

Tingkatan 5 Bab 8
Kinematik Gerakan Linear
Penyelesaian Lengkap

Praktis Formatif 8.1a

1 (a) $s = t^2 - 4t - 12$
 $s = 3^2 - 4(3) - 12$
 $s = -15$ m

(b) $s = 6^2 - 4(6) - 12$
 $s = 0$ m

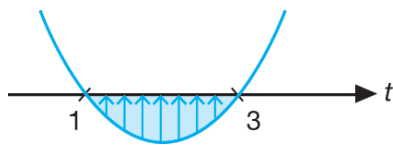
(c) $s = 7^2 - 4(7) - 12$
 $s = 9$ m

2 (a) $s = 3$
 $4t - t^2 = 3$
 $t^2 - 4t + 3 = 0$
 $(t-3)(t-1) = 0$
 $t = 3$ atau 1

(b) $s = -21$
 $4t - t^2 = -21$
 $t^2 - 4t - 21 = 0$
 $(t-7)(t+3) = 0$
 $t = 7$

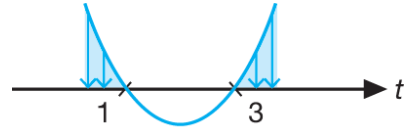
(c) $s = 0$
 $4t - t^2 = 0$
 $t(4-t) = 0$
 $t = 4$

3 (a) (i) $s < 0$
 $t^2 - 4t + 3 < 0$
 $(t-3)(t-1) < 0$



Julat nilai t ialah $1 < t < 3$.

(b) $s > 0$
 $t^2 - 4t + 3 > 0$
 $(t-3)(t-1) > 0$



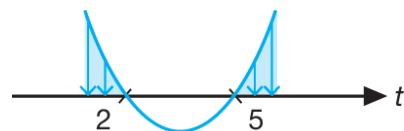
Julat nilai t ialah $0 < t < 1$ atau $t > 3$

(b) $t^2 - 4t + 3 = 0$
 $(t-3)(t-1) = 0$
 $t = 3$ atau 1

4 (a) $s = t^2 - 7t + 10$
 Sesaran awal = 10 m

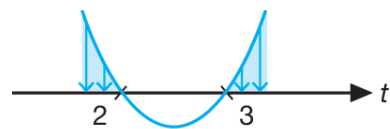
(b) $s = 28$
 $t^2 - 7t + 10 = 28$
 $t^2 - 7t - 18 = 0$
 $(t-9)(t+2) = 0$
 $t = 9$

(c) $s > 0$
 $t^2 - 7t + 10 > 0$
 $(t-5)(t-2) > 0$



Julat nilai t ialah $0 < t < 2$ atau $t > 5$.

5 (a) $s > 0$
 $t^2 - 5t + 6 > 0$
 $(t-2)(t-3) > 0$

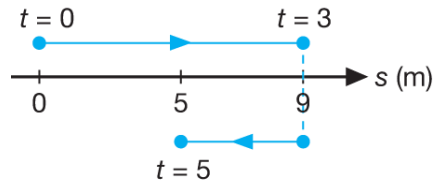


Julat nilai t ialah $0 < t < 2$ atau $t > 3$.

(b) Jarak yang dilalui pada saat keempat
 $= |s_4 - s_3|$
 $= |4^2 - 5(4) + 6 - (3^2 - 5(3) + 6)|$
 $= |2 - 0|$
 $= 2$ m

6 $s = 6t - t^2$

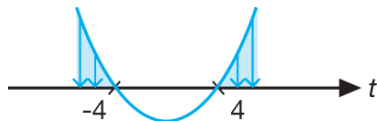
t (s)	0	1	2	3	4	5
s (m)	0	5	8	9	8	5



Jumlah jarak yang dilalui
 $= 9 + 4$
 $= 13$ m

7 (a) $s = -20$
 $16 - t^2 = -20$
 $t^2 = 16 + 20$
 $t^2 = 36$
 $t = 6$

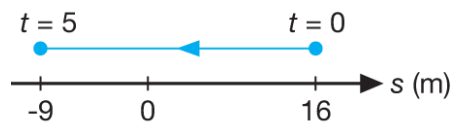
(b) $s < 0$
 $16 - t^2 < 0$
 $t^2 > 16$



Julat nilai t ialah $t > 4$.

(c) $s = 16 - t^2$

t (s)	0	1	2	3	4	5
s (m)	16	15	12	7	0	-9



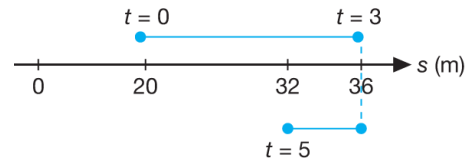
Jumlah jarak yang dilalui
 $= 9 + 16 = 25$ m

8 (a) $s = 20 + 8t - t^2$

Jarak yang dilalui dalam pada saat keenam
 $= |s_6 - s_5|$
 $= |20 + 8(6) - 6^2 - [20 + 8(5) - 5^2]|$
 $= |32 - 35|$
 $= |-3| = 3$ m

(b) $s = 20 + 8t - t^2$

t	0	1	2	3	4	5	6
s	20	27	32	35	36	35	32



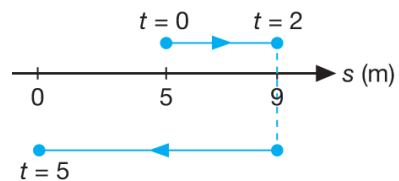
Jumlah jarak yang dilalui
 $= (36 - 20) + (36 - 32)$
 $= 16 + 4$
 $= 20$ m

9 (a) $s = 5 + 4t - t^2$
 $s = 5 + 4(5) - 5^2 = 0$

(b) $|s_5 - s_4|$
 $= |[5 + 4(5) - 5^2] - [5 + 4(4) - 4^2]|$
 $= |0 - 5|$
 $= 5$ m

(c)

t (s)	0	1	2	3	4	5
s (m)	5	8	9	8	5	0

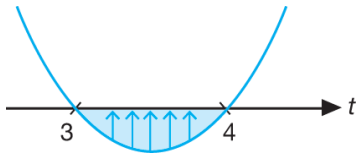


Jumlah jarak yang dilalui
 $= 4 + 9$
 $= 13$ m

Praktis Formatif 8.1b

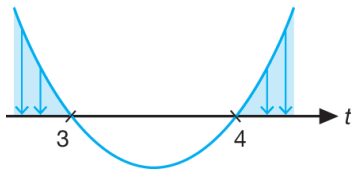
1 (a) $v = t^2 - 7t + 12$
 Apabila $v = 0$,
 $t^2 - 7t + 12 = 0$
 $(t - 4)(t - 3) = 0$
 $t = 4$ atau 3

(b) $v < 0$
 $t^2 - 7t + 12 < 0$
 $(t - 4)(t - 3) < 0$



Julat nilai t ialah $3 < t < 4$.

(c) $v > 0$
 $t^2 - 7t + 12 > 0$
 $(t - 4)(t - 3) > 0$



Julat nilai t ialah $0 < t < 3$ atau $t > 4$.

Praktis Formatif 8.1c

1 (a) $a = 6 - 3t$
 Apabila zarah bergerak dengan halaju malar,
 $a = 0$
 $6 - 3t = 0$
 $t = 2$

(b) (i) Apabila zarah memecut,
 $a > 0$
 $6 - 3t > 0$
 $-3t > -6$
 $t < \frac{-6}{-3}$
 $0 < t < 2$

(ii) Apabila zarah menyahpecut,
 $a < 0$
 $6 - 3t < 0$
 $-3t < -6$
 $t > \frac{-6}{-3}$
 $t > 2$

Praktis Formatif 8.2

1 (a) $s = t^2 + 5t - 36$
 $v = \frac{ds}{dt}$
 $v = 2t + 5$
 Apabila $t = 0$,
 $v = 2(0) + 5 = 5 \text{ ms}^{-1}$

(b) Apabila $s = -22$,
 $t^2 + 5t - 36 = -22$
 $t^2 + 5t - 14 = 0$
 $(t - 2)(t + 7) = 0$
 $t = 2$
 $v = 2(2) + 5 = 9 \text{ ms}^{-1}$

(c) Apabila $v = 13$,
 $2t + 5 = 13$
 $t = 4$
 $s = 4^2 + 5(4) - 36$
 $s = 0$

2 (a) $s = \frac{1}{3}t^3 - \frac{7}{2}t^2 + 10t$
 $v = \frac{ds}{dt}$
 $v = t^2 - 7t + 10$
 Apabila $v = 0$,
 $t^2 - 7t + 10 = 0$
 $(t - 5)(t - 2) = 0$
 $t = 2$ atau 5

(b) Apabila $t = 2$,

$$s = \frac{1}{3}(2)^3 - \frac{7}{2}(2)^2 + 10(2)$$

$$s = 8\frac{2}{3} \text{ m}$$

Apabila $t = 5$

$$s = \frac{1}{3}(5)^3 - \frac{7}{2}(5)^2 + 10(5)$$

$$s = 4\frac{1}{6} \text{ m}$$

Maka, jarak di antara dua titik

$$= 8\frac{2}{3} - 4\frac{1}{6}$$

$$= 4\frac{1}{2} \text{ m}$$

3 (a) $v = t^2 + 3t - 10$

Apabila $v = 8$,

$$t^2 + 3t - 10 = 8$$

$$t^2 + 3t - 18 = 0$$

$$(t - 3)(t + 6) = 0$$

$$t = 3$$

$$a = \frac{dv}{dt}$$

$$a = 2t + 3$$

$$a = 2(3) + 3 = 9 \text{ ms}^{-2}$$

(b) Apabila $v = 0$,

$$t^2 + 3t - 10 = 0$$

$$(t - 2)(t + 5) = 0$$

$$t = 2$$

$$a = 2(2) + 3 = 7 \text{ ms}^{-2}$$

4 $s = t^3 - 9t$

$$v = \frac{ds}{dt} = 3t^2 - 9$$

$$a = \frac{dv}{dt} = 6t$$

Apabila $s = 0$,

$$t^3 - 9t = 0$$

$$t(t^2 - 9) = 0$$

$$t(t + 3)(t - 3) = 0$$

$$t = 3$$

$$v = 3(3)^2 - 9 = 18 \text{ ms}^{-1}$$

$$a = 6(3) = 18 \text{ ms}^{-2}$$

5 (a) $v = t^2 - 3t - 10$

$$a = \frac{dv}{dt} = 2t - 3$$

Apabila $v = 0$,

$$t^2 - 3t - 10 = 0$$

$$(t - 5)(t + 2) = 0$$

$$t = 5$$

$$a = 2(5) - 3 = 7 \text{ ms}^{-2}$$

(b) Apabila $a = 0$,

$$2t - 3 = 0$$

$$t = \frac{3}{2}$$

$$v = \left(\frac{3}{2}\right)^2 - 3\left(\frac{3}{2}\right) - 10 = -12.25 \text{ ms}^{-1}$$

6 (a) $s = t^3 - 9t^2 + 3$

$$v = \frac{ds}{dt} = 3t^2 - 18t$$

$$a = \frac{dv}{dt} = 6t - 18$$

Apabila $t = 0$,

$$a = 6(0) - 18 = -18 \text{ ms}^{-2}$$

(b) Apabila $a < 0$,

$$6t - 18 < 0$$

$$6t < 18$$

$$0 < t < 3$$

7 (a) $s = t^3 - 6t^2$

$$v = \frac{ds}{dt} = 3t^2 - 12t$$

$$a = \frac{dv}{dt} = 6t - 12$$

Apabila $v = 0$,

$$3t^2 - 12t = 0$$

$$3t(t - 4) = 0$$

$$t = 4$$

$$s = 4^3 - 6(4)^2 = -32 \text{ m}$$

(b) $a > 0$

$$6t - 12 > 0$$

$$6t > 12$$

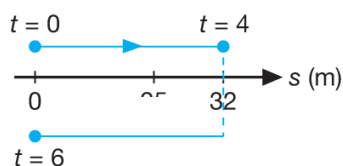
$$t > 2$$

8 (a) $s = 6t^2 - t^3$
 $v = \frac{ds}{dt} = 12t - 3t^2$

Apabila $v = 0$,
 $12t - 3t^2 = 0$
 $3t(4 - t) = 0$
 $t = 4$

(b)

t (s)	0	4	6
s (m)	0	32	0



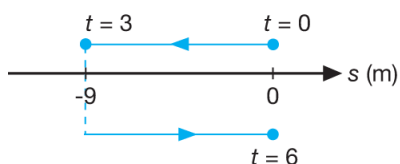
Jumlah jarak yang dilalui
 $= 32 + 32$
 $= 64$ m

9 (a) $s = t^2 - 6t$
 $v = \frac{ds}{dt} = 2t - 6$

Apabila $v = 0$,
 $2t - 6 = 0$
 $t = 3$ s

(b)

t (s)	0	3	6
s (m)	0	-9	0

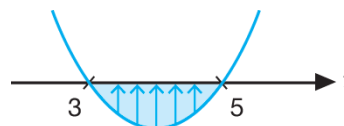


Jumlah jarak yang dilalui
 $= 9 + 9 = 18$ m

10 (a) $s = 4t^2 - \frac{1}{3}t^3 - 15t$
 $v = \frac{ds}{dt} = 8t - t^2 - 15$

Apabila $v = 0$,
 $8t - t^2 - 15 = 0$
 $t^2 - 8t + 15 = 0$
 $(t - 5)(t - 3) = 0$

$t = 5$ atau 3
 (b) $v > 0$
 $8t - t^2 - 15 > 0$
 $t^2 - 8t + 15 < 0$
 $(t - 3)(t - 5) < 0$



Julat nilai t ialah $3 < t < 5$.

11 (a) $s = 4t^2 - \frac{4}{3}t^3$
 $v = \frac{ds}{dt} = 8t - 4t^2$

Apabila $v = 0$,
 $8t - 4t^2 = 0$
 $4t(2 - t) = 0$
 $t = 2$

$s = 4(2)^2 - \frac{4}{3}(2)^3$

$s = 5\frac{1}{3}$ m

(b) $s = 0$

$4t^2 - \frac{4}{3}t^3 = 0$

$12t^2 - 4t^3 = 0$

$4t^2(3 - t) = 0$

$t = 3$

$v = 8(3) - 4(3)^2 = -12$ ms⁻¹

12 (a) $s = 15t - 7t^2 - \frac{1}{3}t^3$

$v = \frac{ds}{dt} = 15 - 14t - t^2$

Apabila $v = 0$,

$15 - 14t - t^2 = 0$

$t^2 + 14t - 15 = 0$

$(t + 15)(t - 1) = 0$

$t = 1$

(b) Apabila sesaran zarah adalah maksimum,

$\frac{ds}{dt} = 0$

$15 - 14t - t^2 = 0$

$t^2 + 14t - 15 = 0$

$(t + 15)(t - 1) = 0$

$t = 1$

$$\frac{d^2s}{dt^2} = -14 - 2t$$

Apabila $t = 1$,

$$\frac{d^2s}{dt^2} = -14 - 2(1) = -16 \text{ (negatif)}$$

Maka, s adalah maksimum.

Sesaran maksimum

$$= 15(1) - 7(1)^2 - \frac{1}{3}(1)^3$$

$$= 7\frac{2}{3} \text{ m}$$

Praktis Formatif 8.3

1 $v = 3t^2 - 2t + 1$

$$s = \int v \, dt$$

$$s = \int (3t^2 - 2t + 1) \, dt$$

$$s = t^3 - t^2 + t + c$$

Apabila $t = 0, s = 0$. Maka, $c = 0$.

$$s = t^3 - t^2 + t$$

Jarak yang dilalui pada saat kelima

$$= |s_5 - s_4|$$

$$= |5^3 - 5^2 + 5 - (4^3 - 4^2 + 4)|$$

$$= |105 - 52|$$

$$= 53 \text{ m}$$

2 $v = 3 + 2t$

$$s = \int (3 + 2t) \, dt$$

$$s = 3t + t^2 + c$$

Apabila $t = 0, s = 2$. Maka, $c = 2$.

$$s = 3t + t^2 + 2$$

Jarak yang dilalui pada saat keempat

$$= |s_4 - s_3|$$

$$= |12 + 16 + 2 - (9 + 9 + 2)|$$

$$= |30 - 20|$$

$$= 10 \text{ m}$$

3 $v = 12t - 3t^2$

$$s = \int v \, dt$$

$$s = \int (12t - 3t^2) \, dt$$

$$s = 6t^2 - t^3 + c$$

Apabila $t = 0, s = 1$. Maka, $c = 0$.

$$s = 6t^2 - t^3$$

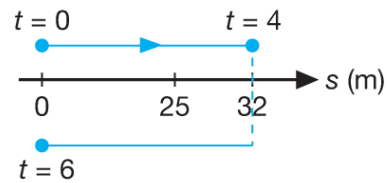
Apabila $v = 0$,

$$12t - 3t^2 = 0$$

$$3t(4 - t) = 0$$

$$t = 4$$

t (s)	0	4	6
s (m)	0	32	0



Jumlah jarak yang dilalui

$$= 32 + 32$$

$$= 64 \text{ m}$$

4 (a) $v = 2t - 6$

$$s = \int (2t - 6) \, dt$$

$$s = t^2 - 6t + c$$

Apabila $t = 0, s = 0$. Maka, $c = 0$.

$$s = t^2 - 6t$$

Apabila $v = 0$,

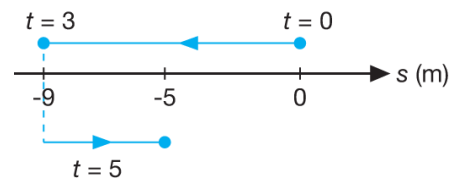
$$2t - 6 = 0$$

$$t = 3$$

$$s = 3^2 - 6(3) = -9 \text{ m}$$

(b)

t (s)	0	3	5
s (m)	0	-9	-5



$$\begin{aligned} & \text{Jumlah jarak yang dilalui} \\ & = 9 + 4 \\ & = 13 \text{ m} \end{aligned}$$

$$5 \quad v = 4 + 3t - t^2$$

$$s = \int (4 + 3t - t^2) dt$$

$$s = 4t + \frac{3t^2}{2} - \frac{t^3}{3} + c$$

Apabila $t = 0$, $s = 0$. Maka, $c = 0$.

$$s = 4t + \frac{3t^2}{2} - \frac{t^3}{3}$$

Apabila sesaran zarah adalah maksimum,

$$\begin{aligned} v &= \frac{ds}{dt} = 0 \\ 4 + 3t - t^2 &= 0 \\ t^2 - 3t - 4 &= 0 \\ (t - 4)(t + 1) &= 0 \\ t &= 4 \end{aligned}$$

$$\frac{d^2s}{dt^2} = 3 - 2t$$

Apabila $t = 4$, $\frac{d^2s}{dt^2} = 3 - 2(4) = -5$ (negatif)

Maka, sesaran maksimum

$$\begin{aligned} &= 4(4) + \frac{3(4)^2}{2} - \frac{4^3}{3} \\ &= 18\frac{2}{3} \text{ m} \end{aligned}$$

$$6 \quad a = 6 - 3t$$

$$v = \int (6 - 3t) dt$$

$$v = 6t - \frac{3t^2}{2} + c$$

Apabila $t = 0$, $v = -9$.

$$\text{Maka, } v = 6t - \frac{3t^2}{2} - 9$$

Apabila halaju zarah adalah maksimum,

$$\begin{aligned} \frac{dv}{dt} &= a = 0 \\ 6 - 3t &= 0 \\ t &= 2 \end{aligned}$$

$$\frac{d^2v}{dt^2} = -3 \text{ (negatif)}$$

Maka, halaju maksimum

$$\begin{aligned} &= 6(2) - \frac{3(2)^2}{2} - 9 \\ &= -3 \text{ ms}^{-1} \end{aligned}$$

$$7 \text{ (a)} \quad v = 12t - 3t^2 - 7$$

$$a = \frac{dv}{dt} = 12 - 6t$$

Apabila $v = 2$,

$$12t - 3t^2 - 7 = 2$$

$$3t^2 - 12t + 9 = 0$$

$$t^2 - 4t + 3 = 0$$

$$(t - 3)(t - 1) = 0$$

$$t = 3 \text{ atau } 1$$

Apabila $t = 3$, $a = 12 - 6(3) = -6 \text{ ms}^{-1}$

Apabila $t = 1$, $a = 12 - 6(1) = 6 \text{ ms}^{-1}$

(b) Apabila halaju zarah adalah maksimum,

$$\begin{aligned} \frac{dv}{dt} &= a = 0 \\ 12 - 6t &= 0 \\ t &= 2 \end{aligned}$$

$$\frac{d^2v}{dt^2} = -6 \text{ (negatif)}$$

Maka, halaju maksimum

$$\begin{aligned} &= 12(2) - 3(2)^2 - 7 \\ &= 5 \text{ ms}^{-1} \end{aligned}$$

$$8 \text{ (a)} \quad a = 6t + 5$$

$$v = \int a dt$$

$$v = \int (6t + 5) dt$$

$$v = 3t^2 + 5t + c$$

Apabila $t = 0$, $v = -8$. Maka, $c = -8$.

$$v = 3t^2 + 5t - 8$$

Apabila $t = 3$,

$$v = 3(3)^2 + 5(3) - 8 = 34 \text{ ms}^{-1}$$

$$(b) \quad s = \int v dt$$

$$s = \int (3t^2 + 5t - 8) dt$$

$$s = t^3 + \frac{5t^2}{2} - 8t + c$$

Apabila $t = 0$, $s = 0$.

$$\text{Maka, } s = t^3 + \frac{5t^2}{2} - 8t$$

Apabila $v = 0$,

$$3t^2 + 5t - 8 = 0$$

$$(t - 1)(3t + 8) = 0$$

$$t = 1$$

$$s = 1^3 + \frac{5(1)^2}{2} - 8(1) = -4.5 \text{ ms}^{-1}$$

9 (a) $a = 3 - 2t$

$$v = \int (3 - 2t) dt$$

$$v = 3t - t^2 + c$$

Apabila $t = 0, v = -2$. Maka, $c = -2$

$$v = 3t - t^2 - 2$$

Apabila $v = 0$,

$$3t - t^2 - 2 = 0$$

$$t^2 - 3t + 2 = 0$$

$$(t - 2)(t - 1) = 0$$

$$t = 2 \text{ atau } 1$$

(b) $s = \int v dt$

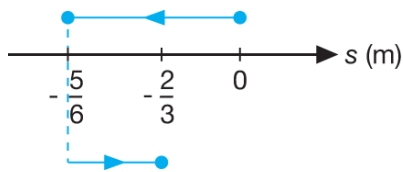
$$s = \int (3t - t^2 - 2) dt$$

$$s = \frac{3t^2}{2} - \frac{t^3}{3} - 2t + c$$

Apabila $t = 0, s = 0$. Maka, $c = 0$

$$s = \frac{3t^2}{2} - \frac{t^3}{3} - 2t$$

t (s)	0	1	2
s (m)	0	$-\frac{5}{6}$	$-\frac{2}{3}$



Jumlah jarak yang dilalui

$$= \frac{5}{6} + \left(\frac{5}{6} - \frac{2}{3} \right)$$

$$= 1 \text{ m}$$

10 $a = 4t - 8$

$$v = \int a dt$$

$$v = \int (4t - 8) dt$$

$$v = 2t^2 - 8t + c$$

Apabila $t = 0, v = 6$. Maka, $c = 6$

$$\text{Maka, } v = 2t^2 - 8t + 6$$

$$s = \int v dt$$

$$s = \int (2t^2 - 8t + 6) dt$$

$$s = \frac{2t^3}{3} - 4t^2 + 6t + c$$

Apabila $t = 0, s = 0$. Maka, $c = 0$

$$s = \frac{2t^3}{3} - 4t^2 + 6t$$

Apabila $v = 0$,

$$2t^2 - 8t + 6 = 0$$

$$t^2 - 4t + 3 = 0$$

$$(t - 1)(t - 3) = 0$$

$$t = 1 \text{ atau } 3$$

Apabila $t = 1$,

$$s = \frac{2(1)^3}{3} - 4(1)^2 + 6(1) = 2\frac{2}{3} \text{ m}$$

Apabila $t = 3$,

$$s = \frac{2(3)^3}{3} - 4(3)^2 + 6(3) = 0 \text{ m}$$

$$\text{Jarak } PQ = 2\frac{2}{3} \text{ m}$$

Praktis Formatif 8.4

1 (a) $v = ht - kt^2$

$$s = \int (ht - kt^2) dt$$

$$s = \frac{ht^2}{2} - \frac{kt^3}{3} + c$$

Apabila $t = 0, s = 0$. Maka, $c = 0$.

$$s = \frac{ht^2}{2} - \frac{kt^3}{3}$$

$$|s_1 - s_0| = \frac{13}{3}$$

$$\frac{h}{2} - \frac{k}{3} = \frac{13}{3}$$

$$3h - 2k = 26 \dots (1)$$

$$a = \frac{dv}{dt} = h - 2kt$$

Apabila $t = 3, a = -2$

$$h - 2k(3) = -2$$

$$h = 6k - 2 \dots (2)$$

Gantikan (2) ke dalam (1) :

$$3(6k - 2) - 2k = 26$$

$$18k - 6 - 2k = 26$$

$$16k = 32$$

$$k = 2$$

Daripada (2) :

$$h = 6(2) - 2 = 10$$

(b) Apabila $h = 10$ dan $k = 2$,

$$v = ht - kt^2$$

$$v = 10t - 2t^2$$

$$s = \frac{10t^2}{2} - \frac{2t^3}{3}$$

$$s = 5t^2 - \frac{2t^3}{3}$$

Apabila $v = 12$,

$$10t - 2t^2 = 12$$

$$2t^2 - 10t + 12 = 0$$

$$t^2 - 5t + 6 = 0$$

$$(t - 2)(t - 3) = 0$$

$$t = 2 \text{ atau } t = 3$$

Maka, masa yang diambil untuk zarah untuk bergerak dari titik A ke titik B ialah 1 saat.

(c) Bagi titik B,

$$s = 5(3)^2 - \frac{2(3)^3}{3}$$

$$s = 27 \text{ m}$$

Apabila $v = 0$,

$$10t - 2t^2 = 0$$

$$2t(5 - t) = 0$$

$$t = 5$$

Bagi titik C,

$$s = 5(5)^2 - \frac{2(5)^3}{3}$$

$$s = 41\frac{2}{3} \text{ m}$$

$$\text{Jarak } BC = 41\frac{2}{3} - 27 = 14\frac{2}{3} \text{ m}$$

$$s = 5t^2 - \frac{2t^3}{3}$$

2 (a) $v_M = 2t - 6$

$$s_M = \int (2t - 6) dt$$

$$s_M = t^2 - 6t$$

$$v_N = 5 - t$$

$$s_N = \int (5 - t) dt$$

$$s_N = 5t - \frac{t^2}{2} + c$$

Apabila $t = 0, s_N = 8$, Maka, $c = 8$

$$s_N = 5t - \frac{t^2}{2} + 8$$

Apabila zarah M dan zarah N bertemu,

$$t^2 - 6t = 5t - \frac{t^2}{2} + 8$$

$$2t^2 - 12t = 10t - t^2 + 16$$

$$3t^2 - 22t - 16 = 0$$

$$(t - 8)(3t + 2) = 0$$

$$t = 8$$

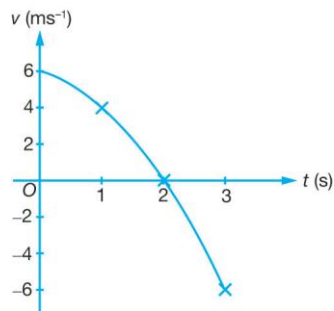
(b) Apabila $t = 8$,

$$s_N = 5(8) - \frac{8^2}{2} + 8$$

$$s_N = 16 \text{ m}$$

3 (a)

t (s)	0	1	2	3
v (ms ⁻¹)	6	4	0	-6

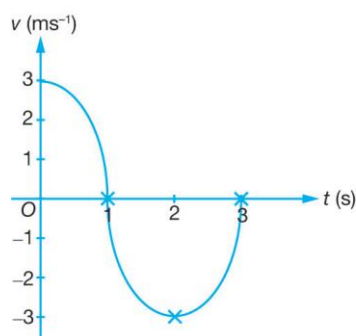


(b) Jumlah jarak yang dilalui

$$\begin{aligned}
 &= \int_0^2 (-t^2 - t + 6) dt + \\
 &\quad \left| \int_2^3 (-t^2 - t + 6) dt \right| \\
 &= \left[-\frac{t^3}{3} - \frac{t^2}{2} + 6t \right]_0^2 + \\
 &\quad \left| \left[-\frac{t^3}{3} - \frac{t^2}{2} + 6t \right]_2^3 \right| \\
 &= -\frac{8}{3} - \frac{4}{2} + 12 + \\
 &\quad \left| -9 - \frac{9}{2} + 18 - \left[\left(-\frac{8}{3} \right) - 2 + 12 \right] \right| \\
 &= 7\frac{1}{3} + \left| 4\frac{1}{2} - 7\frac{1}{3} \right| \\
 &= 7\frac{1}{3} + 2\frac{5}{6} \\
 &= 10\frac{1}{6} \text{ m}
 \end{aligned}$$

4 (a)

t (s)	0	1	2	3
v (ms ⁻¹)	3	0	-3	0



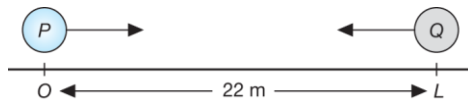
$$(b) v = (t^2 - 1)(t - 3) = t^3 - 3t^2 - t + 3$$

Jumlah jarak yang dilalui

$$\begin{aligned}
 &= \int_0^1 (t^3 - 3t^2 - t + 3) dt + \\
 &\quad \left| \int_1^3 (t^3 - 3t^2 - t + 3) dt \right| \\
 &= \left[\frac{t^4}{4} - t^3 - \frac{t^2}{2} + 3t \right]_0^1 + \\
 &\quad \left| \left[\frac{t^4}{4} - t^3 - \frac{t^2}{2} + 3t \right]_1^3 \right| \\
 &= 1\frac{3}{4} + \left| -2\frac{1}{4} - 1\frac{3}{4} \right| \\
 &= 1\frac{3}{4} + | -4 | \\
 &= 5\frac{3}{4} \text{ m}
 \end{aligned}$$

Praktis Sumatif 8

1



(a) $s_Q = 6t^3 - 2t$

$$v_Q = \frac{ds_Q}{dt} = 18t^2 - 2$$

Apabila $t = 0$, $v_Q = 18(0)^2 - 2 = -2$

Maka, halaju awal zarah Q ialah -2 ms^{-1} .

(b) Apabila zarah Q bertukar arah,

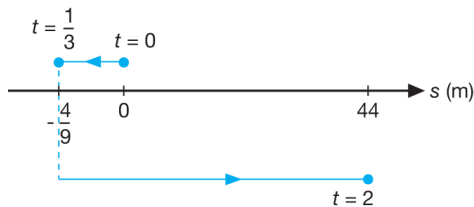
$$v_Q = 0$$

$$18t^2 - 2 = 0$$

$$t^2 = \frac{1}{9}$$

$$t = \frac{1}{3}$$

t (s)	0	$\frac{1}{3}$	2
s_Q (m)	0	$-\frac{4}{9}$	44



Hence, the total distance travelled by particle Q in the first 2 seconds

$$= \frac{4}{9} + \frac{4}{9} + 44$$

$$= 44\frac{8}{9} \text{ m}$$

(c) $v_P = 18t^2 + 20$

$$s_P = \int v_P dt$$

$$s_P = \int (18t^2 + 20) dt$$

$$s_P = 6t^3 + 20t + c$$

Apabila $t = 0$,

$$s_P \text{ (dari titik } O) = 0.$$

Oleh itu, $s_P = 6t^3 + 20t$

$$s_Q = 6t^3 - 2t + 22$$

Apabila $t = 0$, jarak zarah Q dari titik O ialah 22 m.

Apabila P dan zarah Q bertemu,

$$s_P = s_Q$$

$$6t^3 + 20t = 6t^3 - 2t + 22$$

$$22t = 22$$

$$t = 1$$

Maka, apabila zarah P dan zarah Q bertemu, jarak zarah-zarah dari titik O

$$= 6(1)^3 + 20(1)$$

$$= 26 \text{ m}$$

2 (a) $v = pt^2 - 6t$
 $a = \frac{dv}{dt}$
 $a = 2pt - 6$
 Apabila $t = 5, a = 34$
 $34 = 2p(5) - 6$
 $40 = 10p$
 $p = 4$

Jumlah jarak yang dilalui dalam 3 saat pertama
 $= 2\frac{1}{4} + 2\frac{1}{4} + 9$
 $= 13\frac{1}{2} \text{ m}$

(b) $v = 4t^2 - 6t$
 Apabila halaju zarah menyusut,
 $\frac{dv}{dt} < 0$
 $8t - 6 < 0$
 $8t < 6$
 $t < \frac{3}{4}$

Maka, julat nilai t yang dikehendaki ialah $0 < t < \frac{3}{4}$.

(c) $v = 0$
 $4t^2 - 6t = 0$
 $2t(2t - 3) = 0$
 $t = 0$ atau $\frac{3}{2}$

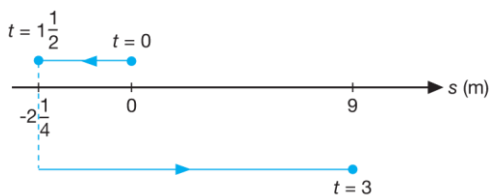
Maka, masa apabila zarah berhenti seketika ialah $1\frac{1}{2}$ s.

(d) $s = \int v dt$
 $s = \int (4t^2 - 6t) dt$
 $s = \frac{4t^3}{3} - \frac{6t^2}{2} + c$

Apabila $t = 0, s = 0$. Maka, $c = 0$.

$\therefore s = \frac{4t^3}{3} - 3t^2$

t (s)	0	$1\frac{1}{2}$	3
s (m)	0	$-2\frac{1}{4}$	9



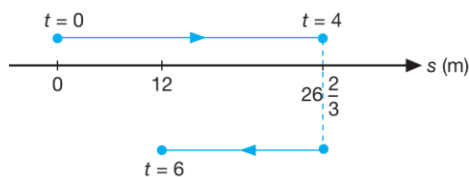
- 3 (a) $v = -t^2 + 2t + 8$
 Apabils $t = 0$, $v = 8$
 Maka, halaju awal zarah ialah 8 ms^{-1} .

- (b) Apabila zarah berhenti seketika,
 $v = 0$
 $-t^2 + 2t + 8 = 0$
 $t^2 - 2t - 8 = 0$
 $(t + 2)(t - 4) = 0$
 $t = -2$ atau 4
 $t = -2$ tidak diterima
 $\therefore t = 4$

- (c) Apabila halaju zarah adalah maksimum,
 $\frac{dv}{dt} = 0$
 $-2t + 2 = 0$
 $t = 1$
 Apabila $t = 1$,
 $v_{\text{mak}} = -(1)^2 + 2(1) + 8 = 9 \text{ ms}^{-1}$

- (d) $s = \int v dt$
 $s = \int (-t^2 + 2t + 8) dt$
 $s = -\frac{t^3}{3} + t^2 + 8t + c$
 Apabila $t = 0$, $s = 0$. Maka, $c = 0$.
 $\therefore s = -\frac{t^3}{3} + t^2 + 8t$

t (s)	0	4	6
s (m)	0	$26\frac{2}{3}$	12



Jumlah jarak yang dilalui dalam 6 saat pertama

$$= 26\frac{2}{3} + \left(26\frac{2}{3} - 12\right) = 41\frac{1}{3} \text{ m}$$

- 4 (a) Apabila $t = 0$, $a = 4 - 2(0) = 4$
 Maka, pecutan awal zarah ialah 4 ms^{-2} .

- (b) $v = \int a dt$
 $v = \int (4 - 2t) dt$
 $v = 4t - \frac{2t^2}{2} + c$
 Apabila $t = 0$, $v = 12$. Maka, $c = 12$
 $v = 4t - t^2 + 12$

Apabila halaju zarah adalah maksimum,

$$\frac{dv}{dt} = 0$$

$$4 - 2t = 0$$

$$t = 2$$

$$\frac{d^2v}{dt^2} = -2 \text{ (negatif)}$$

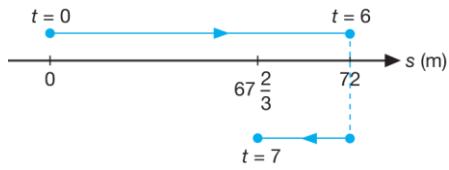
$$\therefore v_{\text{mak}} = 4(2) - 2^2 + 12$$

$$= 16 \text{ ms}^{-1}$$

- (c) Apabila $v = 0$,
 $4t - t^2 + 12 = 0$
 $t^2 - 4t - 12 = 0$
 $(t + 2)(t - 6) = 0$
 $t = -2$ atau 6
 $t = -2$ tidak diterima
 $\therefore t = 6 \text{ s}$

- (d) $s = \int v dt$
 $s = \int (4t - t^2 + 12) dt$
 $s = \frac{4t^2}{2} - \frac{t^3}{3} + 12t + c$
 Apabila $t = 0$, $s = 0$. Maka, $c = 0$
 $s = 2t^2 - \frac{t^3}{3} + 12t$

t (s)	0	6	7
s (m)	0	72	$67\frac{2}{3}$



Maka, jumlah jarak yang dilalui dalam 7 saat pertama

$$= 72 + \left(72 - 67\frac{2}{3} \right)$$

$$= 76\frac{1}{3} \text{ m}$$

5 (a) $a = \frac{dv}{dt} = -4 \text{ ms}^{-2}$

(b) Apabila $v = 0$,
 $6 - 4t = 0$
 $t = 1.5 \text{ s}$

(c) $s = \int v \, dt$

$$s = \int (6 - 4t) \, dt$$

$$s = 6t - 2t^2 + c$$

Apabila $t = 0, s = 0$. Maka, $c = 0$

$$s = 6t - 2t^2$$

Apabila $s = -8$ (pada titik P),

$$6t - 2t^2 = -8$$

$$2t^2 - 6t - 8 = 0$$

$$t^2 - 3t - 4 = 0$$

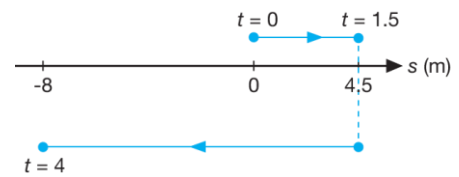
$$(t+1)(t-4) = 0$$

$$\therefore t = 4$$

Apabila $t = 4, v = 6 - 4(4) = -10 \text{ ms}^{-1}$

(d)

$t \text{ (s)}$	0	1.5	4
$s \text{ (m)}$	0	4.5	-8



Jumlah jarak yang dilalui dalam 5 saat pertama

$$= 4.5 + 4.5 + 8 = 17 \text{ m}$$

6 (a) Apabila $a = 0$, $7 - 4t = 0$

$$t = \frac{7}{4} \text{ s}$$

(b) Pada halaju maksimum,

$$\frac{dv}{dt} = 0$$

$$a = 0$$

$$t = \frac{7}{4}$$

$$v = \int a \, dt$$

$$v = \int (7 - 4t) \, dt$$

$$v = 7t - 2t^2 + c$$

Apabila $t = 0$, $v = 4$, $\therefore c = 4$

$$\therefore v = 7t - 2t^2 + 4$$

$$\frac{d^2v}{dt^2} = -4 \quad (< 0)$$

$$\begin{aligned} \text{Maka, } v_{\text{mak}} &= 7\left(\frac{7}{4}\right) - 2\left(\frac{7}{4}\right)^2 + 4 \\ &= 10\frac{1}{8} \text{ ms}^{-1} \end{aligned}$$

(c) Apabila $v = 0$,

$$7t - 2t^2 + 4 = 0$$

$$2t^2 - 7t - 4 = 0$$

$$(2t + 1)(t - 4) = 0$$

$$t = -\frac{1}{2} \text{ atau } 4$$

$$t = -\frac{1}{2} \text{ tidak diterima}$$

$$\therefore t = 4 \text{ s}$$

(d) $s = \int v \, dt$

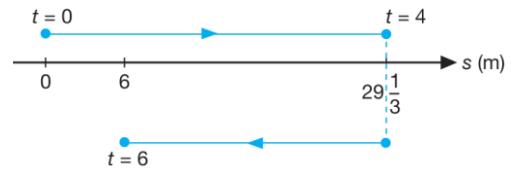
$$s = \int (7t - 2t^2 + 4) \, dt$$

$$s = \frac{7t^2}{2} - \frac{2t^3}{3} + 4t + c$$

Apabila $t = 0$, $s = 0$. Maka, $c = 0$

$$s = \frac{7t^2}{2} - \frac{2t^3}{3} + 4t$$

t (s)	0	4	6
s (m)	0	$29\frac{1}{3}$	6



Maka, jumlah jarak yang dilalui dalam 6 saat pertama

$$\begin{aligned} &= 29\frac{1}{3} + \left(29\frac{1}{3} - 6\right) \\ &= 52\frac{2}{3} \text{ m} \end{aligned}$$

7 (a) $v = \int a dt$

$$v = \int (8 - 2t) dt$$

$$v = 8t - \frac{2t^2}{2} + c$$

$$v = 8t - t^2 + c$$

Apabila $t = 0$, $v = -12$. Maka,

$$c = -12.$$

$$\therefore v = 8t - t^2 - 12$$

Apabila halaju zarah adalah maksimum,

$$\frac{dv}{dt} = 0$$

$$8 - 2t = 0$$

$$t = 4$$

$$v_{\text{mak}} = 8(4) - 4^2 - 12 = 4 \text{ ms}^{-1}$$

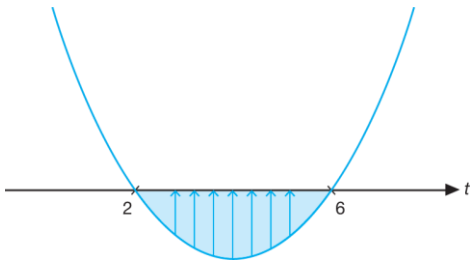
(b) Apabila zarah bergerak ke arah kanan,

$$v > 0$$

$$8t - t^2 - 12 > 0$$

$$t^2 - 8t + 12 < 0$$

$$(t - 2)(t - 6) < 0$$



Maka, julat nilai t ialah

$$2 < t < 6.$$

(c) $s = \int v dt$

$$s = \int (8t - t^2 - 12) dt$$

$$s = \frac{8t^2}{2} - \frac{t^3}{3} - 12t + c$$

$$s = 4t^2 - \frac{t^3}{3} - 12t + c$$

Apabila $t = 0$, $s = 0$. Maka, $c = 0$.

$$\therefore s = 4t^2 - \frac{t^3}{3} - 12t$$

Apabila zarah bertukar arah,

$$v = 0$$

$$8t - t^2 - 12 = 0$$

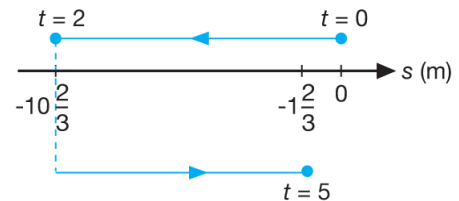
$$t^2 - 8t + 12 = 0$$

$$(t - 2)(t - 6) = 0$$

$$t = 2 \text{ atau } 6$$

Oleh sebab $t \leq 5$, kita guna $t = 2$.

t (s)	0	2	5
s (m)	0	$-10\frac{2}{3}$	$-1\frac{2}{3}$



Jumlah jarak yang dilalui dalam 5 saat pertama

$$= 10\frac{2}{3} + \left(10\frac{2}{3} - 1\frac{2}{3}\right)$$

$$= 19\frac{2}{3} \text{ m}$$

8 (a) Apabila $t = 0$, $v = 15 + 7(0) - 4(0)^2$
 $= 15 \text{ cms}^{-1}$

(b) $a = \frac{dv}{dt} = 7 - 8t$
 Apabila $t = 0$, $a = 7 - 8(0)$
 $a = 7 \text{ cms}^{-2}$

(c) $\frac{dv}{dt} = 7 - 8t$
 Apabila halaju maksimum zarah adalah maksimum,

$$\frac{dv}{dt} = 0$$

$$7 - 8t = 0$$

$$t = \frac{7}{8}$$

$$\frac{d^2v}{dt^2} = -8 \text{ (negatif)}$$

Maka, halaju maksimum

$$= 15 + 7\left(\frac{7}{8}\right) - 4\left(\frac{7}{8}\right)^2$$

$$= 18\frac{1}{16} \text{ cms}^{-1}$$

(d) $s = \int v \, dt$
 $s = \int (15 + 7t - 4t^2) \, dt$
 $s = 15t + \frac{7t^2}{2} - \frac{4t^3}{3} + c$
 Apabila $t = 0$, $s = 0$. Maka, $c = 0$
 $\therefore s = 15t + \frac{7t^2}{2} - \frac{4t^3}{3}$

Apabila $v = 0$,

$$15 + 7t - 4t^2 = 0$$

$$4t^2 - 7t - 15 = 0$$

$$(4t + 5)(t - 3) = 0$$

$$t = -\frac{5}{4} \text{ atau } 3$$

$$t = -\frac{5}{4} \text{ tidak diterima}$$

$$\therefore t = 3$$

Apabila $t = 3$,

$$s = 15(3) + \frac{7(3)^2}{2} - \frac{4(3)^3}{3} = 40\frac{1}{2} \text{ cm}$$

9 (a) Pada titik A,
 $v = 0$

$$12 + 4t - t^2 = 0$$

$$t^2 - 4t - 12 = 0$$

$$(t + 2)(t - 6) = 0$$

$$t = -2 \text{ atau } 6$$

$$t = -2 \text{ tidak diterima}$$

$$\therefore t = 6$$

$$a = \frac{dv}{dt} = 4 - 2t$$

$$\text{Apabila } t = 6, a = 4 - 2(6) = -8 \text{ ms}^{-2}$$

(b) Apabila halaju zarah adalah maksimum,

$$\frac{dv}{dt} = 0$$

$$4 - 2t = 0$$

$$t = 2$$

$$\frac{d^2v}{dt^2} = -2 (< 0)$$

$$\therefore v_{\text{mak}} = 12 + 4(2) - 2^2 = 16 \text{ ms}^{-1}$$

(c) $s = \int v \, dt$

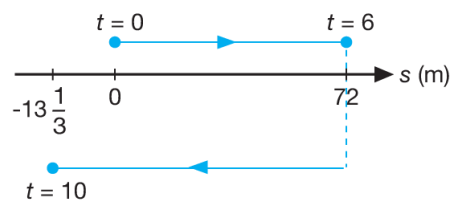
$$s = \int (12 + 4t - t^2) \, dt$$

$$s = 12t + 2t^2 - \frac{t^3}{3} + c$$

Apabila $t = 0$, $s = 0$. Maka, $c = 0$.

$$\therefore s = 12t + 2t^2 - \frac{t^3}{3}$$

t (s)	0	6	10
s (m)	0	72	$-13\frac{1}{3}$



Jumlah jarak yang dilalui dalam 10 saat pertama

$$= 72 + 72 + 13\frac{1}{3}$$

$$= 157\frac{1}{3} \text{ m}$$

10 (a) $v = -10 + 7t - t^2$

Apabila $t = 0, v = -10$

Maka, halaju awal ialah -10 ms^{-1} .

- (b) Apabila halaju zarah adalah maksimum,

$$\begin{aligned}\frac{dv}{dt} &= 0 \\ 7 - 2t &= 0 \\ t &= 3.5\end{aligned}$$

Apabila $t = 3.5$,

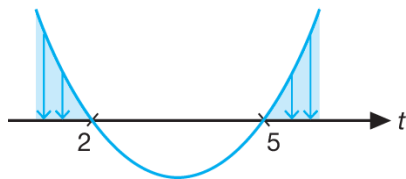
$$\begin{aligned}v &= -10 + 7(3.5) - (3.5)^2 \\ v &= 2.25\end{aligned}$$

$$\frac{d^2v}{dt^2} = -2 \quad (< 0)$$

Maka, halaju maksimum ialah 2.25 ms^{-1} .

- (c) Apabila zarah bergerak ke arah kanan,
 $v > 0$

$$\begin{aligned}-10 + 7t - t^2 &> 0 \\ t^2 - 7t + 10 &< 0 \\ (t - 2)(t - 5) &< 0\end{aligned}$$



Julat nilai t ialah $2 < t < 5$.

- (d) Apabila $v = 0$,

$$\begin{aligned}-10 + 7t - t^2 &= 0 \\ t^2 - 7t + 10 &= 0 \\ (t - 2)(t - 5) &= 0\end{aligned}$$

$$t = 2 \text{ atau } 5$$

Maka, zarah berada dalam keadaan rehat bagi kedua apabila $t = 5$.

$$s = \int v \, dt$$

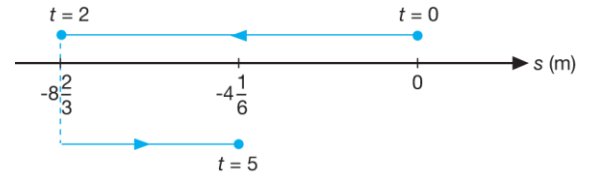
$$s = \int (-10 + 7t - t^2) \, dt$$

$$s = -10t + \frac{7t^2}{2} - \frac{t^3}{3} + c$$

Apabila $t = 0, s = 0$. Maka, $c = 0$.

$$\therefore s = -10t + \frac{7t^2}{2} - \frac{t^3}{3}$$

t (s)	0	2	5
s (m)	0	$-8\frac{2}{3}$	$-4\frac{1}{6}$



Maka jumlah jarak yang dilalui dalam 5 saat pertama

$$= 8\frac{2}{3} + \left(8\frac{2}{3} - 4\frac{1}{6}\right)$$

$$= 8\frac{2}{3} + 4\frac{1}{2}$$

$$= 13\frac{1}{6} \text{ m}$$