

2	(a)		33.75	1	B1	oe eg 33.750
	(b)		33.85	1	B1	allow 33.849 ^o or 33.849 ^r or “33.8499...” do NOT allow 33.879 without indication of recurring “9”
						Total 2 marks

4	a		4.35	1	B1 accept 4.34 ⁸
	b		4.25	1	B1 cao
	c	17.5 or 9.35 or $e - f$ where $17 < e \leq 17.5$ and $9.35 \leq f < 9.4$			M1
			8.15	2	A1
					Total 4 marks

5		58.35 or 58.45 or 19.5 or 20.5 or 3.55 or 3.65		3	B1 for any correct bound Accept 58.449 for 58.45 or 20.49 for 20.5 or 3.649 for 3.65
		$\frac{2 \times 58.45 - 19.5}{3.55}$ (= 27.4366...)			M1 for correct substitution into $\frac{2 \times a_{UB} - c_{LB}}{d_{LB}}$ where $58.4 < a_{UB} \leq 58.45$ and $19.5 \leq c_{LB} < 20$ and $3.55 \leq d_{LB} < 3.6$
			27.44		A1 from correct working allow 27.4 – 27.5
					Total 3 marks

6		9.65, 9.75, 5.85, 5.95, 2.5, 3.5		3	B1	for any one of these stated or used, accept 9.749, 5.949, 3.49
		$\frac{9.75 - 5.85}{2.5}$			M1	for $\frac{UB_t - LB_w}{LB_y}$ where $9.7 < UB_t \leq 9.75$, $5.85 \leq LB_w < 5.9$, $2.5 \leq LB_y < 3$ This allows for the student who uses some sort of lower/upper value, but are slightly inaccurate eg using 9.74 for t
		<i>Working required</i>	1.56		A1	dep on previous marks (as working is requested)
					Total 3 marks	

7	7.75, 7.85, 3.35, 3.45, 13.5, 14.5		3	B1	for sight of a correct upper or lower bound Accept $\dot{3.449}$ for 3.45 or $\dot{7.849}$ for 7.85 or $\dot{14.49}$ for 14.5
	$(k =) \frac{13.5}{7.85 - 3.35}$			M1	for correct substitution into $k = \frac{t_{LB}}{a_{UB} - h_{t_{LB}}}$ where $13.5 \leq t_{LB} < 14$ and $7.8 < a_{UB} \leq 7.85$ and $3.35 \leq h_{t_{LB}} < 3.4$
		3		A1	accept 3.0
Total 3 marks					

8	9.55 or 9.65 or 3.75 or 3.85 or 1.835 or 1.845		3	B1	accept 9.649 for 9.65, 3.849 for 3.85, 1.8449 for 1.845
	$a = \frac{UB_v - LB_u}{LB_l}$ e.g. $a = \frac{9.65 - 3.75}{1.835} (= 3.2152...)$			M1	for correct substitution of $9.6 < UB_v \leq 9.65$ and $3.75 \leq LB_u < 3.8$ and $1.835 \leq LB_l < 1.84$
		3.22		A1	accept 3.21 – 3.22 from correct working
Total 3 marks					

9	77.5 or 82.5 or 2.65 or 2.75 or 32.5 or 33.5 or 0.95 or 1.05 or 77500 or 82500 or 159 or 165 or 32500 or 33500 or 57 or 63		4	B1 For a UB or LB for one of the distances or times in hours or in minutes
	eg $82.5 \div 2.65 (= 31.13\dots)$ or $82500 \div 159 (= 518.867\dots)$ or km/min or m/h			M1 for a method to find the upper bound of Kaidan's average speed eg $UB_K \div LB_K$ where $80 < UB_K \leq 82.5$ and $2.65 \leq LB_K < 2.7$ or use of m/min to find upper bound for Kaidan's average speed eg $UB_K \div LB_K$ where $80000 < UB_K \leq 82500$ and $159 \leq LB_K < 162$ can use km/min or m/h
	eg $32.5 \div 1.05 (= 30.95\dots)$ or $32500 \div 63 (= 515.873\dots)$ or km/min or m/h			M1 indep for a method to find the lower bound of Sonja's average speed eg $LB_S \div UB_S$ where $32.5 \leq LB_S < 33$ and $1 < UB_S \leq 1.05$ or use of m/min to find lower bound for Sonja's average speed $LB_S \div UB_S$ where $32500 \leq LB_S < 33000$ and $60 < UB_S \leq 63$ can use km/min or m/h
	$UB K = 31132\dots$ m/h $LB S = 30952\dots$ m/h $UB K = 0.51886\dots$ km/min $LB S = 0.51587\dots$ km/min	Shown		A1 shown with accurate figures in the same units – sufficient figures for comparison (can be truncated) but must be from correct working and UB for Kaidan and LB for Sonja selected eg UB Kaidan = 31.13... (km/h) and LB Sonja = 30.95... (km/h) or UB Kaidan = 518.867... (m/min) and LB Sonja = 515.873... (m/min) (dep on correct method)
Total 4 marks				

10	7.45, 7.55, 3.415, 3.425, 1.5, 2.5		3	B1 For one correct upper or one correct lower bound Allow 7.549 for 7.55, 3.4249 for 3.425, 2.49 for 2.5
	$(X =) \frac{2 \times 7.55 - 3.415}{1.5}$ oe eg $\frac{11.685}{1.5}$			M1 $\frac{2 \times UB_a - LB_b}{LB_f}$ where $7.5 < UB_a \leq 7.55$, $3.415 \leq LB_b < 3.42$, $1.5 \leq LB_f < 2$ (also award this mark for $\frac{7.55 - 3.415}{1.5}$ or $\frac{2(7.55 - 3.415)}{1.5}$)
		7.79		A1 must be from correct working
Total 3 marks				

11	11.45 or 11.55 or 79.5 or 80.5 or 74.5 or 75.5		4	B1 Accept 11.549 for 11.55 80.49 for 80.5 75.49 for 75.5
	$180 - (74.5 + 79.5) (= 26)$			M1 for a correct calculation to find the upper bound of angle B NB $180^\circ - (LB \text{ of } 75^\circ + LB \text{ of } 80^\circ)$
	$\frac{(AC)}{\sin(26)} = \frac{11.55}{\sin(74.5)}$ oe or $\frac{(AC)}{\sin(180 - 74.5 - 79.5)} = \frac{11.55}{\sin(74.5)}$			M1 for substituting the correct bounds into the sine rule $\frac{(YZ)}{\sin("26")} = \frac{UB_1}{\sin(LB_2)}$ oe where $11.5 < UB_1 \leq 11.55$ and $74.5 \leq LB_2 < 75$
		5.25		A1 awrt 5.25 from correct working
Total 4 marks				

12	3.445, 3.455, 1.85, 1.95, 4.5, 5.5		3	B1 any one bound
	$(A =) 3.445 - \frac{1.95^2}{4.5}$			M1 $A = LB_w - \frac{(UB_x)^2}{LB_y}$ where $3.445 \leq LB_w < 3.45$, $1.9 < UB_x \leq 1.95$, $4.5 \leq LB_y < 5$
		2.6		A1 oe, (dep on M1), from correct figures (3.445, 1.95, 4.5)
Total 3 marks				

13	(a)		17.75	1	B1 oe
	(b)		18.25	1	B1 oe 18.249 (allow 18.249...)
					SC B1 for 17.5 in (a) and 18.5 (or 18.49) in (b)
					Total 2 marks

14	$\frac{0.515}{6.25}$		2	M1	For either bound correct (used or seen)
	<i>Working required</i>	0.0824		A1	dep on M1 Allow $\frac{103}{1250}$
				Total 2 marks	

15	45.225 or 45.235 or 5.115 or 5.125 or 8.45 or 8.55		5	B2 for all 6 correct (B1 for 4 or 5 correct) Accept $45.234\dot{9}$ for 45.235 $5.124\dot{9}$ for 5.125 $8.54\dot{9}$ for 8.55
	$\frac{45.235 - 5.115}{8.45} (= 4.7479\dots)$			M1 for correct substitution into the <i>UB</i> $a = \frac{v-u}{t}$ where $45.23 < v_{(UB)} \leq 45.235$ $5.115 \leq u_{(LB)} < 5.12$ $8.45 \leq t_{(LB)} < 8.5$
	$\frac{45.225 - 5.125}{8.55} (= 4.6900\dots)$			M1 for correct substitution into the <i>LB</i> $a = \frac{v-u}{t}$ where $45.225 \leq v_{(LB)} < 45.23$ $5.12 < u_{(UB)} \leq 5.125$ $8.5 < t_{(UB)} \leq 8.55$
	<i>Working required</i>	4.7 and correct reason		A1 dep on M2 4.7 and both answers round to 4.7 oe e.g. 1 dp or 2 sf
Total 5 marks				

16	(a)		2.745	1	B1
	(b)		2.755	1	B1 allow 2.7549

17	47.5 or 52.5 or 1.25 or 1.35		4	B1	for a correct bound, accept 4750 or 5250 or 125 or 135 if working in cm
	eg $\frac{47.5}{1.35}$ (= 35.18...) or $\frac{52.5}{1.25}$ (= 42)			M1	for correct substitution of $47.5 \leq LB_F < 50$ and $1.3 < UB_{FP} \leq 1.35$ or $50 < UB_F \leq 52.5$ and $1.25 \leq LB_{FP} < 1.3$
	eg ("42" – "36") $\times$ 8.65 or "42" $\times$ 8.65 – "36" $\times$ 8.65 or 363.3 – 311.4			M1	(dep on M1) for using their lower and upper bounds for the number of fence panels needed to find the cost – lower bound and/or upper bound must be an integer rounded up
	<i>Working required</i>	51.9(0)		A1	cao dep on M2
Total 4 marks					

18	255 or 265 or 2.85 or 2.75		4	B1	for sight of a correct upper or lower bound
	$(V =) \frac{4}{3}\pi \times (2.75)^3$ $(= \frac{1331}{48}\pi \text{ or } 87.1137\dots)$			M1	calculation to find V using $V = \frac{4}{3}\pi r_{LB}^3$ where $2.75 \leq r_{LB} < 2.8$ or use of 2.85
	$(D =) \frac{265\pi}{\frac{4}{3} \times \pi \times 2.75^3}$ (condone missing π for 265π (also may have cancelled out π))			M1	method to find UB of density, using LB of V and UB of M for correct substitution into $D = \frac{\pi M_{UB}}{V_{LB}}$ where $260 < M_{UB} \leq 265$ and $87.11\dots \leq V_{LB} < 91.95\dots$ oe
		9.56		A1	dep on M2 and all correct bounds used allow 9.55 - 9.56
Total 4 marks					