Answers: Revision Paper 5

Question			Answer	Marks	Guidance	
1	(i)		$kx^{\frac{1}{2}-1}$ or $kx^{-\frac{1}{2}}$ seen $3x^{-\frac{1}{2}}$ or $\frac{3}{\sqrt{x}}$ isw	M1 A1 [2]	$k > 0$ A0 for eg $3x^{-\frac{1}{2}} + c$	B2 for correct answer unsupported
1	(ii)		kx^{-2+1} or kx^{-1} oe seen $-12x^{-1}$ or $-\frac{12}{x}$ or $\frac{-12}{x}$ isw $+ c$	M1 A1 A1 [3]	for any non-zero k seen at least once following integration	SC0 for $\frac{12}{2x}$ or $\frac{6}{x}$ A0 for $\frac{12}{-x}$ or $\frac{12x^{-1}}{-1}$ do not allow MR for integration of $12x^2$
2	(i)		(i) [5], 10, 5, [10] [10 + 5 + 10 =] 25 (ii) 0	M1 A1 B1 [3]	ignore extra terms not from wrong working	condone wrongly attributed terms B2 for 25 unsupported
3			$1.5 + (4 - 1)d = 12$ or better $d = 3.5$ $r = 2$ 1.5 × their 2^9 – (1.5 + 9 × their 3.5) oe difference = 735	M1 A1 B1 M1 A1 [5]	or $1.5 \times r^{(4-1)} = 12$ or better $r = 2$ $d = 3.5$ M0 for use of their S_{10} in either term	if first M0 B0 allow B3 for $d = 3.5$ and $r = 2$; B2 for one of these; may be embedded in calculation of difference NB 768 – 33 allow –735

Question			Answer	Marks	Guidance	
4			$5.6^2 + 7.2^2 - 2 \times 5.6 \times 7.2 \times \cos 68$ seen	**M1**	may be implied by 53 or BC in range	
			53 or 53.0	**M1**	may be implied by BC in range	**NB** 52.9917243; (allow 47.7 to 47.71 from calculator in radian mode; may be implied by 6.90 to 6.91)
			[BC =] 7.3 or 7.27 to 7.28	**A1**	**NB** 7.27954…	
			$\sin C = \frac{7.2 \times \sin 68}{\text{their } BC}$	**M1**	or $[\cos C] = \frac{\text{their } BC^2 + 5.6^2 - 7.2^2}{2 \times 5.6 \times \text{their } BC}$	
			66 or awrt 66.5	**A1**	allow 1.2 or awrt 1.16 (radians); **A0** for eg 1.2 degrees	**NB** $\sin C = 0.917053\ldots$ $\cos C = 0.398766\ldots$
				[5]		
			Alternatively eg if the perpendicular from B to AC, BX, is used			eg if perpendicular from C to AB, CY, is used, mark as follows
			7.2 × cos 68 seen	**M1***	if unsupported, **B2** for 2.70 or better	5.6 × cos 68 seen
			2.7 or 2.697 to 2.70	**A1**		2.1 or 2.097 to 2.10
			XC = 5.6 – their AX	**M1dep***	**NB** 2.902832527	BY = 7.2 – their AY
			$\tan C = \left[\frac{\text{BX}}{\text{XC}}\right] = \frac{7.2 \times \sin 68}{\text{their XC}}$	**M1**		$\tan B = \left[\frac{\text{CY}}{\text{BY}}\right] = \frac{5.6 \times \sin 68}{\text{their BY}}$
			66 or awrt 66.5	**A1** **[5]**	allow 1.2 or awrt 1.19 (radians); **A0** for eg 1.2 degrees	C [= 90 – B] = 66 or awrt 66.5

Question			Answer	Marks	Guidance	
5	(i)		$\sin kx$ $y = \sin 2x$	**M1** **A1** **[2]**	$k > 0$ and $k \neq 1$ must see "$y =$" at some stage for **A1**	condone use of other variable condone f(x) = $\sin 2x$
5	(ii)		sketch of sine curve with period 360° and amplitude 1 sine curve centred on $y = -3$ and starting at (0, –3)	**B1** **B1** **[2]**	for $0 \leq x \leq 450$; ignore curve outside this range; do not allow sketch of $y = \cos x$ or $y = -\sin x$ for either mark	amplitude, period and centring on $y = -3$ must be clear from correct numerical scale, numerical labelling or comment; strokes on axes insufficient to imply scale: mark intent allow full marks if $y = \sin x$ and $y = \sin x - 3$ seen on same diagram
6	(i)		$\frac{1}{2}r^2\theta$ or $\frac{1}{2}a^2 \sin\theta$ or $a^2 \sin\frac{1}{2}\theta \cos\frac{1}{2}\theta$ seen $\frac{1}{2}r^2\theta - \frac{1}{2}a^2 \sin\theta$ isw oe	**M1** **A1** **[2]**	do not allow use of variable other than θ	allow eg $\frac{\theta}{2\pi} \times \pi r^2$ or $\frac{1}{2}a^2 \sin\left(\frac{180\theta}{\pi}\right)$ seen oe
6	(ii)		$\frac{1}{2}a^2 \sin 0.8 = \frac{1}{2} \times 12^2 \times 0.8 - \frac{1}{2}a^2 \sin 0.8$ oe [a =] 8.96 cao; mark the final answer	**B1** **B1** **[2]**	or eg $\frac{1}{2}a^2 \sin 0.8 = \frac{1}{4} \times 12^2 \times 0.8$ [= 28.8] or equivalent in degrees NB $\theta = 45.8366236\ldots°$ if unsupported, allow **B2** for 8.96 or allow **B1** for 9.0 or 8.96074…to 4 sf or more	**NB** $a^2 = \frac{57.6}{0.717356} = 80.29485$ **NB** $\theta = 45.83662361\ldots°$ **NB** $\frac{1}{2}\sin 0.8 = 0.35867..$

Question			Answer	Marks	Guidance	
7	(i)		substitution of $\tan x = \frac{\sin x}{\cos x}$ or $\sqrt{1-\sin^2 x} = \sqrt{\cos^2 x}$ or $\cos x$ in given LHS both substitutions seen and completion to $\sin x$ as final answer	**M1** **A1** **[2]**	if no substitution, statements must follow a logical order and the argument must be clear; if one substitution made correctly, condone error in other part of LHS **NB AG**; answer must be stated allow consistent use of other variable eg θ for both marks	condone omission of variable throughout for **M1** only , but allow recovery from omission of variable at end **M0** if first move is to square one or both sides Simply stating eg $\tan x = \frac{\sin x}{\cos x}$ is insufficient *Alternatively* **SC2** for complete argument eg $\tan x = \frac{\sin x}{\cos x}$ $[\tan x \times \cos x = \sin x]$ $\sin^2 x + \cos^2 x = 1$ $\cos x = \sqrt{1-\sin^2 x}$ $\tan x = \frac{\sin x}{\sqrt{1-\sin^2 x}}$ $\tan x \times \sqrt{1-\sin^2 x} = \sin x$ oe
7	(ii)		0, 180, 360 14 or 14.47 to 14.5 166 or awrt 165.5	**B1** **B1** **B1** **[3]**	all 3 required radians: mark as scheme but deduct one from total 0, π, 2π; 0.25 or 0.253 or awrt 0.2527; 2.89 or 2.889 or awrt 2.8889	**NB** $\sin y = 0$ or ¼ ignore extra values outside range if **B3**, deduct 1 mark for extra values within range

Question			Answer	Marks	Guidance	
8	(i)		$\log_a 1 = 0$ soi or $3m\log_a a$ or $\log_a a^{-3m}$ seen $-3m$ cao	M1 A1 [2]	do not condone $3m\log a$	do not allow MR for $(\log_a a^m)^3$
8	(ii)		$(2x+1)\log_3 3 = \log_3 1000$ or $2x+1 = \log_3 1000$ oe $[x =]\dfrac{\log_3 1000 - 1}{2}$ oe 2.64 cao; mark the final answer	M1 M1 A1 [3]	Or $(2x+1)\log_{10} 3 = \log_{10} 1000$ [= 3] or $[x =]\dfrac{\dfrac{3}{\log_{10} 3} - 1}{2}$ oe not from wrong working	condone omission of brackets; allow omission of base 10 or consistent use of other base allow one sign error and / or omission of brackets allow recovery from bracket error for **A1** 0 if unsupported or for answer obtained by trial and error on $3^{2x+1} = 1000$
9	(i)		$\dfrac{h}{2} \times (0 + 0 + 2[4 + 4.9 + 5 + 4.9 + 4])$ oe all non-zero y-values correctly placed $h = 1$ used in formula or consistently with two triangles and four trapezia area = 22.8 **and** volume = 1140 isw cao	M1 M1 B1 A1 [4]	correct formula used with 4, 5 or 6 strips and numerical value for h; condone omission of zeros or omission of outer brackets for both **M** marks **M0M0** if 1, 2, 3 or 6 used as y-values (these are x-values) if **M0M0** allow **B1** for $h = 1$ and **B2** for 22.8 from area of 4 trapezia and 2 triangles and **B1** for 1140 ignore units	allow eg ½ × 1 × (4 + 4 + 2[4.9 + 5 + 4.9]) ½ × 1 × (4 + 0 + 2[4 +4.9 + 5 + 4.9]) (**NB** may be implied by 18.8 & 20.8 respectively) if **M0M0B0** allow **SC4** for 22.8 and 1140 obtained correctly by other method

Question			Answer	Marks	Guidance	
9	(ii)	A	substitution of $x = 1.2$ or 4.8 to find y $y = 4.35$ or 4.352 and correct comparison with 4.4 isw	**M1** **A1** **[2]**	allow substitution of $1.2 \leq x \leq 1.234$ or $4.766 \leq x \leq 4.8$	or **M1** for $y = 4.4$, $x = 1.234$ [or 4.766] and **A1** for comparison of 1.234 with 1.2 or 4.766 with 4.8 [so gap less than 3.6]
9	(ii)	B	$F[x] = \frac{5}{81}\left(\frac{108}{2}x^2 - \frac{54}{3}x^3 + \frac{12}{4}x^4 - \frac{x^5}{5}\right)$ oe eg $\frac{10}{3}x^2 - \frac{10}{9}x^3 + \frac{5}{27}x^4 - \frac{1}{81}x^5$ $F[6] - F[0]$ or $2 \times (F[3] - F[0])$ 24 1200	**M2** **M1** **A1** **B1** **[5]**	**M1** for 3 correct terms; ignore $+c$ allow coefficients 3.333333…, 1.11111…, 0.185185.., 0.01234567…r.o.t to 2 sf or better or decimal equivalents in numerator: 6.6666…, 3.333333…, 0.74074…, 0.061728… r.o.t to 2 sf or better dependent on at least two terms correctly integrated in bracket; condone omission of $-F(0)$	condone omission of $\frac{5}{81}$; **M0** if $\frac{5}{81}x$ seen outside bracket but next **M1** is still available; ignore subsequent attempt to evaluate c for first **M2** **M0** for non-zero lower limit 24 unsupported does not score ignore units
10	(i)		$\frac{(5.1^2 - 10.2) - (5^2 - 10)}{5.1 - 5}$ oe 8.1	**M1** **A1** **[2]**	condone omission of brackets	0 for 8.1 unsupported

Question			Answer	Marks	Guidance	
10	(ii)		$\frac{(5+h)^2-2(5+h)-\text{their } 15}{h}$ oe	M1	condone omission of brackets	
			$25+10h+h^2-10-2h$ oe seen	M1	allow one sign error	
			numerator is $8h+h^2$	A1		
			$8+h$ isw	A1 [4]		
10	(iii)		$h \to 0$	M1	may be embedded; allow eg "tends to 0"	**M0** for differentiation of x^2-2x **M0** for following from part (i) **M0** for $h=0$
			their 8	A1	**FT** their $k+h$ from part (ii)	
				[2]		
10	(iv)		$y=8x-25$ isw	B1	or $y-15=8(x-5)$ isw or $y=8x+c$ and $c=-25$ stated isw	
			non-zero numerical value for x-intercept on their straight line found	M1		
			$[x=]$ 3.125 oe	A1	may be embedded in calculation for area	
			$\frac{1}{2}\times$ their non-zero y-intercept $\times$ their $\frac{25}{8}$	M1	condone arithmetic slips in finding values of intercepts	or integration and evaluation of their $\int_0^{25/8}(8x-25)dx$; lower limit must be 0
			$\frac{625}{16}$ or $39\frac{1}{16}$ or 39.0625 isw	A1	accept rounded to 1 dp or better for **A1**; but **A0** if **final** answer negative	
				[5]		

Question			Answer	Marks	Guidance	
11	(i)		$\log_{10} y = \log_{10} a + bt$ www	B1	B0 for just $\log_{10} y = \log_{10} a + bt \log_{10} 10$	allow omission of base throughout question
			gradient is b, intercept is $\log_{10} a$ cao	B2	B1 for one correct; award independently of their equation; must be stated – linking by arrows etc is insufficient; condone $m = b$ and $c = \log a$	ignore t-intercept is $\frac{-\log_{10} a}{b}$ B0 for gradient is bt
				[3]		
11	(ii)		1.58, 1.8[0], 1.98, 2.37, 2.68	B1	allow values which round to these numbers to 2 dp;	all values must be correct
			all values correct and all plotted accurately	B1	within tolerance on overlay;	
			ruled line of best fit for at least $1 \leq t \leq 10$	B1	within tolerance on overlay: must not cut red or green line; line between (1, 0.6) and (1, 1.05) at lower limit and between (10, 2.3) and (10, 2.75) at upper limit;	use ruler tool to check if line is ruled where necessary; tolerance: one small square horizontally at each end; not dependent on correct plots
			evaluation of $\frac{\log y_2 - \log y_1}{t_2 - t_1}$ or substitution of $(t_1,\ \log y_1)$ and $(t_2,\ \log y_2)$ in $\log y = bt + \log a$ to obtain a numerical value for the gradient	M1	$(t_1,\ \log y_1)$ and $(t_2,\ \log y_2)$ are points on their line gradient must be identified as b for **A1**	condone use of values from table
			$0.14 \leq b \leq 0.24$	A1		
			$2.5 \leq a \leq 6.3$	B1	must be identified as a ; not from wrong working	
			$y =$ their $a \times 10^{\text{their}b \times t}$ or $y = 10^{\text{their}bt + \text{their}\log a}$ or $10^{\text{their}\log a} \times 10^{\text{their}b \times t}$ oe	M1		if **M0A0B0M0** allow **SC3** for substitution directly into given formula to obtain $y = a10^{bt}$ with a **and** b in acceptable range
			a and b or $\log a$ and b both in acceptable range	A1 [8]	$0.4 \leq \log a \leq 0.8$	
11	(iii)		260 **or** 261	B1 [1]	B0 for non-integer answer	