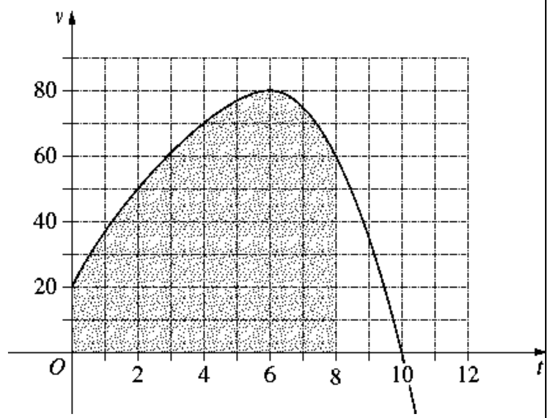
08 **6b** The graph shows the velocity of a particle, *v* metres per second, as a function of time, *t* seconds.



(i) What is the initial velocity of the particle? **1**

(ii) When is the velocity of the particle equal to zero? **1**

(iii) When is the acceleration of the particle equal to zero? **1**

(iv) By using Simpson's Rule with five function values, estimate the distance travelled by the particle between t = 0 and t = 8. **3**

i. From the graph, when $t = 0$, $v = 20$. The initial velocity is 20 metres per second.

ii. From the graph, when $v = 0$, $t = 10$. The velocity is 0 after 10 seconds.

iii. Acceleration is zero when velocity is max/min. From graph, velocity is max when $t = 6$.
Acceleration is zero after 6 seconds.

iv. Distance is the primitive (or integral) of the velocity function.
From the graph, with 5 function values: 0, 2, 4, 6, 8:

x	0	2	4	6	8
v	20	50	70	80	60

$$\text{Distance} = \frac{2}{3}[20 + 60 + 2 \times 70 + 4 \times [50 + 80]$$
$$= \frac{2}{3}[80 + 140 + 520]$$
$$= 493\frac{1}{3}$$

$\therefore$ Distance is about 493 metres

Board of Studies: Notes from the Marking Centre

(ii) and (iii)

In better responses, candidates interpreted the velocity graph and the language of motion. In some weaker responses, candidates did not distinguish between $v = 0$ and $a = 0$ and consequently made errors in parts (ii) and (iii).

(iv) A range of techniques were used with the most successful being

$$\text{Area} \approx \frac{h}{3}\{y_0 + y_n + 4(\text{odds}) + 2(\text{evens})\}.$$

Candidates that used this approach made fewer mistakes and demonstrated the most efficient working, although some swapped the odds and evens in the above equation. Using a table was also a very successful technique but involved a little more setting out. The least successful method was repeated application of $\text{Area} \approx \frac{b-a}{6}\left\{f(a) + 4f\left(\frac{a+b}{2}\right) + f(b)\right\}$ as candidates often used y values for a and b and often did not find function values. Mistakes included using the wrong number of function values, using x values in place of y and inappropriate use of the brackets in the formula. Some candidates used the Trapezoidal Rule instead.

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