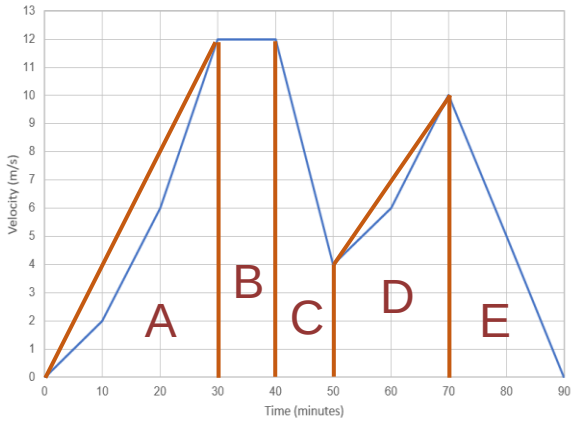
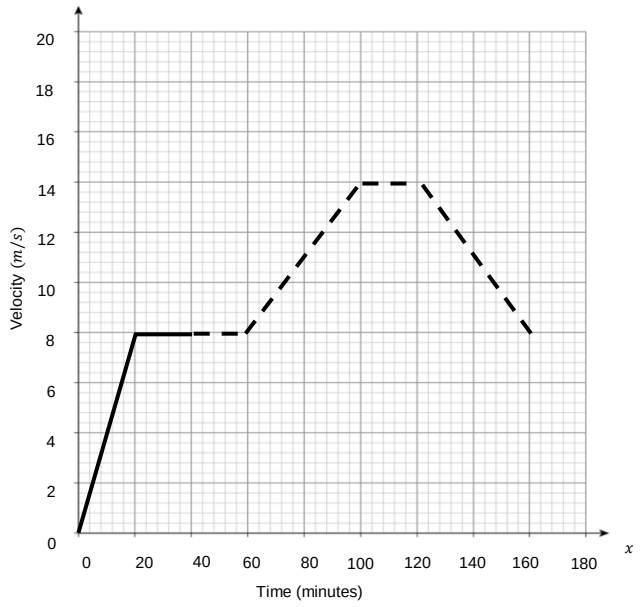
	Velocity – Time Graphs Mark Scheme	
1(a)	$A\ or\ C\ or\ D\ or\ E\ or\ H\ or\ I$	[1] Sections of acceleration
1(b)	B or F	[1] Sections of constant velocity
1(c)	D	[1] Section of greatest acceleration
1(d)	$C\ and\ G$	[1] Two sections with the same magnitude and direction of acceleration
2(a)	$\frac{6}{10 \times 60} = \frac{6}{600} = \frac{1}{100} = 0.01$	[1] Steepest section of the graph
	0.01 m/s	[1] Correct units
2(b)		[1] Split graph into appropriate sections
	$A: \frac{1}{2} \times 12 \times 30 \times 60 = 10800$ $E: \frac{1}{2} \times 20 \times 10 \times 60 = 6000$	[1] Area of first and last triangle
	$B: 10 \times 12 \times 60 = 7200$	[1] Area of rectangular section
	$C: \frac{1}{2} \times 10 \times (12 + 4) \times 60 = 4800$ $D: \frac{1}{2} \times 20 \times (10 + 4) \times 60 = 8400$	[1] Area of parallelograms
	$Total\ distance\ =\ 37200\ m$	[1] Sum of all areas
3	$\frac{1}{2} \times 20 \times 60 \times 8 = 4800\ m$ $20 \times 60 \times 8 = 9600\ m$ $4800 + 9600 = 14{,}400\ m$	[1] Distance covered in the first 40 mins
	$24000 - 14400 = 9600\ m$ $9600 \div (20 \times 60) = 8$	[1] Velocity during 40 – 60 mins

		[1] Correct acceleration and deceleration [1] Complete graph
4(a)	She calculated average acceleration	[1] Valid comment
	Her actual acceleration is not constant	[1] Valid comment
4(b)	Average acceleration	[1] Valid comment
4(c)	Diane's estimate is incorrect because the flat line between 14:00 and 14:30 is representing a constant velocity, and not a pause. This needs to be included.	[1] Valid comment
	$22 + \frac{20}{2} = 32$	[1] Actual distance covered
4(d)	Overestimate	[1] Correct statement
	More of the curve is below the line used for the estimate	[1] Valid reason
4(e)	Use multiple trapeziums or triangles	[1] Valid improvement to approach
5(a)	$\left(\frac{1}{2} \times 1.5 \times 4.5 \times 60\right) + \left(\frac{1}{2} \times (4.5 + 2) \times 2.5 \times 60\right) =$	[1] Division of graph into triangles
	$= 690\, m$	[1] Area under graph
5(b)	Underestimate as more of the curve is above the line used for the estimate	[1] Dependant on how the graph has been drawn will be
6(a)	Travel in other direction	[1] Correct interpretation
6(b)	$A: \frac{1}{2}\left(\frac{1}{2} + 4.5\right) \times 18 = 45\, miles$	[1] Area calculation
	$B: \frac{1}{2}(0.5 + 2.50)\ \times 12 = 18\, miles$	[1] Area calculation
	$18 + 45 = 63\, miles$	[1] Total area
6(c)	It will be shorter due to travel in other direction	[1] Correct interpretation

END