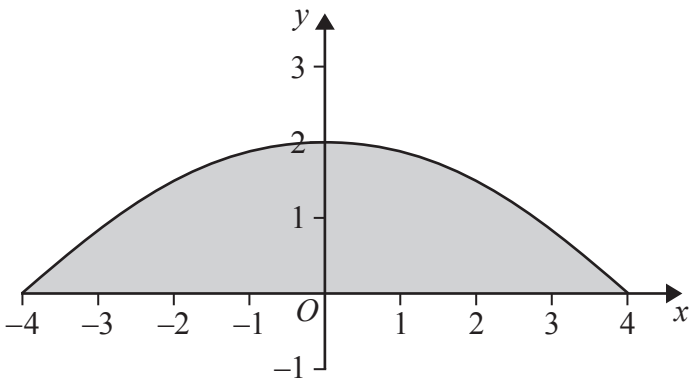
19 Here is a sketch of the graph of $y = 2 - \frac{1}{8}x^2$



The graph is used to model the shape of a cross-section of a domed roof.
The cross-section of the roof is shaded.

(a) Calculate an estimate of the area of the cross-section of the roof.

.....

(4)

(b) Describe how you could increase the accuracy of your estimate.

.....

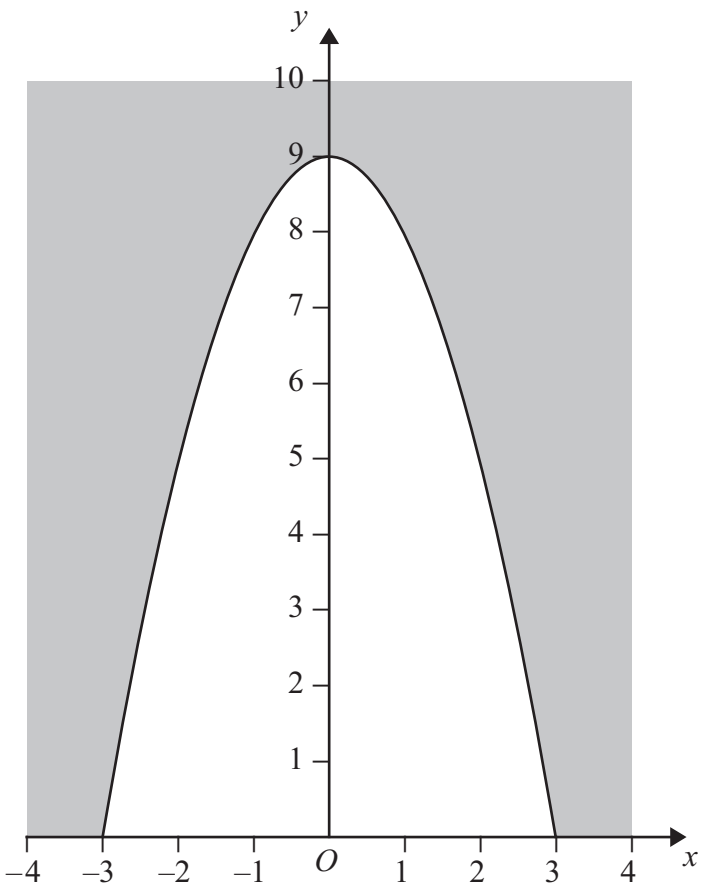
.....

.....

(1)

(Total for Question 19 is 5 marks)

23 Here is a sketch of the graph of $y = 9 - x^2$



The graph is used to model the cross section of a tunnel.
The unshaded area is the cross section of the tunnel.

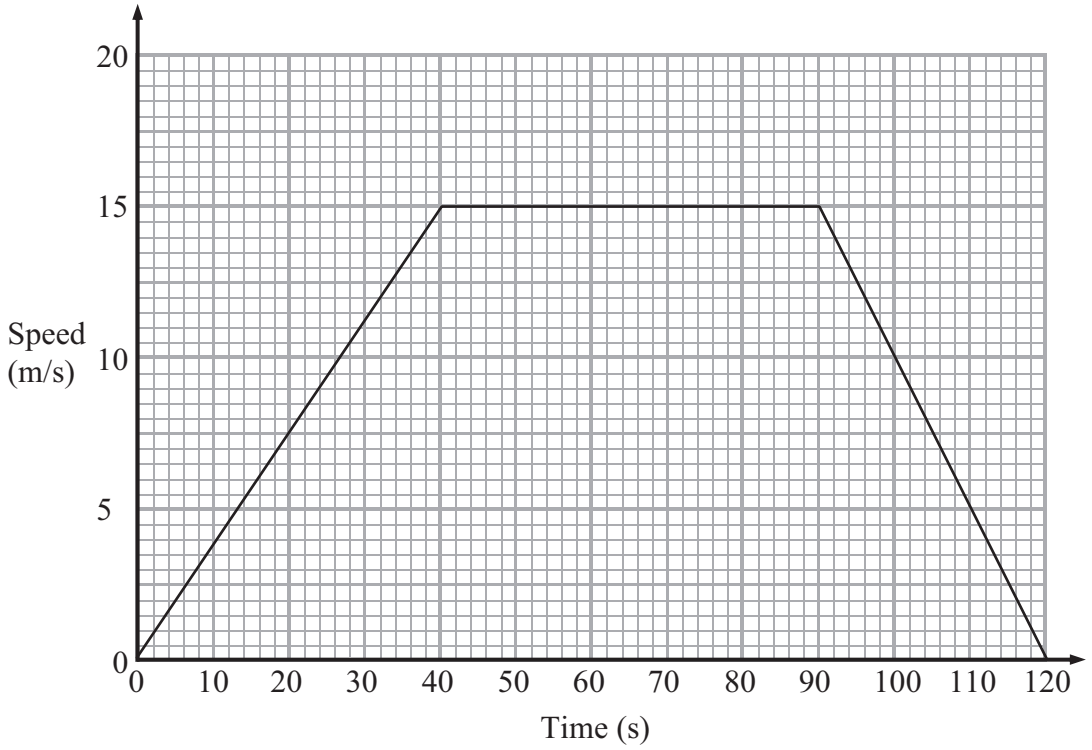
Calculate an estimate of the area of the cross section of the tunnel.

.....

(Total for Question 23 is 4 marks)

20 A car travels along a straight road between 2 sets of traffic lights.

Here is the speed time graph for this journey.



(a) Work out the acceleration of the car during the first 40 seconds.

..... m/s^2

(2)

(b) Describe what happens to the speed of the car between the times of 40 s and 120 s.

.....

.....

(2)

(c) Find the total distance, in metres, that the car travels between the two sets of traffic lights.

..... m

(2)

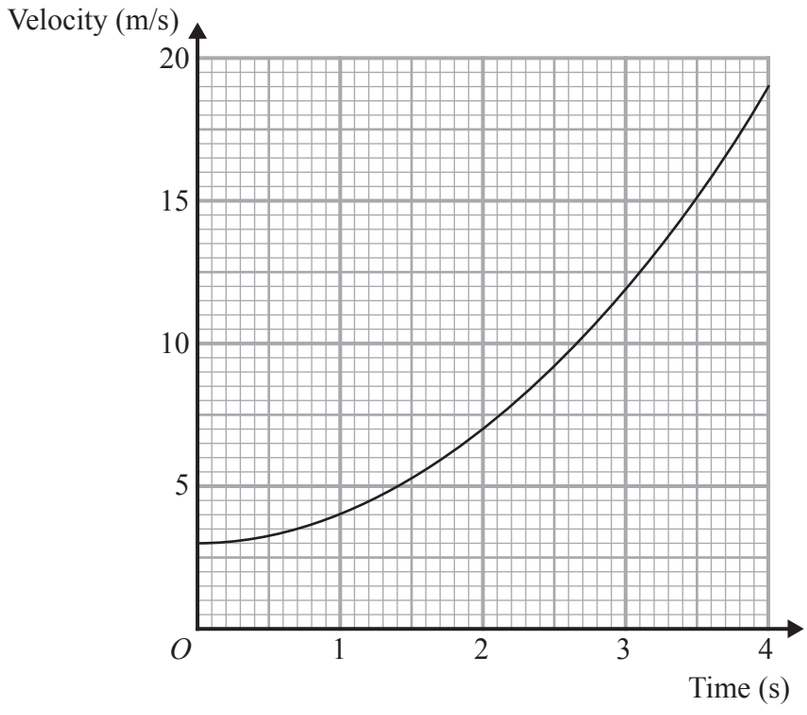
(d) Work out the average speed of the car in kilometres per hour between the two sets of traffic lights.

..... km/h

(3)

(Total for Question 20 is 9 marks)

23 The graph gives information about the velocity of a particle during the first 4 seconds of its motion.



(a) Work out an estimate for the acceleration after 1.5 seconds

..... m/s^2

(3)

(b) Work out an estimate for the distance travelled by the particle during the first 4 seconds of its motion.

..... m

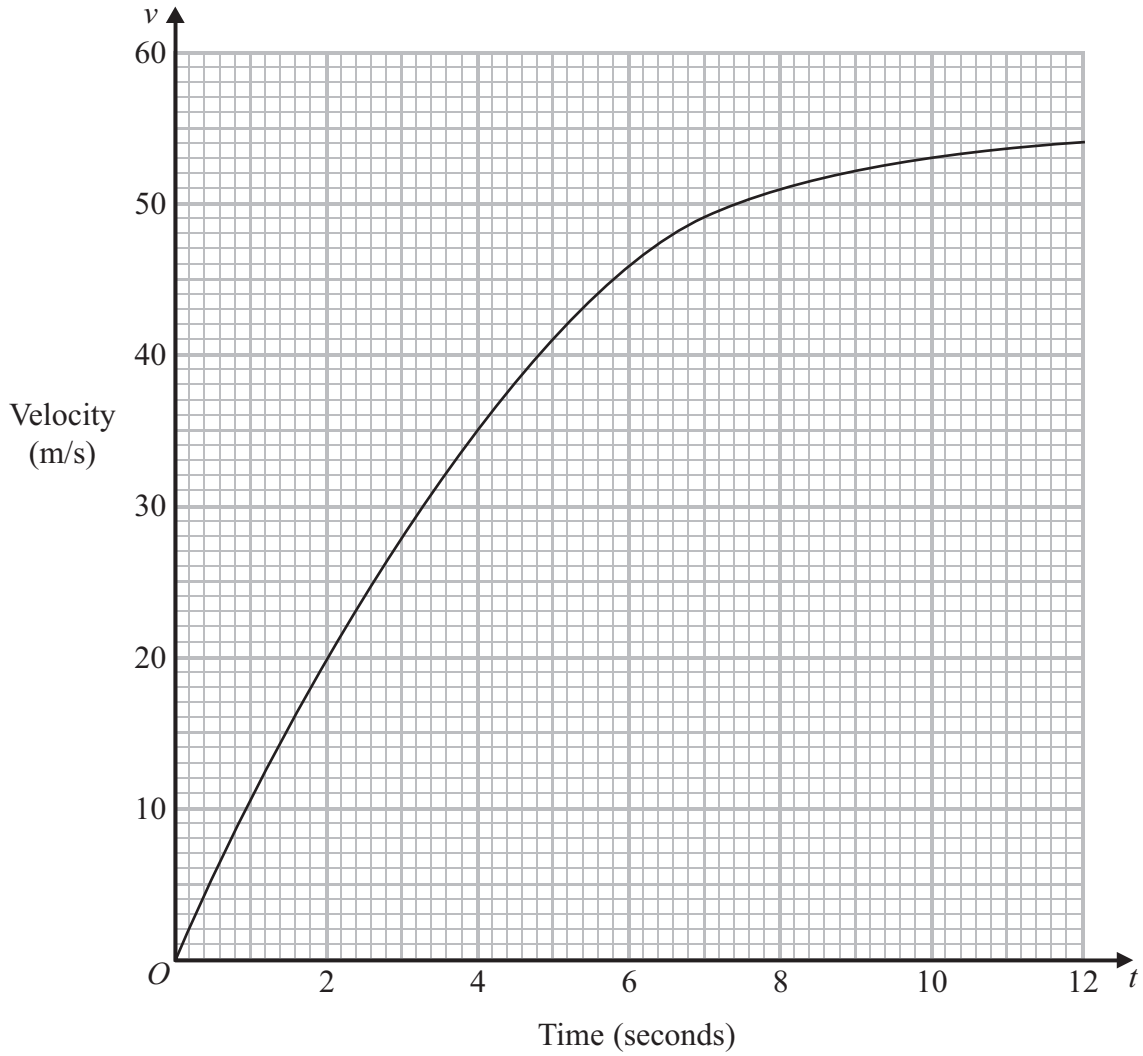
(3)

(Total for Question 23 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS

18 A parachutist jumps out of a plane.

This graph shows information about the velocity, v m/s, of the parachutist t seconds after he jumped.



(a) Work out an estimate for the acceleration of the parachutist when $t = 8$

..... m/s^2

(3)

(b) Work out an estimate for the distance the parachutist falls in the first 6 seconds.

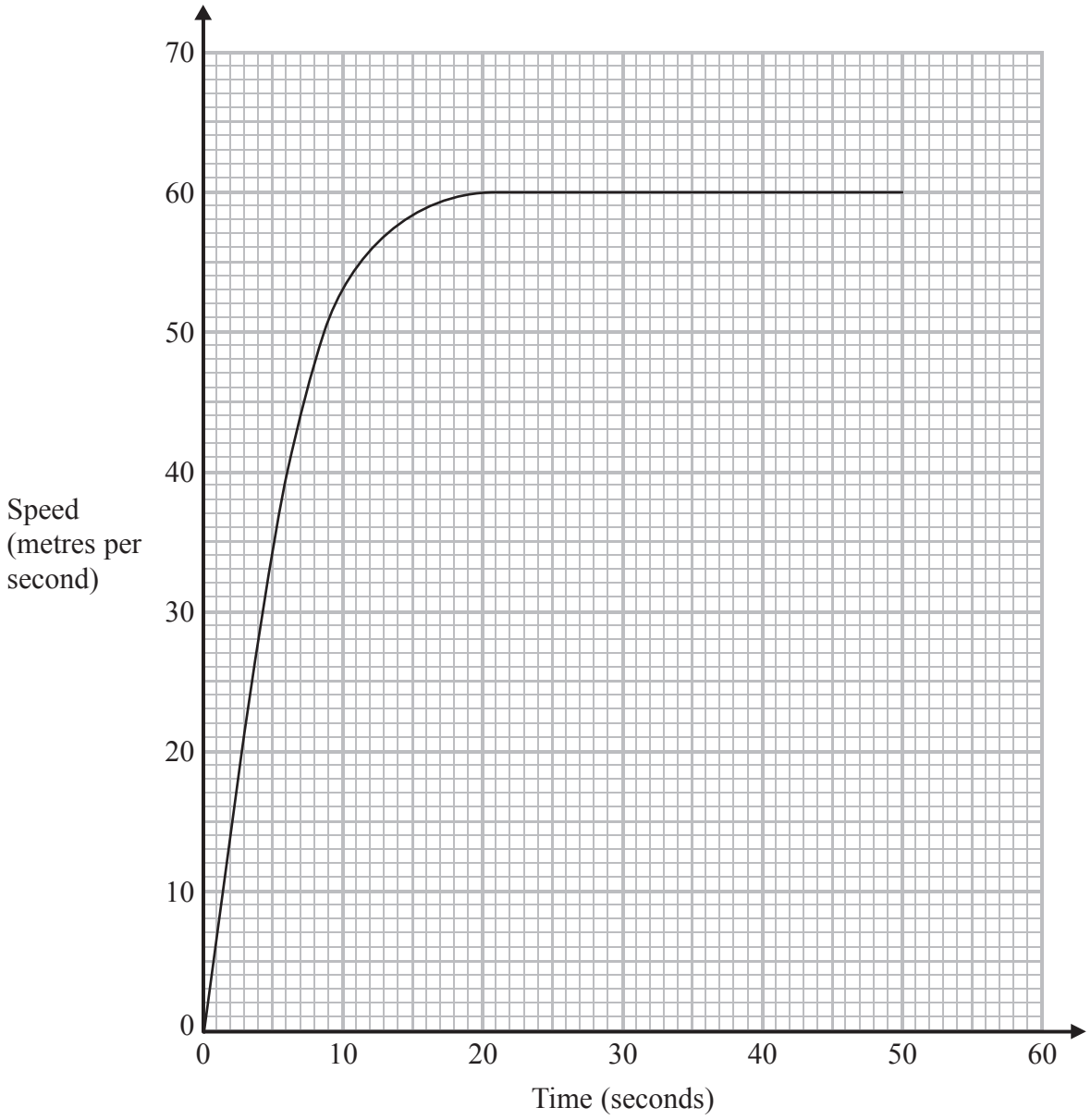
..... m

(3)

(Total for Question 18 is 6 marks)

20 A car accelerates from 0 metres per second to 60 metres per second in 20 seconds.
It then travels at a constant speed of 60 metres per second for 30 seconds.

The speed-time graph shows this information.



Work out an estimate for the distance the car travelled in these 50 seconds.

..... km

(Total for Question 20 is 3 marks)

16 When a car accelerates from rest, its speed, v m/s, is proportional to the square of the time, t seconds, for which it travels.

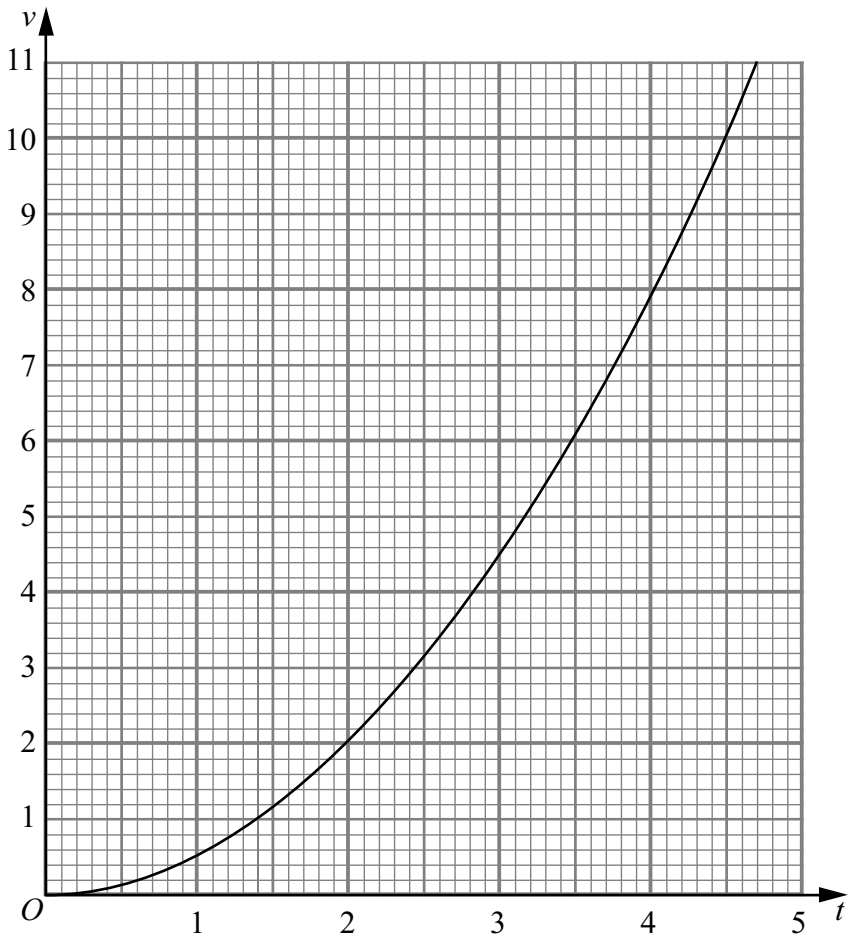
When $t = 4$, $v = 8$

(a) Work out the value of v when $t = 10$

.....

(4)

Here is the graph of v against t for the car.



(b) Work out an estimate for the distance the car travels during the first 4 seconds.

..... m

(3)

The speed of a van is given by $v = 1 + 2t$

(c) Find the value of t for which the speed of the van is the same as the speed of the car.
Give your answer correct to 1 decimal place.

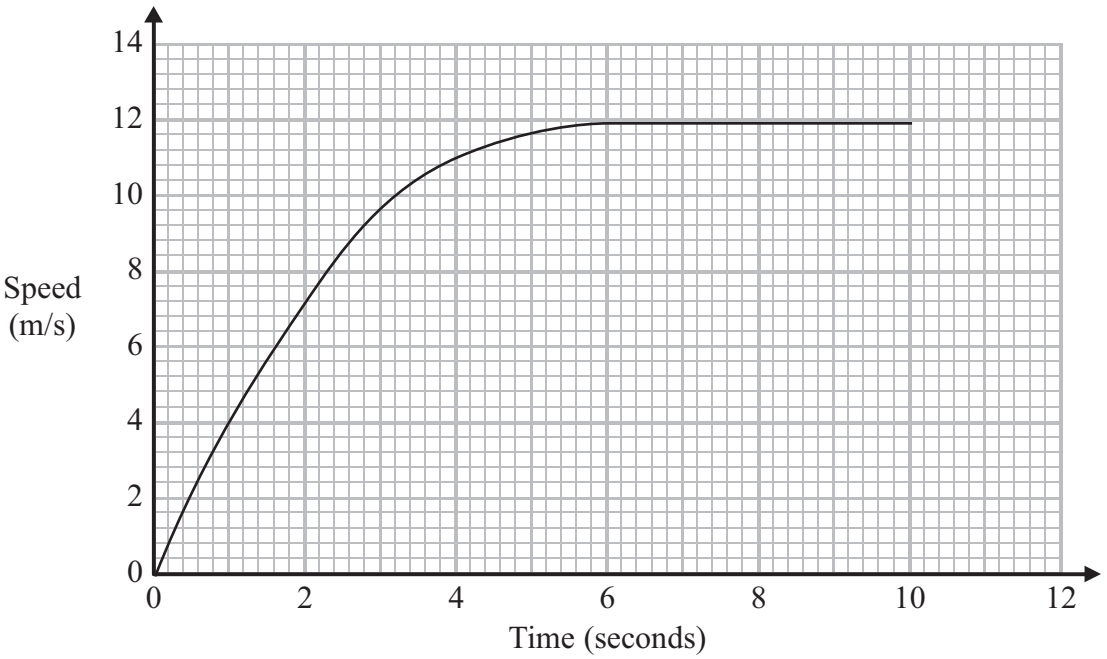
$t =$ ....

(4)

(Total for Question 16 is 11 marks)

20 An athlete is running in a race.

The diagram shows a speed-time graph for the athlete.



(a) Work out an estimate for the acceleration of this athlete at 3 seconds.

..... m/s^2

(3)

The athlete ran the race in 10 seconds.

The area under the graph gives the distance the athlete ran in the 10 seconds.

*(b) Show that this race could have been a 100 metre race.

(3)

(Total for Question 20 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS

Mark schemes

PAPER: 5AM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
19	(a)	$2\times\left(\frac{2\times(2+1.5)}{2}+\frac{1.5}{2}\right)=2\times(3.5+0.75)$ or $2\times\left(\frac{2+1.875}{2}+\frac{1.875+1.5}{2}+\frac{1.5+0.875}{2}+\frac{0.875}{2}\right)=$ $2\times(1.9375+1.6875+1.1875+0.4375)=2\times5.25$	8 – 10.6	4	M1 for use of at least one triangle or rectangle or trapezium to calculate an approximation to the area under the curve. M1 for any correct calculation of the area of at least one appropriate triangle or trapezium or rectangle. M1 for any correct method that would lead to an answer in the interval 8 – 10.6 A1 8 – 10.6
	(b)		explanation	1	eg take more strips oe

23		eg x: -3, -2, -1, 0, 1, 2, 3 y: 0, 5, 8, 9, 8, 5, 0	36	4	M1 for attempting to find area under curve M1 for correct method to find the area under the curve between $x = -3$ and $x = 3$ (at least 3 areas) A2 for 35 – 36

20	(a)	15 ÷ 40	0.375	2	M1 for $\frac{15}{40}$ oe or sight of right-angled triangle against line A1 0.375 or 0.38
	(b)		Describes motion	2	B1 for constant speed oe for 50 seconds oe B1 for slows down (to stop) for 30 seconds oe
	(c)	$\frac{40\times15}{2}+50\times15+\frac{30\times15}{2}$	1275	2	M1 for $\frac{50+120}{2}\times15$ or correct area for at least one of 3 sections 300, 750 or 225 seen A1 cao
	(d)	$\frac{1275\div1000}{120\div3600}$	38.25	3	M1 for attempt to find $\frac{'totaldistance'}{'total\ time'}$ M1 for '1275' ÷ 1000 or 120 ÷ 3600 oe A1 for 38 – 38.3 or ft '1275'

23	(a)		3	3	M1 for tangent drawn M1 for correct method to find gradient A1 2.5 – 3.5
	(b)		$33^1/_3$	3	M1 for area split into trapeziums M1 for correct area of one trapezium A1 26 – 35

18	(a)		1.5	3	B1 for tangent drawn at $t = 8$ M1 for height ÷ base for a triangle with the tangent as hypotenuse A1 for 1.25 to 1.75
	(b)		156	3	M1 for attempting to find area under curve M1 for correct method to find the area under the curve between $t = 0$ and $t = 6$ (at least 3 areas) A1 for 150 – 160

20		Examples: ½ × 10 × 53 = 265 m ½ × (53 + 60) × 10 = 565 m 30 × 60 =1800 m 2630 m **or** 10 × 60 × 3 =1800 m ½ × 5 × 34 = 85 m ½ × (34 + 53) × 5 = 217.5 m ½ × (53 + 58) × 5 = 277.5 m ½ × (58 + 60) × 5 = 295 m 2675 m	2.6 to 2.7	3	M1 for a method to find the area of a triangle or a trapezium or a rectangle between the graph and the Time axis M1 for a complete method to find the area of at least 3 correct shapes under the graph A1 for answer in range 2.6 to 2.7 km or 2600 to 2700 m

16	(a)	$v = kt^2$ $k = \frac{8}{16} = 0.5$ When $t = 10$, $v = 0.5 \times 10^2 = 50$	50	4	M1 $v = kt^2$ or $v \propto t^2$ M1 $k = 8 \div 16$ M1 $v =$ '0.5' $\times 10^2$ A1 50 cao OR M1 $t^2 = kv$ or $t^2 \propto v$ M1 $k = 16 \div 8$ M1 $v = \frac{10^2}{\text{'2'}}$ A1 50 cao OR M1 $\frac{v_2}{v_1} = \frac{t_2^2}{t_1^2}$ M1 $\frac{v_2}{8} = \frac{10^2}{4^2}$ M1 $v_2 = 8 \times 6.25$ A1 50 cao
	(b)	Values of s are 0, .5, 2, 4.5 , 8 Area = $\frac{0+.5}{2} + \frac{.5+2}{2} + \frac{2+4.5}{2} + \frac{4.5+8}{2}$ .25 + 1.25 + 3.25 + 6.25	11	3	M1 attempts to find area under curve M1 $\frac{0+.5}{2} + \frac{.5+2}{2} + \frac{2+4.5}{2} + \frac{4.5+8}{2}$ oe A1 10 – 12

16	(c)	Draw graph of $v = 1 + 2t$ Intersection with $v = 0.5t^2$ OR $1 + 2t = 0.5t^2$ $t = \frac{--2 \pm \sqrt{(-2)^2 - 4 \times 0.5 \times (-1)}}{2 \times 0.5}$	$t = 4.4$	4	M1 draws a straight line that is not horizontal or vertical A1 graph of $s = 1 + 2t$ correct M1 indicates intersection with $s = 0.5t^2$ A1 4.4 – 4.5 Alternative method: M1 $1 + 2t = 0.5t^2$ M1 $t = \frac{--2 \pm \sqrt{(-2)^2 - 4 \times 0.5 \times (-1)}}{2 \times 0.5}$ allow errors in the signs of b and c A1 4.4 or – 0 4 A1 4.4 – 4.5

20	(a)		1.6 – 2.4	3	M1 for tangent drawn at time = 3 M1 (dep) for 'diff y' ÷ 'diff x' A1 for 1.6 – 2.4
	*(b)	Example: 2(0 + 7) ÷ 2 = 7 2(7 + 11) ÷ 2 = 18 2(11 + 12) ÷ 2 = 23 2(12 + 12) ÷ 2 = 24 2(12 + 12) ÷ 2 = 24 Total = 96 **OR** Area ≈ 50 squares 1 square = 2 × 1 = 2 m 50 × 2 = 100	96 – 102 plus comparison	3	M1 for division of area into trapezia or counting squares M1 for use of at least one trapezium (oe) to calculate area or totalling all squares and part squares C1 (dep on M1) for answer in range 96 – 102 and positive comment to compare 'area' with 100 (SC B1 for area of 84 if M1 not scored)