

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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**Pearson Edexcel Level 3 GCE**

**Thursday 25 May 2023**

Afternoon

Paper  
reference

**8MA0/22**

**Mathematics**

**Advanced Subsidiary**

**PAPER 22: Mechanics**

**You must have:**

Mathematical Formulae and Statistical Tables (Green), calculator

Total Marks

**Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

### Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Unless otherwise indicated, wherever a value of  $g$  is required, take  $g = 9.8 \text{ m s}^{-2}$  and give your answer to either 2 significant figures or 3 significant figures.

### Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The total mark for this part of the examination is 30. There are 4 questions.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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1.

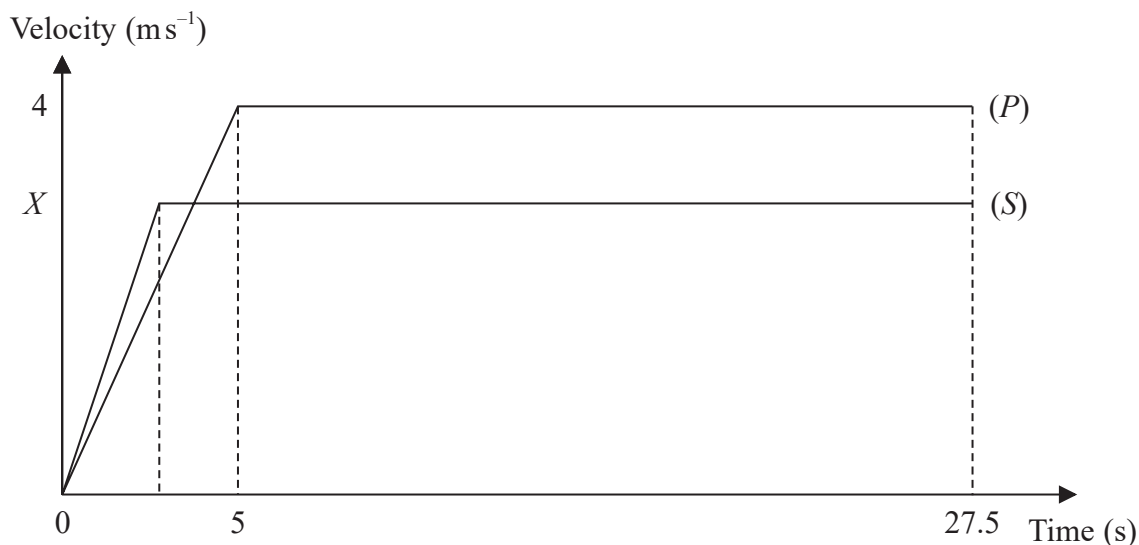


Figure 1

Two children, Pat ( $P$ ) and Sam ( $S$ ), run a race along a straight horizontal track.

Both children start from rest at the same time and cross the finish line at the same time.

In a model of the motion:

Pat accelerates at a constant rate from rest for 5 s until reaching a speed of  $4 \text{ ms}^{-1}$  and then maintains a constant speed of  $4 \text{ ms}^{-1}$  until crossing the finish line.

Sam accelerates at a constant rate of  $1 \text{ ms}^{-2}$  from rest until reaching a speed of  $X \text{ ms}^{-1}$  and then maintains a constant speed of  $X \text{ ms}^{-1}$  until crossing the finish line.

Both children take 27.5 s to complete the race.

The velocity-time graphs shown in Figure 1 describe the model of the motion of each child from the instant they start to the instant they cross the finish line together.

Using the model,

- (a) explain why the areas under the two graphs are equal, (1)
- (b) find the acceleration of Pat during the first 5 seconds, (1)
- (c) find, in metres, the length of the race, (2)
- (d) find the value of  $X$ , giving your answer to 3 significant figures. (4)













3.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

A fixed point  $O$  lies on a straight line.

A particle  $P$  moves along the straight line such that at time  $t$  seconds,  $t \geq 0$ , after passing through  $O$ , the velocity of  $P$ ,  $v \text{ m s}^{-1}$ , is modelled as

$$v = 15 - t^2 - 2t$$

- (a) Verify that  $P$  comes to instantaneous rest when  $t = 3$  (1)
- (b) Find the magnitude of the acceleration of  $P$  when  $t = 3$  (3)
- (c) Find the total distance travelled by  $P$  in the interval  $0 \leq t \leq 4$  (4)











