

Vectors 2D SUVAT Example Question

SUVAT Equations

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$s = vt - \frac{1}{2}at^2$$

$$s = \frac{u+v}{2}$$

$$v^2 = u^2 + 2as$$

$$\underline{v} = \underline{u} + \underline{a}t$$

$$\underline{s} = \underline{u}t + \frac{1}{2}\underline{a}t^2$$

$$\underline{s} = \underline{v}t - \frac{1}{2}\underline{a}t^2$$

$$\underline{s} = \frac{\underline{u} + \underline{v}}{2}$$

$$v^2 = u^2 + 2as$$

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- 6 The points A and B have position vectors $(3\mathbf{i} + 2\mathbf{j})$ metres and $(6\mathbf{i} - 4\mathbf{j})$ metres respectively. The vectors \mathbf{i} and \mathbf{j} are in a horizontal plane.
- (a) A particle moves from A to B with constant velocity $(\mathbf{i} - 2\mathbf{j}) \text{ m s}^{-1}$. Calculate the time that the particle takes to move from A to B . (3 marks)
- (b) The particle then moves from B to a point C with a constant acceleration of $2\mathbf{j} \text{ m s}^{-2}$. It takes 4 seconds to move from B to C .
- (i) Find the position vector of C . (4 marks)
- (ii) Find the distance AC . (2 marks)

$$\begin{aligned} \text{a) Distance} &= \sqrt{(6-3)^2 + (-4-2)^2} \\ &= \sqrt{9+36} \\ &= \sqrt{45} \end{aligned}$$

$$\text{Speed} = \sqrt{1^2 + (-2)^2} = \sqrt{5}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{\sqrt{45}}{\sqrt{5}} = \sqrt{9} = 3 \text{ s}$$

$$\text{b) i) } \underline{s} - \underline{s}_0 = \underline{u}t + \frac{1}{2}\underline{a}t^2$$

$$\underline{S} - \begin{pmatrix} 6 \\ -4 \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \end{pmatrix} t + \frac{1}{2} \begin{pmatrix} 0 \\ 2 \end{pmatrix} t^2$$

$$\underline{S} - \begin{pmatrix} 6 \\ -4 \end{pmatrix} = 4 \begin{pmatrix} 1 \\ -2 \end{pmatrix} + \frac{1}{2} \begin{pmatrix} 0 \\ 2 \end{pmatrix} \times 4^2$$

$$\underline{S} = \begin{pmatrix} 4 \\ -8 \end{pmatrix} + \begin{pmatrix} 0 \\ 16 \end{pmatrix} + \begin{pmatrix} 6 \\ -4 \end{pmatrix}$$

$$\underline{S} = \begin{pmatrix} 10 \\ 4 \end{pmatrix} \text{ m}$$

$$\underline{S} = 10\underline{i} + 4\underline{j} \text{ m}$$

ii) Distance from $A = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ to $C = \begin{pmatrix} 10 \\ 4 \end{pmatrix}$

$$= \sqrt{(10-3)^2 + (4-2)^2}$$

$$= \sqrt{49+4}$$

$$= \sqrt{53} = 7.28 \text{ m}$$
