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13	14 a	The velocity of a particle moving along the x-axis is given by $\dot{x} = 10 - 2t$, where x is the displacement from the origin in metres and t is the time in seconds. Initially the particle is 5 metres to the right of the origin.	
		(i) Show that the acceleration of the particle is constant.	1
		(ii) Find the time when the particle is at rest.	1
		(iii) Show that the position of the particle after 7 seconds is 26 metres to the right of the origin.	2
		(iv) Find the distance travelled by the particle during the first 7 seconds.	2

(i) $\ddot{x} = -2$, which is constant.

(ii) $\dot{x} = 10 - 2t = 0$

$$2t = 10$$

$$t = 5$$

∴ at rest after 5 seconds

(iii) $\dot{x} = 10 - 2t = 0$

$x = 10t - t^2 + c$

When $t = 0$, $x = 5$:

$$5 = 10(0) - (0)^2 + c$$

$$c = 5$$

∴ $x = 10t - t^2 + 5$

When $t = 7$:

$$x = 10(7) - (7)^2 + 5$$

$$= 26$$

∴ after 7 sec, 26 m to the right.

(iv) $x = 10t - t^2 + 5$

Subs $t = 0$, $x = 5$

Subs $t = 5$, $x = 10(5) - (5)^2 + 5$

$$= 30$$

Subs $t = 7$, $x = 10(7) - (7)^2 + 5$

$$= 26$$

From $x = 5$ to $x = 30$ is 25 metres, then back to $x = 26$ is 4 metres.

∴ particle travels 29 metres.

State Mean:
0.87/1
0.88/1
1.65/2
0.74/2

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by the Board of Studies

Board of Studies: Notes from the Marking Centre

(i) Most candidates completed this section successfully.

Common problems were:

- mismanaging +/−
- substituting $t = 0$.

(ii) Candidates needed to solve $10 - 2t = 0$ to find $t = 5$. In most responses, the stated condition $\left(\frac{dx}{dt} = 0\right)$ was clearly evident.

A common problem was:

- not associating 'at rest' with $\dot{x} = 0$ or $\frac{dx}{dt} = 0$.

(iii) In correct responses, candidates calculated $\int_0^7 10 - 2t \, dt$ and then added the initial position. Most candidates integrated the velocity equation $\dot{x} = 10 - 2t$, and then used the initial conditions to produce $x(t) = 10t - t2 + 5$, and subsequently $x(7) = 26$.

(iv) Candidates who drew a diagram had much greater success with this part. Only a small number of candidates solved the question by calculating absolute value of sections and adding.

A common problems was:

- not understanding the difference between distance travelled and position.

Source: http://www.boardofstudies.nsw.edu.au/hsc_exams/