Answers – Motion Graphs

1.

(a) Distance = ½ x 4 x 9 + 16 x 9 **or** ½ (20 + 16) x 9 M1

= 162 m A1
(2)

(b) Distance over last 5 s = ½(9 + *u*) x 5 M1

162 + ½(9 + *u*) x 5 = 200 M1 A1√

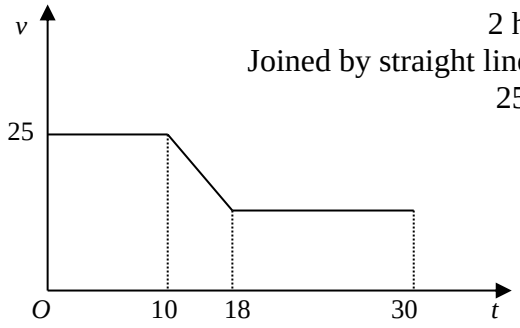
⇒ *u* = 6.2 m s^{-1} A1
(4)

(c) 6.2 = 9 + 5*a* M1 A1√

a = (–) 0.56 m s^{-2} A1
(3)

2.

(a)



2 horizontal lines
Joined by straight line sloping down
25, 10, 18, 30 oe

(b) $25\times10+\frac{1}{2}(25+V)\times8+12\times V=526$

Solving to $V=11$

(c) "$v=u+at$" $\Rightarrow$ $11=25-8a$ ft their V

$a=1.75$ $\left(\text{m s}^{-2}\right)$

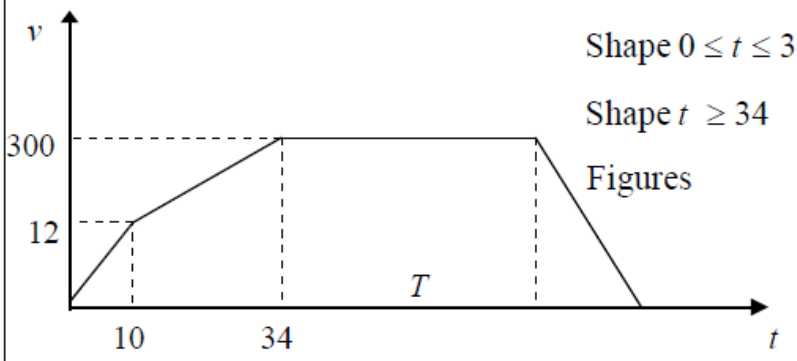
3.

(a) After 10 s, speed $= 1.2 \times 10 = 12\ \text{m s}^{-1}$ B1

After next 24 s, $v = "u + at" = 12 + 0.75 \times 24 = 30\ \text{m s}^{-1}$ M1 A1

(3)

(b)



Shape $0 \le t \le 34$ B1

Shape $t \ge 34$ B1

Figures B1

(c) $\text{Distance} = \frac{1}{2} \times 10 \times 12, + \frac{1}{2}(30+12)24$ B1, M1 A1

$= 60 + 504 = \underline{564\ \text{m}}$ A1

(4)

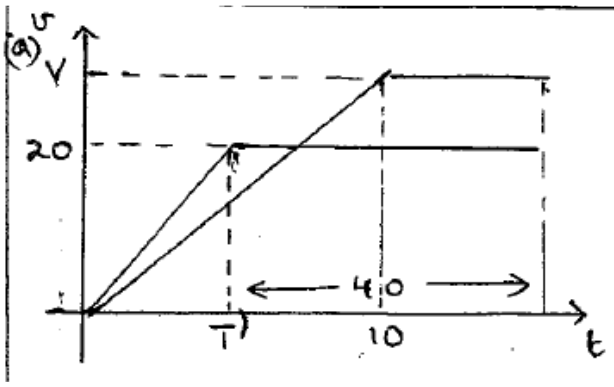
(d) $\text{Distance travelled decelerating} = \frac{1}{2} \times 30 \times 10$ B1

$564 + 30T + \frac{1}{2} \times 30 \times 10 = 3000$ M1 A1√

$\Rightarrow \text{T} = \underline{76.2\ \text{s}}$ A1

(4)

4.



One shape correct B1

2nd shape correct rel. to first B1

Figs (10, 20, 40) B1 (3)

(b) Scooter: dist travelled = area under graph

$850 = \frac{1}{2}T.20 + 20.40$ m1 A1

$\Rightarrow T = 5s$ A1 (3)

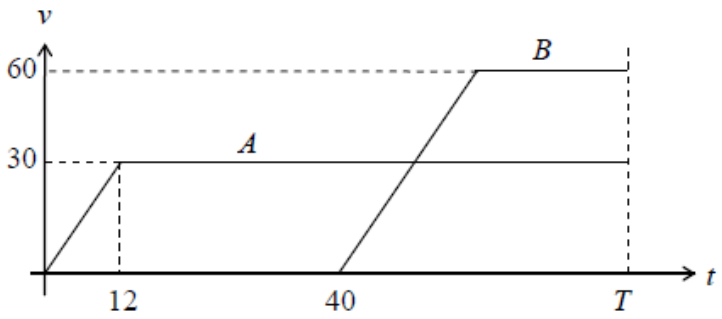
(c) Van: $850 = \frac{1}{2}V.10 + V(40-5)$ m1 A1√(T)

$\Rightarrow V = 21.25\ ms^{-1}$ A1 (3)

(9)

5.

(a)



Shape for A B1

Shape for B with parallel slope B1

Figures B1 (3)

(b)

Distance moved by $A = \frac{1}{2} \times 12 \times 30, + 30(T - 12)$ B1, M1 A1

B accelerates for 24 s B1

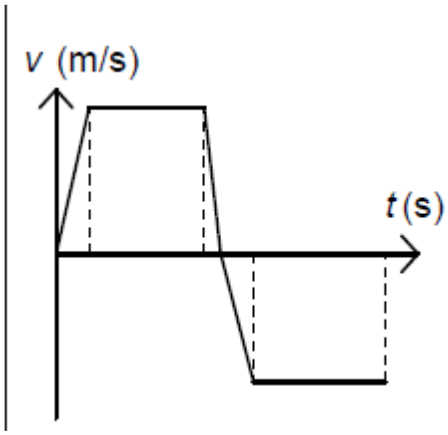
Distance moved by $B = \frac{1}{2} \times 24 \times 60, + 60(T - 64)$ B1, M1 A1

$\frac{1}{2} \times 12 \times 30, + 30(T - 12) = \frac{1}{2} \times 24 \times 60, + 60(T - 64)$ M1

$\Rightarrow T = 98$ s A1 (9)

6.

(i)



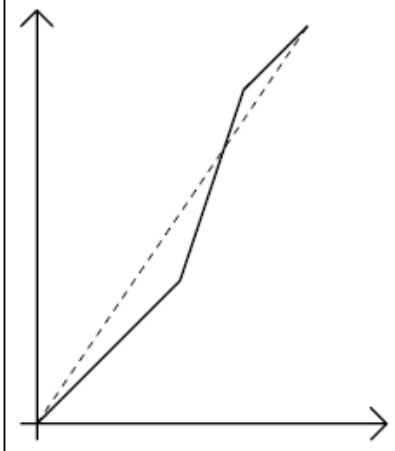
M1

A1

B1 3

(ii)	OA = ½ 20×9 + 82×9 + ½ 8×9 = 90 + 738 + 36	M1	
	Distance *OA* is 864 m	A1	2
(iii)	$\Delta t = 16$	B1	
	Distance at constant speed = 864 – ½ 16×8	M1	
	110 + 16 + 800/8	M1	
	Total time is 226 s	A1ft	4

7.

(i)		B1 B1 B1	
	Time intervals 80, 40, 40 *t* = 80, 120, 160	B1 B1	
(ii)	Line joining (0, 0) and (160, 360)	B1 ft	6
(iii)	*v* = 360/160	M1 M1	
	s = 120 + 4.5(*t* – 80)	A1	
	2.25*t*	M1	
	$t = 106\ \frac{2}{3}$ (107)	A1	5
	SR Construction method Plotting points on graph paper *t* between 104 and 109 inclusive	M1 A1	

8.

(i)	$\frac{1}{2} 25v_m = 8$ or $\frac{1}{2}Tv_m+\frac{1}{2}(25 - T)v_m = 8$	B*1	
	Greatest speed is 0.64 ms^{-1}	D*B 1	2
(ii)		M1	
	V = 0.02 x 40	A1	
	V = 0.8	A1	3
(iii)		M1	
		M1	
	½ (70 + T) x 0.8 = 40 - 8	A1ft	
	Duration is 10s	A1	4
(iv)		M1	
	0=0.8+a(30–10)	A1ft	
	Deceleration is $0.04ms^{-2}$	A1	3
	Or	M1	
	40-8-½ x 40 x 0.8-10x0.8	A1ft	
	$=0.8(30-10)-a(30–10)^2/2$	A1	
	Deceleration is $0.04ms^{-2}$		