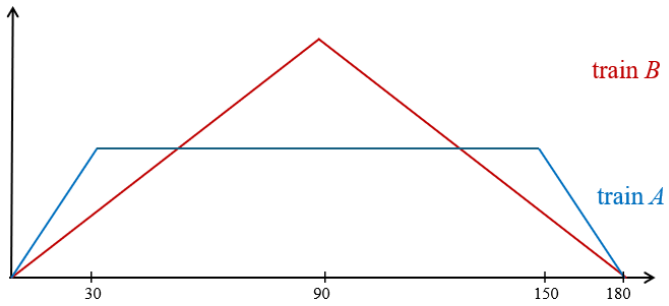
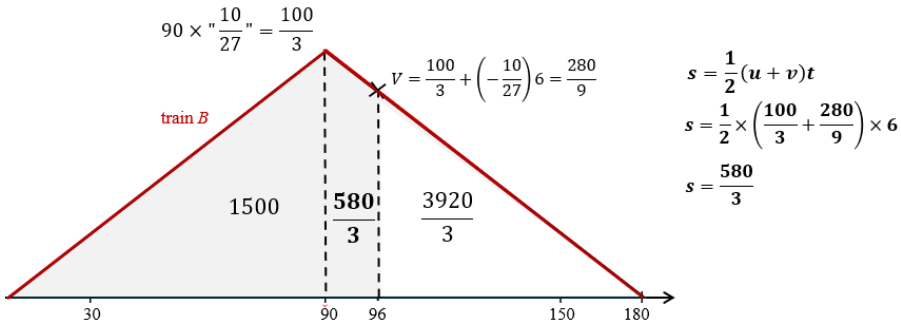
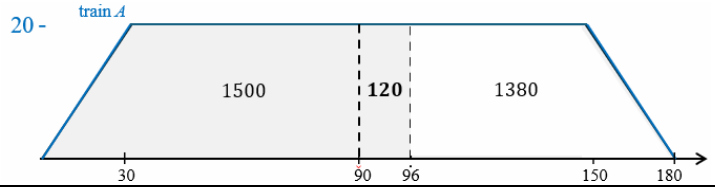
Question Number	Scheme	Marks
7(a)		B1 (trap) B1 (triangle with 2 inters.) B1 all figs
		(3)
7(b)	Using train A, method to find the distance or half distance	M1
	For example, area of trapezium or half trapezium or *suvat* • $\frac{1}{2}(180+120)20$ • $\frac{1}{2}(90+60)20$	A1
	Combining with train B, complete method to find the acceleration	M1
	For example, area of triangle or half area of triangle or *suvat* • $"1500"=\frac{1}{2}(90\times V) \Rightarrow V=\frac{100}{3} \Rightarrow a=\frac{V}{90}$ • $"3000"=\frac{1}{2}(180\times V) \Rightarrow V=\frac{100}{3} \Rightarrow a=\frac{V}{90}$ • $"1500"=\frac{1}{2}a90^2$	A1 ft
	$(a=)\frac{10}{27}$, 0.37 or better	A1
		(5)
7(c)	Method to form an equation in t	M1
	$"a"t_1="\frac{2}{3}\times 30"$	A1 ft
	$t_1=54\,(s)$ **or** $t_2=126\,(s)$	A1
	$t_1=54\,(s)$ **and** $t_2=126\,(s)$	A1
		(4)
7(d)		
	Method to find maximum speed of train B $"a"\times 90 \quad \left(=\frac{100}{3}=33.\dot{3}\right)$	M1

	Complete method to find the distance moved by train *B* for $90,, t,, 96$ or $84,, t,, 90$ 	M1
	Correct distance, for example, • Area of trapezium/suvat $\frac{1}{2}\left(\frac{100}{3}+\frac{280}{9}\right)6 \quad \left(=\frac{580}{3}=193.\dot{3}\right)$ • suvat $\frac{100}{3}\times 6-\frac{1}{2}\left(\frac{10}{27}\right)6^2 \quad \left(=\frac{580}{3}=193.\dot{3}\right)$	A1
	Complete and correct method to fnd the required distance. For example $\frac{580}{3}-(6\times 20)$ 	dM1
	$=\frac{220}{3}$, accept 73 or better (m)	A1
		(5)
		[17]
	Notes	
7 (a)		
B1	Shape of graph for train *A*: isosceles (approx.) trapezium, start and finish on the horizontal axis.	
B1	Shape of graph of train *B*: should be an isosceles (approx.) triangle. Must start and finish on the horizontal axis. The graphs should intersect at two points.	
B1	All figures on the same horizontal axis: 30, 90, 150, 180. Accept equivalent delineators.	
7(b)		
M1	Complete method using train *A* to find the distance (or half the distance) between the stations. May use area of their graph but it must be a trapezium. The formula for the area of a trapezium or a triangle must have the correct structure. May use of *suvat* but M0 if $a=\frac{2}{3}$ for $t>30$. May see 20 or their $\frac{2}{3}\times 30$.	
A1	Correct unsimplified expression for the distance or half distance.	

M1	A complete method by combining with train *B* to find the required acceleration.
A1ft	Correct unsimplified equation in *a*, follow through their distance.
A1	Correct answer, accept 0.37 or better
7(c)	
M1	Correct method using train *B* to form an equation in a relevant time, *t*
A1ft	Correct expression, follow through their *a* and their 20 If using second half, with $v = u + at$, follow through their *a*, 20 and $\frac{100}{3}$
A1	At least one correct time
A1	Both correct times
7(d)	
M1	Method to find the maximum speed of train *B*. This may appear on a graph or in earlier working. It must be used in part (d) to earn the mark here.
M1	Method to find the distance travelled by train *B* in the 'extra' 6 seconds **Note**: the method to find the area of the additional trapezium leads straight to the final answer $\frac{1}{2}\left(\frac{40}{3}+\frac{100}{9}\right)6 \quad \left(=\frac{220}{3}\right)$ The final 4 marks are all available.  $s = \frac{1}{2} \times \left[\left(\frac{100}{3} - 20\right) + \left(\frac{280}{9} - 20\right)\right] \times 6$
A1	Correct distance, accept rounded values in their working eg $\frac{1}{2}\left(\frac{100}{3}+\frac{280}{9}\right)6$ or $\frac{1}{2}(33.3+31.1)6$
dM1	Dependent on both previous method marks. Complete method comparing train *A* and train *B* distances to find the required distance. Must use a correct method for calculating distances before subtraction.
A1	Correct answer, accept 73 or better. Accept more significant figures but must be rounded correctly to their choice of s.f. Exact value is $73.\dot{3}$
(d)	
ALT 1	For candidates who do not use the maximum speed and use the distance from the end.
M1	Complete method to find the distance from the end point for train *B*.
M1	
A1	$s = 0 - \frac{1}{2}\left(-\frac{10}{27}\right)84^2 \quad \left(=\frac{3920}{3}=1306.\dot{6}\right)$
dM1	Dependent on both previous method marks. Complete and correct method comparing train *A* and train *B* distances to find the required distance. Must use a correct method for calculating distances before subtraction: $1380 - \frac{3920}{3}$

A1	Correct answer, accept 73 or better. Accept more significant figures but must be rounded correctly to their choice of s.f. Exact value is $73.\dot{3}$