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MARK SCHEME

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Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	$180 \div (2 + 3 + 5) \times 5 [= 90]$	1	with no errors seen
1(a)(ii)	7.05 or 7.053...	3	M2 for $\frac{x}{12} = \sin 36$ oe or better or B1 for 36 or 54 seen
1(b)(i)	13	2	M1 for $7.8 \div 3$ soi
1(b)(ii)	36.9 or 36.86 to 36.87	3	B1 for smallest angle identified M1 for $\sin[] = \frac{3}{5}$ oe or $\sin[] = \frac{7.8}{\text{their } b(i)}$ oe If zero scored, SC1 for calculation of 53.1
2(a)	343	1	
2(b)(i)	1	1	
2(b)(ii)	x^{10} final answer	1	
2(b)(iii)	$9x^{16}$ final answer	2	B1 for x^{12} or x^{16} or $(3x^8)^2$ seen
2(c)(i)	$2(x - 3)(x + 3)$ final answer	2	M1 for $(2x + 6)(x - 3)$ or $(2x - 6)(x + 3)$ or $(x - 3)(x + 3)$
2(c)(ii)	$\frac{2(x + 3)}{x + 10}$ or $\frac{2x + 6}{x + 10}$ final answer nfw	3	M2 for $(x + 10)(x - 3)$ or M1 for $(x + a)(x + b)$ where $ab = -30$ or $a + b = 7$
3(a)	480	3	M2 for $456 \div \left(1 - \frac{5}{100}\right)$ oe or M1 for associating 456 with 95%
3(b)	261.47	2	M1 for $200 \times \left(1 + \frac{1.5}{100}\right)^{18}$

Question	Answer	Marks	Partial Marks
3(c)	1.2	3	M2 for $\sqrt[17]{\frac{2449.62}{2000}}$ oe, soi by 1.012[0...] or M1 for $\frac{2449.62}{2000}$ or $2000 \times (\dots)^{17} = 2449.62$
3(d)	$c - \frac{cp}{100}$ oe	2	M1 for $\frac{cp}{100}$ seen
4(a)	$80 < t \leq 100$	1	
4(b)	86 nfw	4	M1 for midpoints soi M1 for use of Σfx with x in correct interval including both boundaries M1 (dep on 2nd M1) for $\Sigma fx \div 150$
4(c)(i)	Reference to not knowing the individual values so we do not know the highest or the lowest values	1	
4(c)(ii)	62.4	2	M1 for $26 \div 150$ or $360 \div 150$
4(d)	$\frac{22}{150}$ oe	1	
4(e)(i)	$\frac{90}{22350}$ oe	2	M1 for $\frac{10}{150} \times \frac{9}{149}$ After zero scored, SC1 for answer $\frac{100}{22500}$ oe
4(e)(ii)	$\frac{440}{22350}$ oe	3	M2 for $\frac{10}{150} \times \frac{22}{149} + \frac{22}{150} \times \frac{10}{149}$ oe or M1 for $\frac{10}{150} \times \frac{22}{149}$ or $\frac{22}{150} \times \frac{10}{149}$ oe After zero scored, SC1 for answer $\frac{440}{22500}$ oe
4(f)	13, 8.5, 7.25, 1.1	3	B2 for 3 correct or B1 for 1 correct or for 3 correct FD.s 5.2, 3.4, 2.9, 0.44 oe

Question	Answer	Marks	Partial Marks
5(a)(i)	Image at (0, 1), (0, 2), (–3, 1)	2	B1 for reflection in $y = 0$ or $x = k$
5(a)(ii)	Image at (0, 0), (0, –2), (6, –2)	2	B1 for correct size and correct orientation wrong position or for 2 correct vertices plotted
5(a)(iii)	Image at (–5, 4), (–5, 5), (–2, 4)	2	B1 for translation by $\begin{pmatrix} -5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 3 \end{pmatrix}$
5(b)	Rotation 90° clockwise oe (4, –1)	3	B1 for each
6(a)	–7	1	
6(b)	$5 - 2x$	2	M1 for $2(3 - x) - 1$
6(c)(i)	$\frac{4}{3}$ oe	2	M1 for $2x - 1 = 3 - x$
6(c)(ii)	–3	1	
6(d)	$\frac{x+1}{2}$ oe final answer	2	M1 for $x = 2y - 1$ or $y + 1 = 2x$ or $\frac{y}{2} = x - \frac{1}{2}$
6(e)	$\frac{3x-2}{x}$ final answer	2	M1 for $3 - \frac{2}{x}$
6(f)	16	1	
7(a)(i)	25.5 or 25.46...	2	M1 for $\pi \times 5^2 \times h = 2000$ oe
7(a)(ii)	9.85 or 9.847...	3	M2 for $[r^3 =] 2000 \div \left(\frac{2}{3}\pi\right)$ oe or M1 for $\frac{2}{3}\pi r^3 = 2000$ oe
7(a)(iii)	952 or 952.4...	3	M2 for $[6 \times] \sqrt[3]{2000}^2$ or M1 for $\sqrt[3]{2000}$ or 6 times <i>their</i> area of one face
7(b)(i)	22.5 or 22.49...	2	M1 for $\frac{1}{2} \times 7 \times 10 \times \sin 40$
7(b)(ii)	$\sqrt{(10^2 + 7^2 - 2 \times 10 \times 7 \cos 40)} + 7 + 10$	M3	M2 for $10^2 + 7^2 - 2 \times 10 \times 7 \cos 40$ or M1 for correct implicit cosine rule
	23.46...	A2	A1 for 6.46... or 41.7 to 41.8

Question	Answer	Marks	Partial Marks
7(c)	64.9 or 64.92 to 64.94	3	M2 for $28.2 - 2 \times 9 = \frac{c}{360} \times 2 \times \pi \times 9$ oe or M1 for $\frac{c}{360} \times 2 \times \pi \times 9$ soi
8(a)	9, – 6, 9	3	B1 for each
8(b)	Correct graph	4	B3FT for 6 or 7 correct points or B2FT for 4 or 5 correct points or B1FT for 2 or 3 correct points
8(c)	–3.5 to –3.35 and 0.8 to 0.9..	2FT	FT <i>their</i> graph B1FT for either
8(d)	$a = \frac{5}{4}$ or $1\frac{1}{4}$ or 1.25 $b = -\frac{49}{8}$ or $-6\frac{1}{8}$ or –6.125	3	B2 for either correct or M1 for $[2]\left(x + \frac{5}{4}\right)^2$ seen isw or for $2x^2 + 4ax + 2a^2 + b$
9(a)(i)	5	1	
9(a)(ii)	$-\frac{3}{2}$ oe	1	
9(b)	$\left(\frac{4}{5}, 0\right)$ oe	2	M1 for $5x - 4 = 0$ soi
9(c)	$y = -0.2x + 11$ final answer	4	M2 for $y = -0.2x + b$ oe (any form) FT <i>their</i> (a) or B1FT for grad = $\frac{-1}{\text{their (a)(i)}}$ soi and M1 for substitution of (10, 9) into <i>their</i> equation
9(d)	(2, 6)	3	M1 for elimination of one variable A1 for $x = 2$ or $y = 6$
9(e)	13 oe	3	M2 for $(4 + 9) \times \text{their } 2 \div 2$ oe or B1 for 9 oe or 4 or –4 seen

Question	Answer	Marks	Partial Marks
10(a)	$\frac{10}{x-0.5}$ final answer	1	Accept $\frac{20}{2x-1}$
10(b)(i)	$\frac{10}{x-0.5} - \frac{10}{x} = 0.25$ oe	M1	FT <i>their</i> (a)
	$10x - 10(x - 0.5) = 0.25x(x - 0.5)$ oe	M1	Clears algebraic denominators or collects as a single fraction FT <i>their</i> algebraic fractions dep on two fractions with algebraic denominators
	$10x - 10x + 5 = 0.25x^2 - 0.125x$ or better	B1	Expands brackets
	$2x^2 - x - 40 = 0$	A1	Dep on M1M1B1 and no errors seen
10(b)(ii)	$\frac{- -1 \pm \sqrt{(-1)^2 - 4 \times 2 \times -40}}{2 \times 2}$ oe	B2	B1 for $\sqrt{(-1)^2 - 4(2)(-40)}$ or better or B1 for $\frac{- -1 + \sqrt{q}}{2 \times 2}$ or $\frac{- -1 - \sqrt{q}}{2 \times 2}$ or both
	-4.23 and 4.73 final answers	B1B1	SC1 for -4.229... and 4.729... or for -4.23 and 4.73 seen in working or for -4.73 and 4.23 as final answer or for -4.2 or -4.22 and 4.7 or 4.72 as final answer
10(b)(iii)	2 [hours] 7 [minutes]	3	B2 for 2.11 or 2.114 to 2.115 or 126.8 to 126.9 or 127 or M1 for $10 \div \text{their positive root from (b)(ii)}$
11(a)(i)	$2^2 \times 3^2 \times 5$ oe	2	M1 for 3 correct prime factors in a tree or table seen before the first error or for 2, 3, 5 identified
11(a)(ii)	540	2	M1 for $2^2 \times 3^3 \times 5$ or 2×3^3 shown or answer 540k
11(b)	$X = 8575$ $Y = 6125$	4	B3 for $X = 8575$ or $Y = 6125$ or B2 for $a = 5$ or $b = 1$ soi or B1 for $1225 = 5^2 \times 7^2$ or $42\,875 = 5^3 \times 7^3$ or M1 for $a^2 \times 7^2 [= 1225]$ or $a^3 \times 7^{b+2} [= 42\,875]$