

27.5 Time (s)

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:

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

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

Both children take 27.5 s to complete the race.

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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 t	he two	graphs are	equal,
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(1)

(1)

(b) find the acceleration of Pat during the first 5 seconds,

(c) find, in metres, the length of the race,

(d) find the value of X, giving your answer to 3 significant figures.

1.

(4)

(2)