

1. Nov/2022/Paper\_9709\_41/No.5

A particle  $P$  moves on the  $x$ -axis from the origin  $O$  with an initial velocity of  $-20\text{ m s}^{-1}$ . The acceleration  $a\text{ m s}^{-2}$  at time  $t\text{ s}$  after leaving  $O$  is given by  $a = 12 - 2t$ .

- (a) Sketch a velocity-time graph for  $0 \leq t \leq 12$ , indicating the times when  $P$  is at rest. [5]

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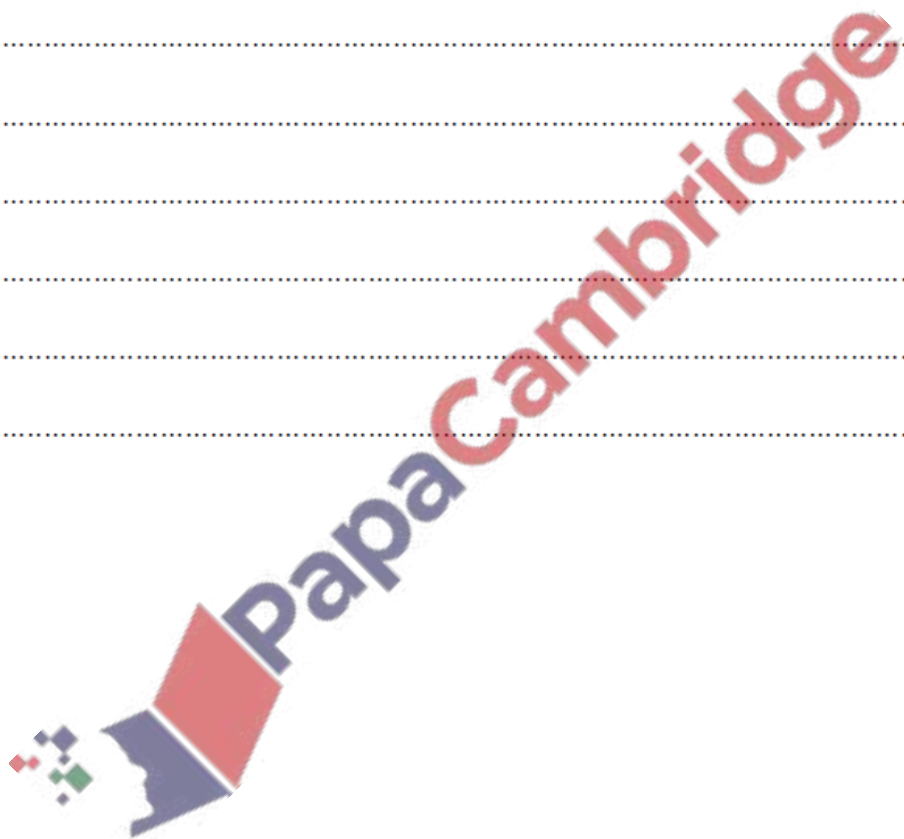
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A particle  $P$  travels in a straight line, starting at rest from a point  $O$ . The acceleration of  $P$  at time  $t$  s after leaving  $O$  is denoted by  $a \text{ m s}^{-2}$ , where

$$a = 0.3t^{\frac{1}{2}} \quad \text{for } 0 \leq t \leq 4,$$

$$a = -kt^{-\frac{3}{2}} \quad \text{for } 4 < t \leq T,$$

where  $k$  and  $T$  are constants.

- (a) Find the velocity of  $P$  at  $t = 4$ . [2]

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- (b) It is given that there is no change in the velocity of  $P$  at  $t = 4$  and that the velocity of  $P$  at  $t = 16$  is  $0.3 \text{ m s}^{-1}$ .

Show that  $k = 2.6$  and find an expression, in terms of  $t$ , for the velocity of  $P$  for  $4 \leq t \leq T$ . [4]

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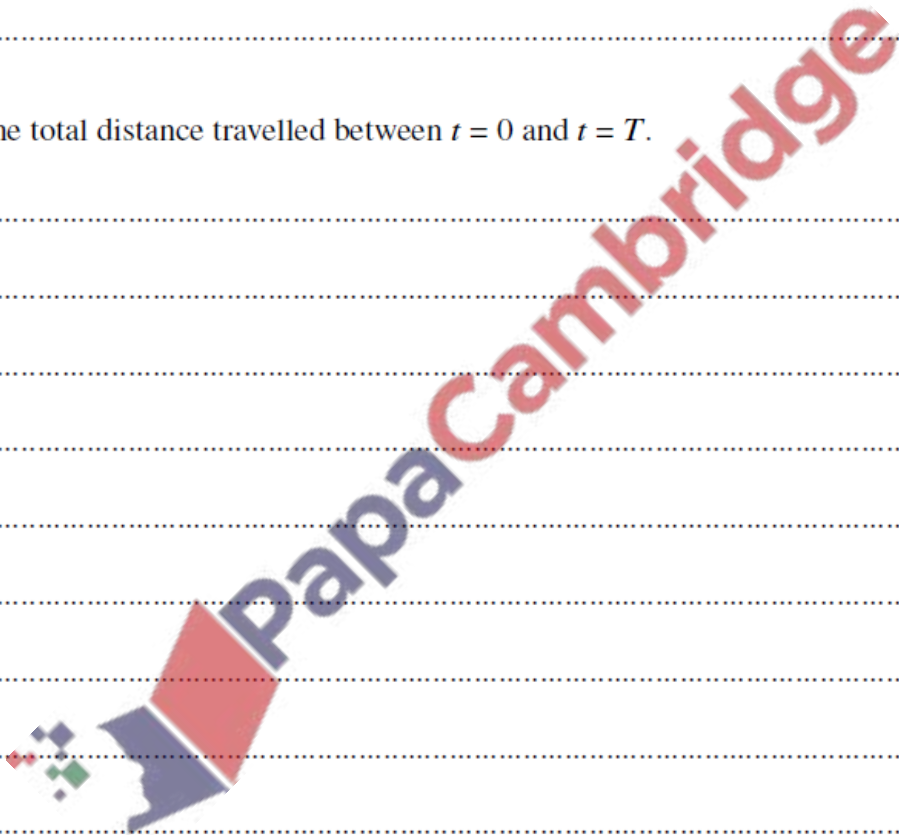
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(c) Given that  $P$  comes to instantaneous rest at  $t = T$ , find the exact value of  $T$ . [2]

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(d) Find the total distance travelled between  $t = 0$  and  $t = T$ . [4]

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3. Nov/2022/Paper\_9709\_43/No.1

A particle  $P$  is projected vertically upwards with speed  $u \text{ m s}^{-1}$  from a point on the ground.  $P$  reaches its greatest height after 3 s.

(a) Find  $u$ . [1]

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(b) Find the greatest height of  $P$  above the ground. [2]

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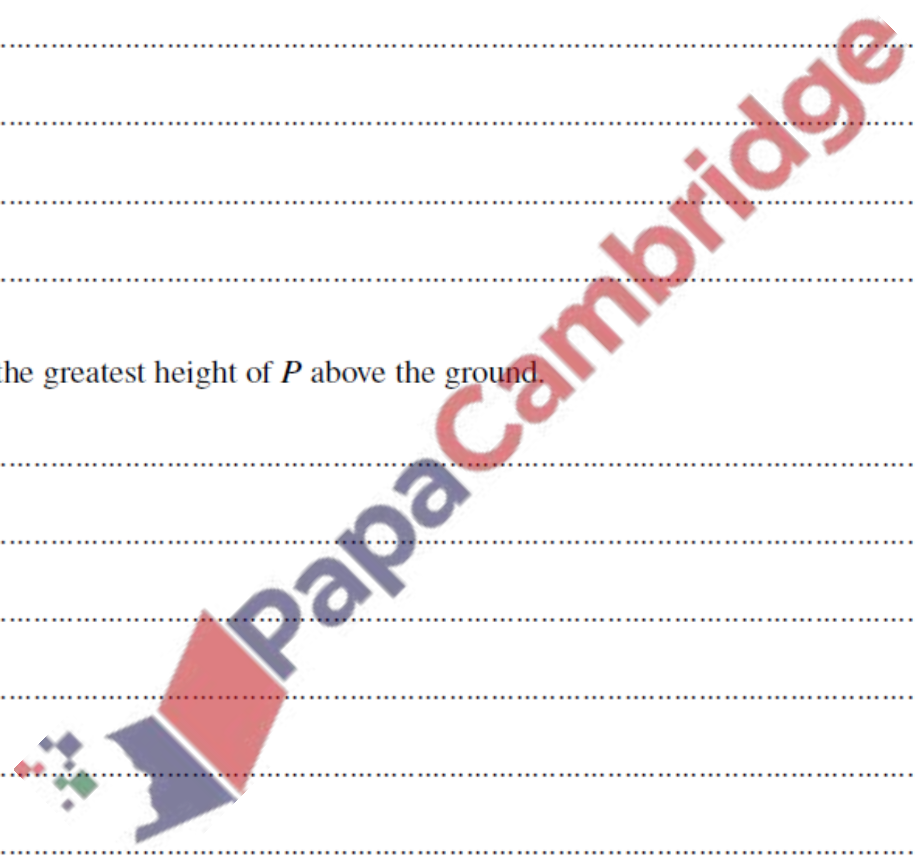
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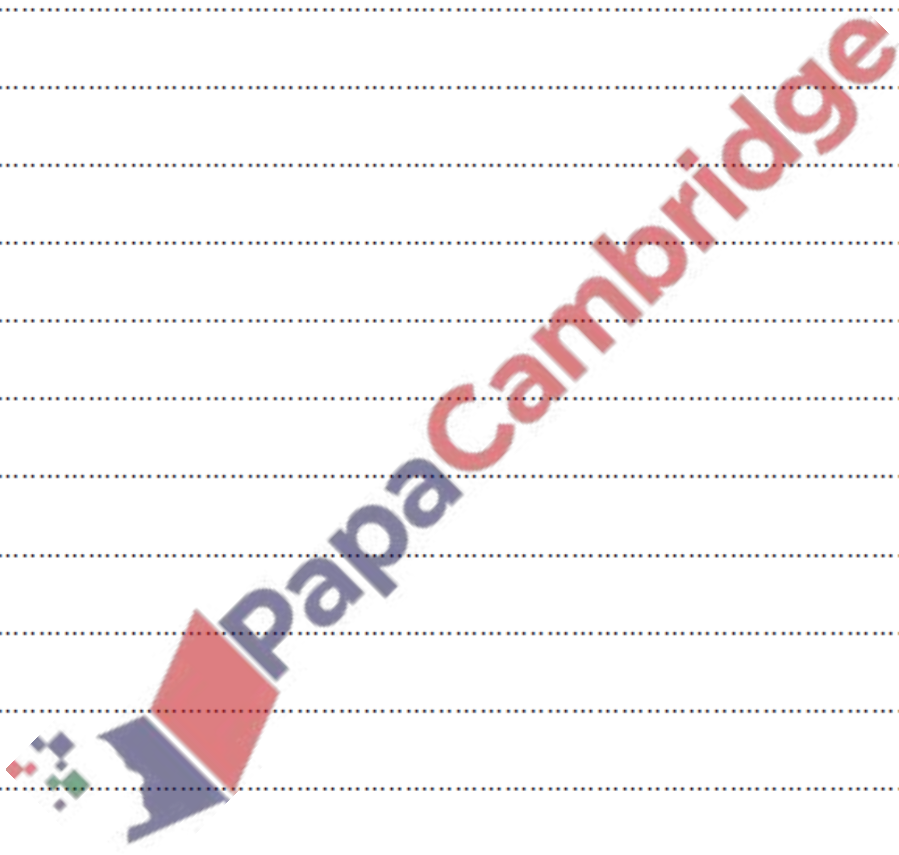


4. Nov/2022/Paper\_9709\_43/No.4

A particle  $P$  travels in the positive direction along a straight line with constant acceleration.  $P$  travels a distance of 52 m during the 2nd second of its motion and a distance of 64 m during the 4th second of its motion.

(a) Find the initial speed and the acceleration of  $P$ . [5]

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(b) Find the distance travelled by  $P$  during the first 10 seconds of its motion.

[2]

5. Nov/2022/Paper\_9709\_43/No.5

Particles  $X$  and  $Y$  move in a straight line through points  $A$  and  $B$ . Particle  $X$  starts from rest at  $A$  and moves towards  $B$ . At the same instant,  $Y$  starts from rest at  $B$ .

At time  $t$  seconds after the particles start moving

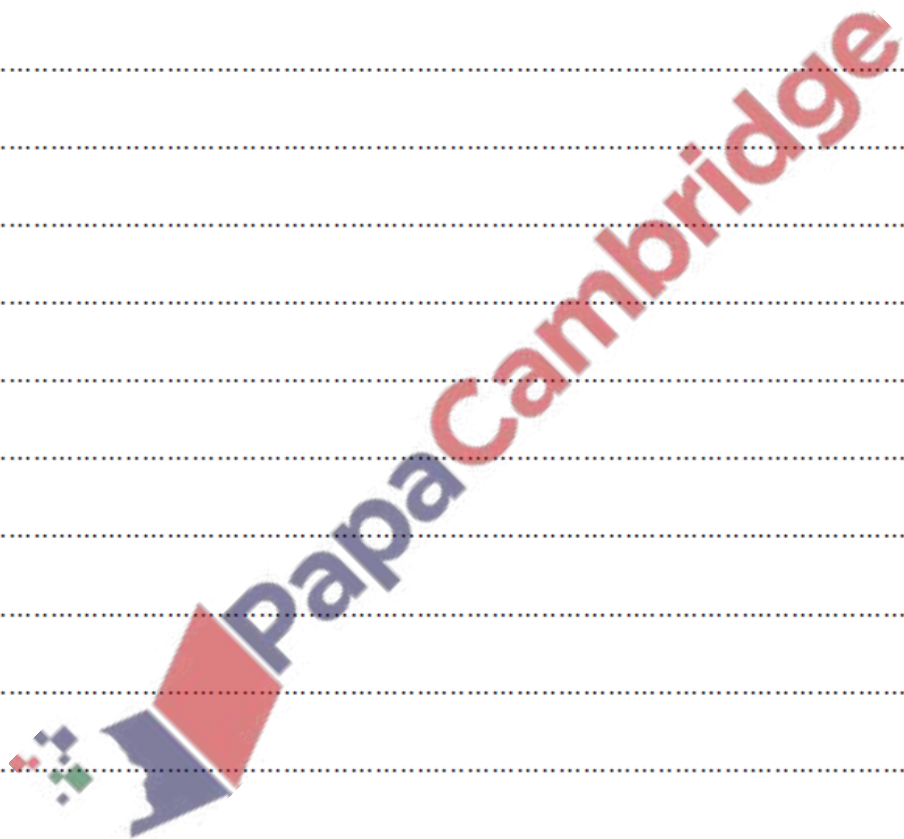
- the acceleration of  $X$  in the direction  $AB$  is given by  $(12t + 12) \text{ m s}^{-2}$ ,
- the acceleration of  $Y$  in the direction  $AB$  is given by  $(24t - 8) \text{ m s}^{-2}$ .

(a) It is given that the velocities of  $X$  and  $Y$  are equal when they collide.

Calculate the distance  $AB$ .

[6]

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(b) It is given instead that  $AB = 36$  m.

Verify that  $X$  and  $Y$  collide after 3 s.

[2]