

Kinematics

It's the section you've all been waiting for... Kinematics. Push the pedal to the metal and enjoy high-octane thrills and spills calculating velocity, acceleration and displacement. I've even thrown in a roller-coaster — what a treat.

- 1 A motorcyclist is travelling at 15 ms^{-1} . As she passes point A on a straight section of road, she accelerates uniformly for 4 s until she passes point B at 40 ms^{-1} . She then immediately decelerates at 2.8 ms^{-2} so that when she passes point C she is travelling at 26 ms^{-1} .

- a) Find her acceleration between A and B .

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(2 marks)

- b) Find the time it takes her to travel from B to C .

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(2 marks)

- c) Find the distance from A to C .

.....
(3 marks)

- 2 A van is travelling with velocity 21 ms^{-1} . As it nears its destination, the driver brakes and the van decelerates uniformly to rest in 6 seconds. The van is stationary for 10 seconds, then sets back off in the direction it came, accelerating uniformly to a velocity of $-U \text{ ms}^{-1}$ in 4 seconds. It maintains this speed for 5 seconds.

- a) Taking when the driver starts to brake as $t = 0 \text{ s}$, draw a velocity-time graph showing the van's motion.

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(3 marks)

- b) Find the van's deceleration.

.....
(2 marks)

- c) In total, the van travels a distance of 161 m during the measured time. Find the value of U .

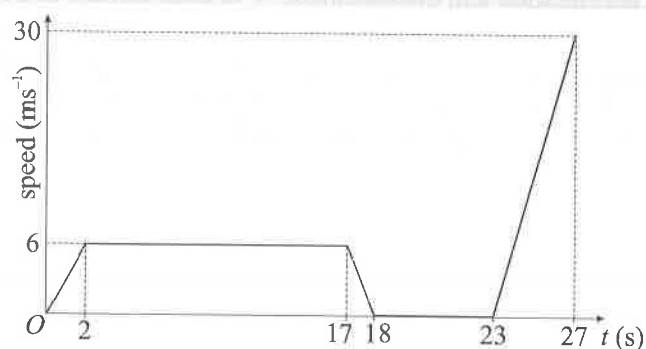
$U =$
(3 marks)

- d) Calculate the van's displacement at time $t = 25 \text{ s}$ from its position at time $t = 0 \text{ s}$.

.....
(2 marks)

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- 3 The diagram below shows how the speed of a roller coaster varies along a straight section of its track.



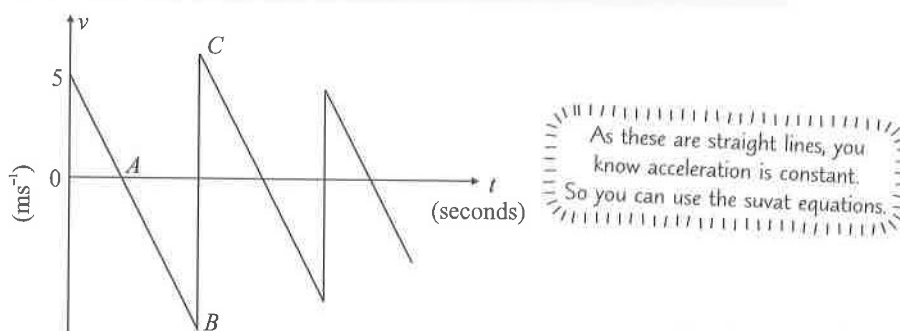
- a) Find the greatest acceleration experienced by the roller coaster.

(2 marks)

- b) Calculate the total distance travelled by the roller coaster.

(3 marks)

- 4 A ball is thrown vertically upwards with velocity 5 ms^{-1} from a point 2 m above the ground. The velocity-time graph below shows the motion of the ball.



- a) Find the time taken by the ball to reach point A.

(3 marks)

- b) Find the velocity of the ball when it reaches point B.

(3 marks)