
Further Kinematics - Edexcel Past Exam Questions

1. A particle P of mass 0.4 kg is moving under the action of a single force \mathbf{F} newtons. At time t seconds, the velocity of P , \mathbf{v} m s⁻¹, is given by

$$\mathbf{v} = (6t + 4)\mathbf{i} + (t^2 + 3t)\mathbf{j}.$$

When $t = 0$, P is at the point with position vector $(-3\mathbf{i} + 4\mathbf{j})$ m. When $t = 4$, P is at the point S .

- (a) Calculate the magnitude of \mathbf{F} when $t = 4$.

(4)

- (b) Calculate the distance OS .

(5)

Jan 05 Q4

2. A particle P moves in a horizontal plane. At time t seconds, the position vector of P is \mathbf{r} metres relative to a fixed origin O , and \mathbf{r} is given by

$$\mathbf{r} = (18t - 4t^3)\mathbf{i} + ct^2\mathbf{j},$$

where c is a positive constant. When $t = 1.5$, the speed of P is 15 m s⁻¹. Find

- (a) the value of c ,

(6)

- (b) the acceleration of P when $t = 1.5$.

(3)

June 05 Q3

3. A particle P of mass 0.4 kg is moving so that its position vector \mathbf{r} metres at time t seconds is given by

$$\mathbf{r} = (t^2 + 4t)\mathbf{i} + (3t - t^3)\mathbf{j}.$$

- (a) Calculate the speed of P when $t = 3$.

(5)

Jan 06 Q2 (edited)

4. A particle P moves on the x -axis. At time t seconds, its acceleration is $(5 - 2t) \text{ m s}^{-2}$, measured in the direction of x increasing. When $t = 0$, its velocity is 6 m s^{-1} measured in the direction of x increasing. Find the time when P is instantaneously at rest in the subsequent motion.

(6)

June 06 Q1

5. A particle P of mass 0.5 kg is moving under the action of a single force \mathbf{F} newtons. At time t seconds, $\mathbf{F} = (1.5t^2 - 3)\mathbf{i} + 2t\mathbf{j}$. When $t = 2$, the velocity of P is $(-4\mathbf{i} + 5\mathbf{j}) \text{ ms}^{-1}$.

(a) Find the acceleration of P at time t seconds. (2)

(b) Show that, when $t = 3$, the velocity of P is $(9\mathbf{i} + 15\mathbf{j}) \text{ ms}^{-1}$. (5)

Jan 07 Q6 (edited)

6. A particle P moves on the x -axis. At time t seconds the velocity of P is $v \text{ m s}^{-1}$ in the direction of x increasing, where v is given by

$$v = \begin{cases} 8t - \frac{3}{2}t^2, & 0 \leq t \leq 4 \\ 16 - 2t, & t > 4. \end{cases}$$

When $t = 0$, P is at the origin O .

Find

(a) the greatest speed of P in the interval $0 \leq t \leq 4$, (4)

(b) the distance of P from O when $t = 4$, (3)

(c) the time at which P is instantaneously at rest for $t > 4$, (1)

(d) the total distance travelled by P in the first 10 s of its motion. (8)

June 07 Q8

7. At time t seconds ($t \geq 0$), a particle P has position vector \mathbf{p} metres, with respect to a fixed origin O , where

$$\mathbf{p} = (3t^2 - 6t + 4)\mathbf{i} + (3t^3 - 4t)\mathbf{j}.$$

Find

- (a) the velocity of P at time t seconds, (2)
 (b) the value of t when P is moving parallel to the vector \mathbf{i} . (3)

Jan 08 Q2 (edited)

8. A particle P of mass 0.5 kg is moving under the action of a single force \mathbf{F} newtons. At time t seconds,

$$\mathbf{F} = (6t - 5)\mathbf{i} + (t^2 - 2t)\mathbf{j}.$$

The velocity of P at time t seconds is \mathbf{v} m s⁻¹. When $t = 0$, $\mathbf{v} = \mathbf{i} - 4\mathbf{j}$.

- (a) Find \mathbf{v} at time t seconds. (6)

June 08 Q4 (edited)

9. A particle P moves along the x -axis in a straight line so that, at time t seconds, the velocity of P is v m s⁻¹, where

$$v = \begin{cases} 10t - 2t^2, & 0 \leq t \leq 6, \\ \frac{-432}{t^2}, & t > 6. \end{cases}$$

At $t = 0$, P is at the origin O . Find the displacement of P from O when

- (a) $t = 6$, (3)

- (b) $t = 10$. (5)

Jan 09 Q4

10. At time $t = 0$ a particle P leaves the origin O and moves along the x -axis. At time t seconds the velocity of P is v m s⁻¹, where

$$v = 8t - t^2.$$

- (a) Find the maximum value of v . (4)

- (b) Find the time taken for P to return to O . (5)

June 09 Q2

11. A particle P moves along the x -axis. At time t seconds the velocity of P is v m s⁻¹ in the positive x -direction, where $v = 3t^2 - 4t + 3$. When $t = 0$, P is at the origin O . Find the distance of P from O when P is moving with minimum velocity.

(8)

Jan 10 Q1

12. A particle P moves on the x -axis. The acceleration of P at time t seconds, $t \geq 0$, is $(3t + 5)$ m s⁻² in the positive x -direction. When $t = 0$, the velocity of P is 2 m s⁻¹ in the positive x -direction. When $t = T$, the velocity of P is 6 m s⁻¹ in the positive x -direction.

Find the value of T .

(6)

June 10 Q1

13. A particle moves along the x -axis. At time $t = 0$ the particle passes through the origin with speed 8 m s⁻¹ in the positive x -direction. The acceleration of the particle at time t seconds, $t \geq 0$, is $(4t^3 - 12t)$ m s⁻² in the positive x -direction.

Find

(a) the velocity of the particle at time t seconds, (3)

(b) the displacement of the particle from the origin at time t seconds, (2)

(c) the values of t at which the particle is instantaneously at rest. (3)

Jan 11 Q3

14. A particle P moves on the x -axis. The acceleration of P at time t seconds is $(t - 4)$ m s⁻² in the positive x -direction. The velocity of P at time t seconds is v m s⁻¹. When $t = 0$, $v = 6$.

Find

(a) v in terms of t , (4)

(b) the values of t when P is instantaneously at rest, (3)

(c) the distance between the two points at which P is instantaneously at rest. (4)

June 11 Q6
