MATHEMATICS 4722

Core Mathematics 2

MARK SCHEME

Specimen Paper

MAXIMUM MARK | 72

This mark scheme consists of 4 printed pages.

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1	$1 - 8x + 24x^2 - 32x^3 + 16x^4$	B1		For first two terms $1 - 8x$
		M1		For expansion in powers of $(-2x)$
		M1		For any correct use of binomial coefficients
		A1		For any one further term correct
		A1	**5**	For completely correct expansion
			5	

2	**(i)** $\int x^{-2}\,dx = -x^{-1} + c$	M1		For any attempt to integrate x^{-2}
		A1		For correct expression $-x^{-1}$ (in any form)
		B1	**3**	For adding an arbitrary constant
	(ii) $y = -x^{-1} + c$ passes through $(1, 3)$,			
	so $3 = -1 + c \Rightarrow c = 4$	M1		For attempt to use $(1, 3)$ to evaluate c
		A1✓		For correct value from their equation
	Hence curve is $y = -\dfrac{1}{x} + 4$	A1	**3**	For correct equation
			6	

3	**(a)** **(i)** $2\log_2 x$	B1	**1**	For correct answer
	(ii) $\log_2(8x^2) = \log_2 8 + \log_2 x^2$	M1		For relevant sum of logarithms
		M1		For relevant use of $8 = 2^3$
	$= 3 + 2\log_2 x$	A1	**3**	For correct simplified answer
	(b) $2\log_3 y = \log_3 27$	M1		For taking logs of both sides of the equation
	Hence $\log_3 y = \frac{3}{2}$	A1		For any correct expression for $\log_3 y$
		A1	**3**	For correct simplified answer
			7	

4	**(i)** $r = \dfrac{2400}{3000} = 0.8$	B1		For the correct value of r
	Forecast for week 20 is $3000 \times 0.8^{19} \approx 43$	M1		For correct use of ar^{n-1}
		A1	**3**	For correct (integer) answer
	(ii) $\dfrac{3000(1 - 0.8^{20})}{1 - 0.8} = 14\,827$	M1		For correct use of $\dfrac{a(1 - r^n)}{1 - r}$
		A1	**2**	For correct answer (3sf is acceptable)
	(iii) $\dfrac{3000}{1 - 0.8} = 15\,000$	M1		For correct use of $\dfrac{a}{1 - r}$
		A1	**2**	For correct answer
			7	

5	**(i)** LHS is $15(1 - \sin^2 \theta°)$	M1		For using the relevant trig identity
	Hence equation is $15\sin^2 \theta° + \sin \theta° - 2 = 0$	A1	**2**	For correct 3-term quadratic
	(ii) $(5\sin \theta° + 2)(3\sin \theta° - 1) = 0$	M1		For factorising, or other solution method
	Hence $\sin \theta° = -\frac{2}{5}$ or $\frac{1}{3}$	A1		For both correct values
	So $\theta = 19.5, 160.5, 203.6, 336.4$	M1		For any relevant inverse sine operation
		A1		For any one correct value
		A1✓		For corresponding second value
		A1✓	**6**	For both remaining values
			8	

3

6	**(i)**	$\dfrac{3}{\sin C}=\dfrac{5}{\sin 2.1}\Rightarrow \sin C=\frac{3}{5}\sin 2.1$	M1	For any correct initial statement of the sine rule, together with an attempt to find $\sin C$
		Hence $C=0.544$	A1 **2**	For correct value
	(ii)	Angle A is $\pi-2.1-0.5444=0.4972$	M1	For calculation of angle A
		Area is $\frac{1}{2}\times 5\times 3\times\sin 0.4972$	M1	For any complete method for the area
		i.e. 3.58 cm^2	A1✓ **3**	For correct value, following their C
	(iii)	Sector perimeter is $6+3\times 0.4972$	M1	For using $r\theta$ with their A in radians
		i.e. 7.49 cm	A1t	For correct value, following their A
		Sector area is $\frac{1}{2}\times 3^2\times 0.4972$	M1	For using $\frac{1}{2}r^2\theta$ with their A in radians
		i.e. 2.24 cm^2	A1✓ **4**	For correct value, following their A
			9	
7	**(i)**	$-75+45+30=0,\ 25-15-10=0$	B1	For checking one point in both equations
		$-12-18+30=0,\ 4+6-10=0$	B1 **2**	For checking the other point in both
	(ii)	Area is $\int_{-5}^{2}\{(-3x^2-9x+30)-(x^2+3x-10)\}\,dx$	M1	For use of $\int(y_1-y_2)\,dx$
		i.e. $\int_{-5}^{2}(-4x^2-12x+40)\,dx$, as required	A1 **2**	For showing given answer correctly
	(iii)	*EITHER*: Area is $\left[-\frac{4}{3}x^3-6x^2+40x\right]_{-5}^{2}$	M1	For integration attempt with one term OK
			A1	For at least two terms correct
			A1	For completely correct indefinite integral
		$=(-\frac{32}{3}-24+80)-(\frac{500}{3}-150-200)$	M1	For correct use of limits
		$=228\frac{2}{3}$	A1	For showing given answer correctly
		OR: Area under top curve is	M1	For complete evaluation attempt
			A1	For correct indefinite integration (allow for other curve if not earned here)
		$\left[-x^3-\frac{9}{2}x^2+30x\right]_{-5}^{2}=171\frac{1}{2}$	A1	For correct value
		Area above lower curve is		
		$-\left[\frac{1}{3}x^3+\frac{3}{2}x^2-10x\right]_{-5}^{2}=57\frac{1}{6}$	M1	For evaluation and sign change
		So area between is $171\frac{1}{2}+57\frac{1}{6}=228\frac{2}{3}$	A1 **5**	For showing given answer correctly
			9	
8	**(i)**	$1.25^x=2\Rightarrow x\log 1.25=\log 2$	B1	For correct initial use of logs
		Hence $x=\dfrac{\log 2}{\log 1.25}=3.11$	M1	For correct log expression for x
			A1 **3**	For correct numerical value
	(ii)	$\frac{1}{2}\{1.25^0+2(1.25^1+1.25^2+1.25^3)+1.25^4\}$	B1	For correct recognition of $h=1$
			M1	For any use of values 1.25^x for $x=0,\dots,4$
			M1	For use of correct formula
		Area is 6.49	A1 **4**	For correct answer
	(iii)	The trapezia used in **(ii)** extend above the curve	M1	For stating or sketching trapezia above curve
		Hence the trapezium rule overestimates the area	A1 **2**	For stating overestimate with correct reason
	(iv)	Use more trapezia, with a smaller value of h	B1 **1**	For stating that more trapezia should be used
			10	

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9	**(i)**	$8 + 4a + 2b - 6 = -8 + 4a - 2b - 6$	M1		For equating $f(2)$ and $f(-2)$
			A1		For correct equation
		Hence $4b = -16 \Rightarrow b = -4$	A1	**3**	For showing given answer correctly
	(ii)	$1 + a - 4 - 6 = 0$	M1		For equating $f(1)$ to 0 (*not* $f(-1)$)
		Hence $a = 9$	A1	**2**	For correct value
	(iii)	$f(x) = (x-1)(x^2 + 10x + 6)$	M1		For quadratic factor with x^2 and/or $+6$ OK
			A1		For trinomial with both these terms correct
			A1	**3**	For completely correct factorisation
	(iv)	The discriminant of the quadratic is 76	M1		For evaluating the discriminant
		Hence there are 3 real roots altogether	M1		For using positive discriminant to deduce that there are 2 roots from the quadratic factor
			A1	**3**	For completely correct explanation of 3 roots

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