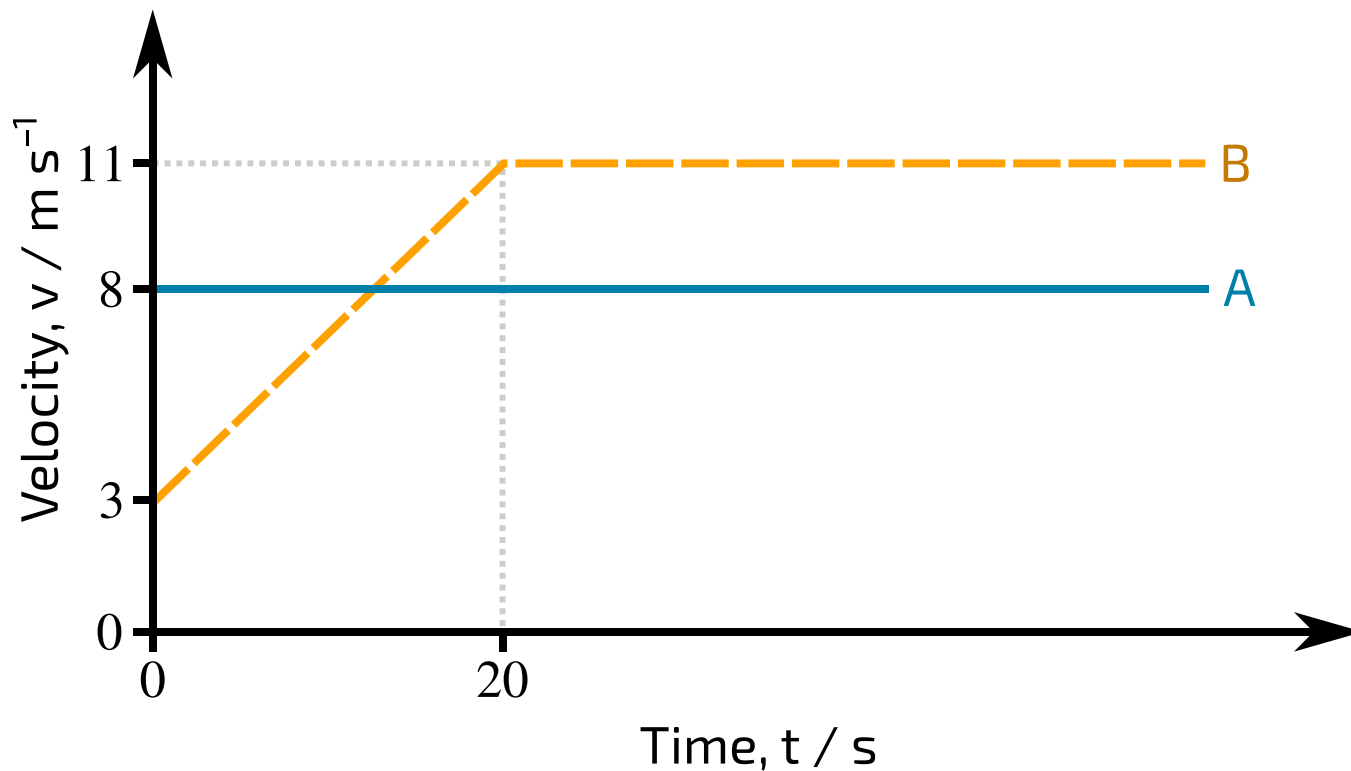
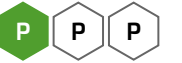


Figure 1: Velocity-time graph of the motion of two cyclists A and B racing.

Figure 1 shows the motion of two cyclists A and B who are travelling along a horizontal straight road. At time $t = 0$, A, who cycles with constant speed 8 m s^{-1} , overtakes B who has initial speed 3 m s^{-1} . From time $t = 0$, B cycles with constant acceleration for 20 s. When $t = 20$ her speed is 11 m s^{-1} , which she subsequently maintains.

Part A Same speed

Find the value of t when A and B have the same speed. Give your answer to 2 significant figures.

Part B Time of overtaking

Calculate the value of t when B overtakes A. Give your answer to 2 significant figures.

Part C Displacement-time graph

On a single diagram, sketch the (t, x) graphs for the two cyclists for the time from $t = 0$ until after B has overtaken A.

Choose the correct option from the sketches below.

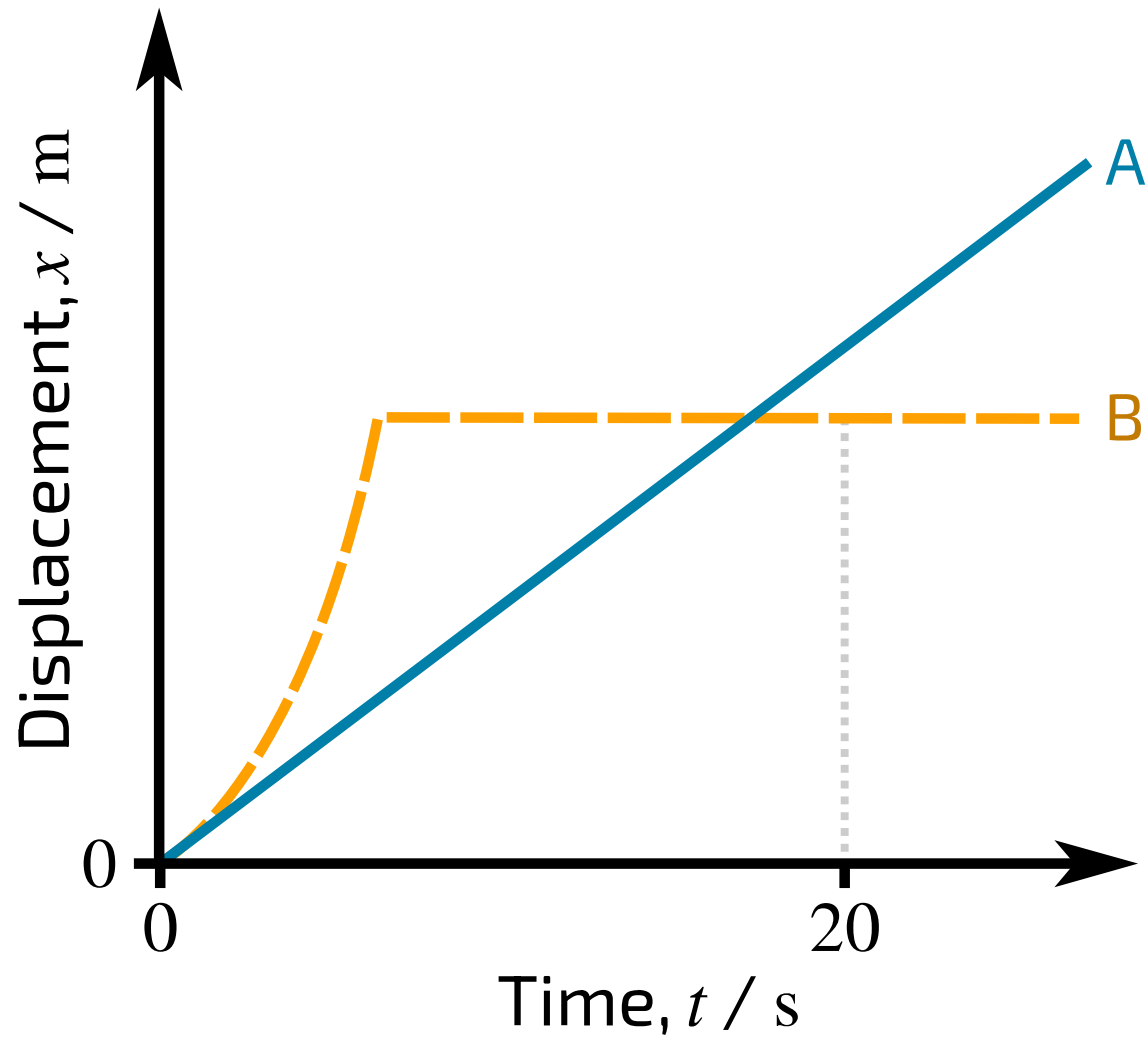


Figure 2: Option 1

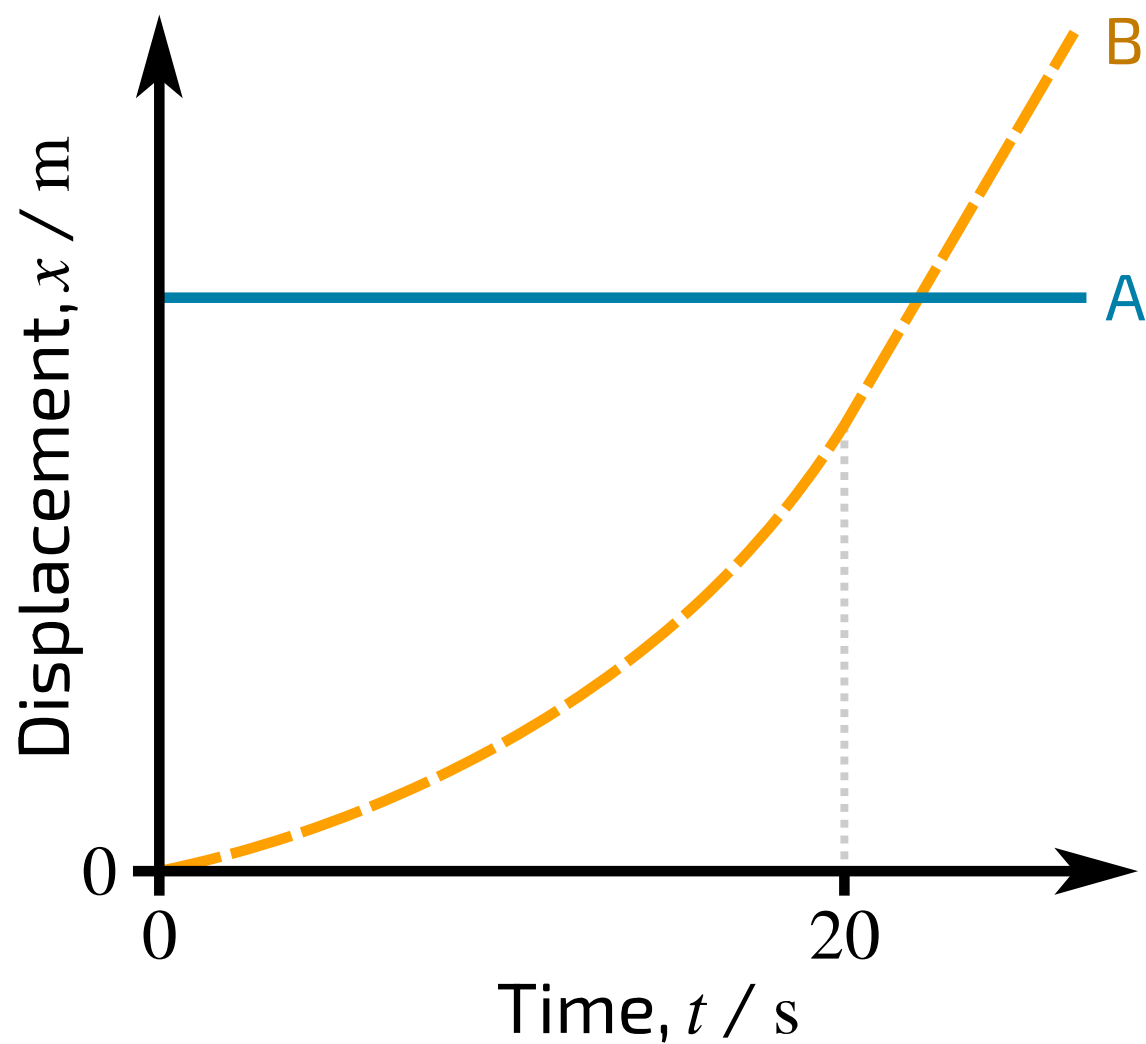


Figure 3: Option 2

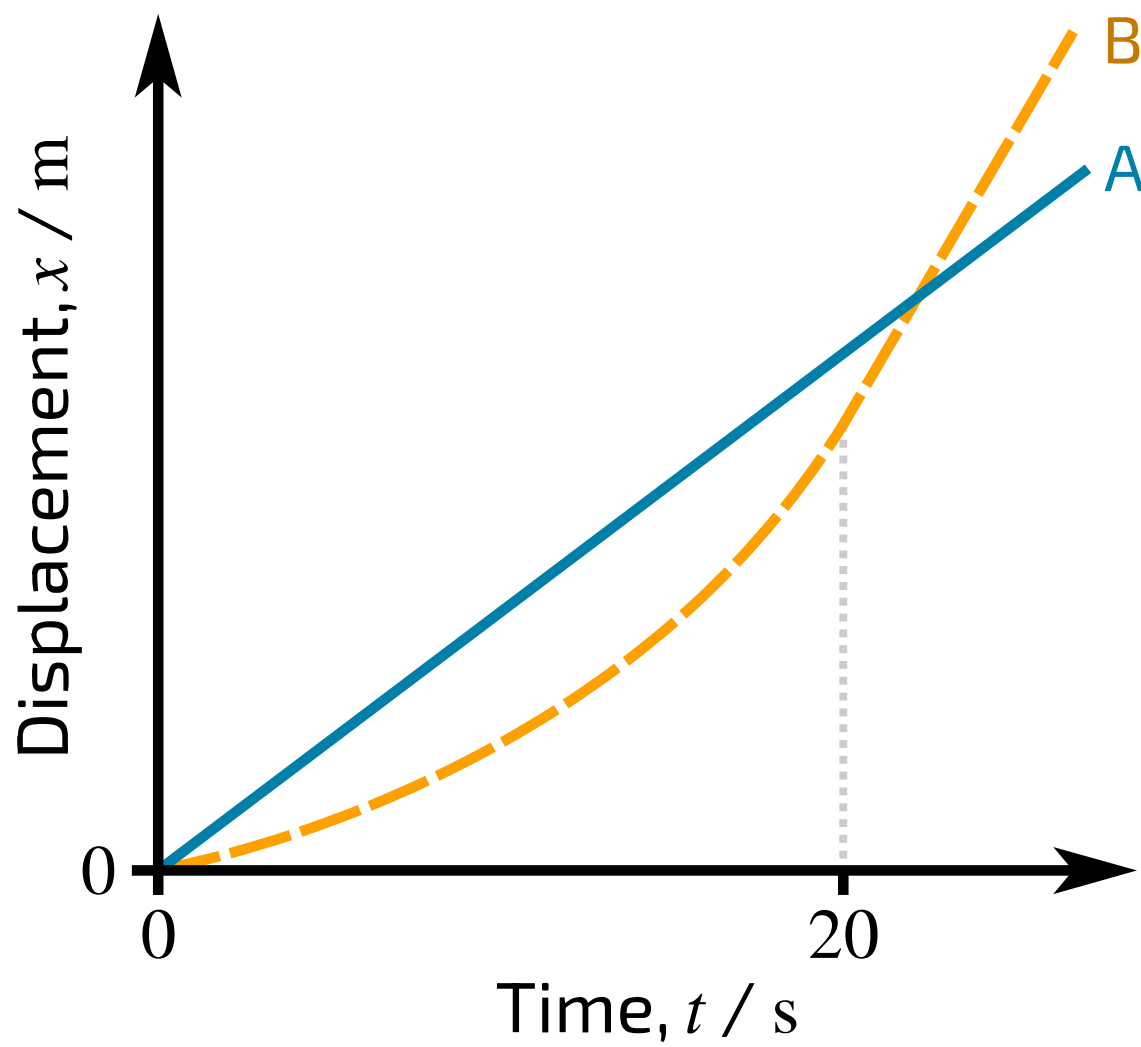


Figure 4: Option 3

- ☐ Option 1
- ☐ Option 2
- ☐ Option 3

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General Kinematics 3ii

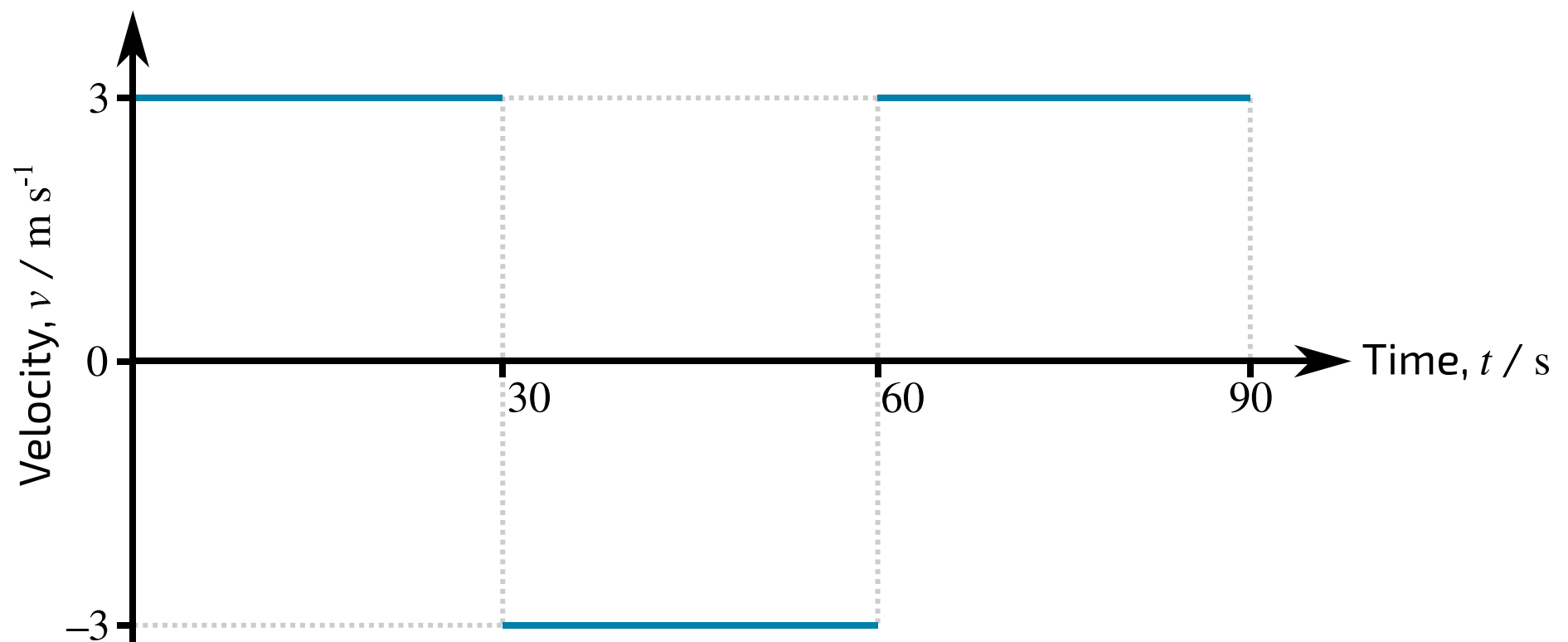
A Level
P P P

Figure 1: Velocity-time graph of a woman running between A and B.

A woman runs from A to B, then from B to A and then from A to B again, on a straight track, taking 90 s. The woman runs at a constant speed throughout.

Part A Total distance

Find the total distance run by the woman.

Part B Distances

Find the distance of the woman from A when

$t = 50$:

$t = 80$:

Part C Child's speed

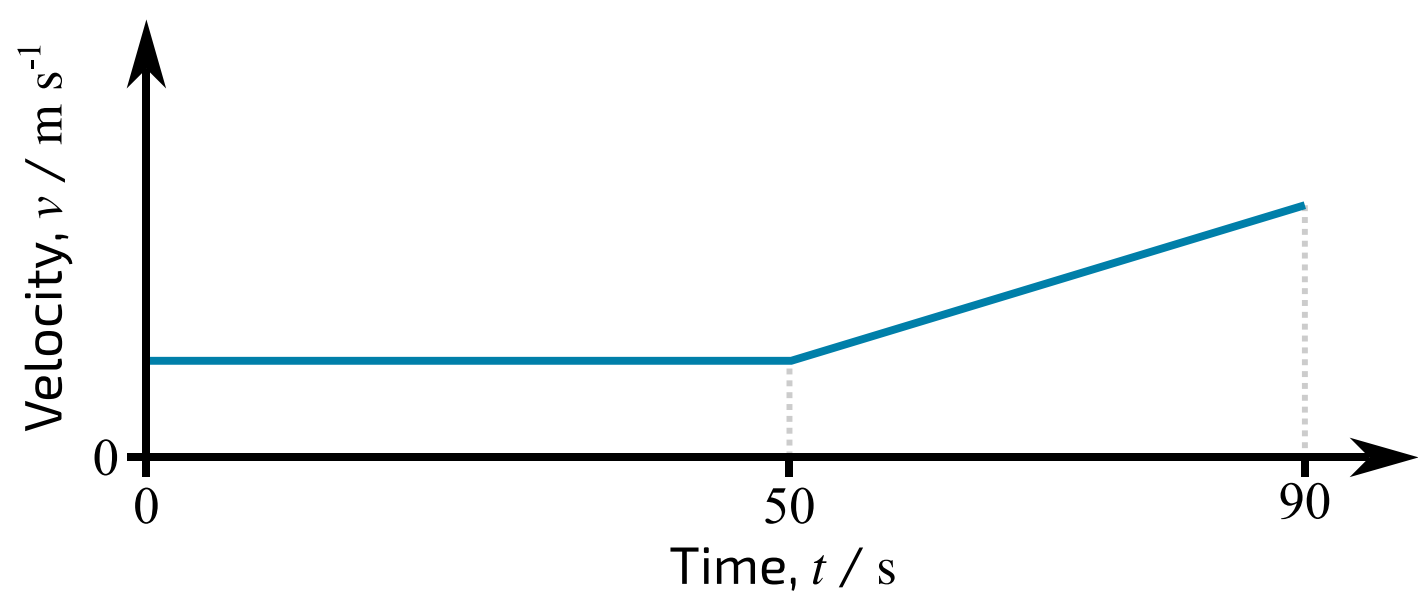


Figure 2: Velocity-time graph of a child moving from A along AB.

At time $t = 0$, a child also starts to move, from A, along AB. The child walks at a constant speed for the first 50 s and then at an increasing speed for the next 40 s.

At time $t = 50$, the woman and the child pass each other, moving in opposite directions. Find the speed of the child during the first 50 s.

Part D Overtaking

At time $t = 80$, the woman overtakes the child. Find the speed of the child at this instant.

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Constant Acceleration 3i

A Level

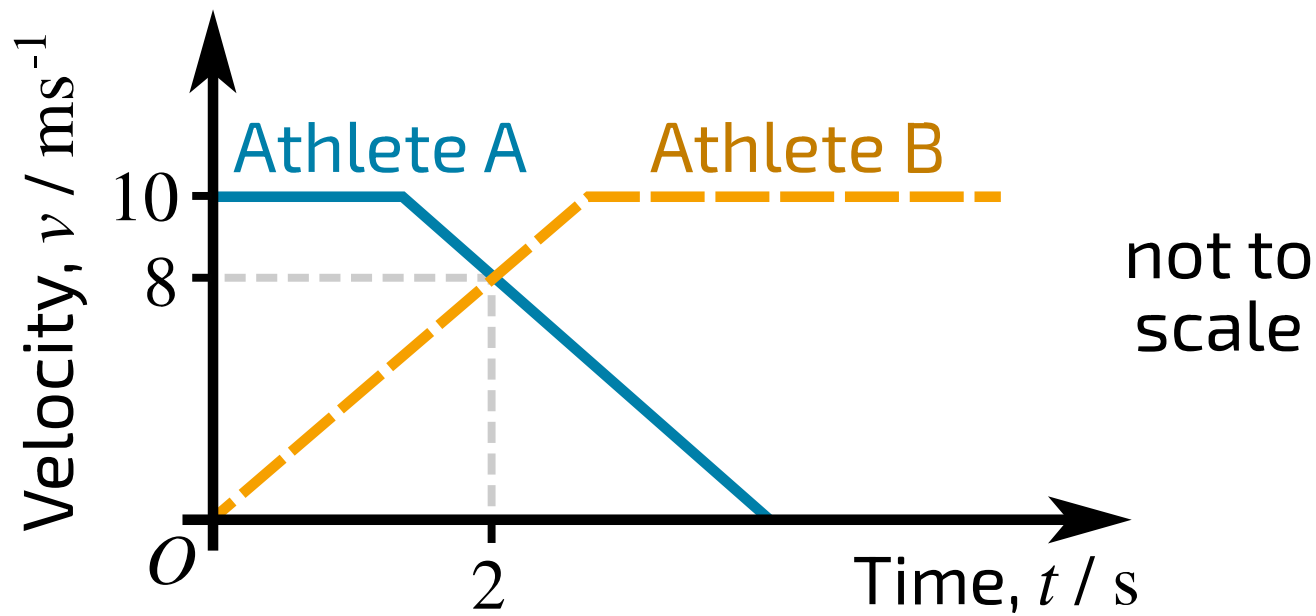
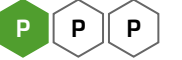


Figure 1: (t, v) graph of athletes A and B running in the same direction.

The diagram shows the (t, v) graphs for two athletes, A and B , who run in the same direction in the same straight line while they exchange the baton in a relay race. A runs with constant velocity 10 m s^{-1} until he decelerates at 5 m s^{-2} and subsequently comes to rest. B has constant acceleration from rest until reaching his constant speed of 10 m s^{-1} . The baton is exchanged 2 s after B starts running, when both athletes have speed 8 m s^{-1} and B is 1 m ahead of A .

Part A Deceleration

Find the value of t at which A starts to decelerate.

Part B **Distance AB**

Calculate the distance between A and B at the instant when B starts to run. Give your answer to 3 significant figures.

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Projectiles (1D) 1ii

A Level
P P P

A particle is projected vertically upwards with speed 7 m s^{-1} from a point on the ground.

Part A Speed 0.4 s after

Find the speed of the particle 0.4 s after projection to 3 significant figures.

Part B Distance 0.4 s after

Find the distance above the ground 0.4 s after projection to 3 significant figures.

Part C Total distance travelled

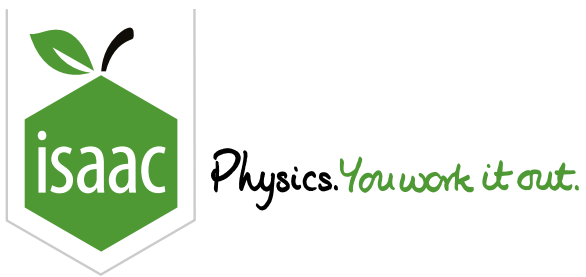
Find the total distance travelled by the particle in the first 0.9 s after projection. Give your answer to 3 significant figures.

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[Home](#) [Gameboard](#) [Maths](#) [Projectiles \(1D\) 2ii](#)

Projectiles (1D) 2ii



A particle P is projected vertically downwards with initial speed 3.5 m s^{-1} from a point A which is 5 m above horizontal ground.

Part A Speed before striking

Find the speed of P immediately before it strikes the ground to 3 significant figures.

Part B Speed after leaving

After striking the ground, P rebounds and moves vertically upwards and 0.87 s after leaving the ground P passes through A .

Calculate the speed of P immediately after it leaves the ground.

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