

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

**Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education**

MATHEMATICS

4722

Core Mathematics 2

MARK SCHEME

Specimen Paper

MAXIMUM MARK	72
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This mark scheme consists of 4 printed pages.

1 $1 - 8x + 24x^2 - 32x^3 + 16x^4$	B1 M1 M1 A1 A1	For first two terms $1 - 8x$ For expansion in powers of $(-2x)$ For any correct use of binomial coefficients For any one further term correct For completely correct expansion 5 5
2 (i) $\int x^{-2} dx = -x^{-1} + c$ ----- (ii) $y = -x^{-1} + c$ passes through $(1, 3)$, so $3 = -1 + c \Rightarrow c = 4$ Hence curve is $y = -\frac{1}{x} + 4$	M1 A1 B1 M1 A1✓ A1	For any attempt to integrate x^{-2} For correct expression $-x^{-1}$ (in any form) For adding an arbitrary constant For attempt to use $(1, 3)$ to evaluate c For correct value from their equation For correct equation 3 6
3 (a) (i) $2\log_2 x$ ----- (ii) $\log_2(8x^2) = \log_2 8 + \log_2 x^2$ $= 3 + 2\log_2 x$ ----- (b) $2\log_3 y = \log_3 27$ Hence $\log_3 y = \frac{3}{2}$	B1 M1 M1 A1 M1 A1 A1	For correct answer For relevant sum of logarithms For relevant use of $8 = 2^3$ For correct simplified answer For taking logs of both sides of the equation For any correct expression for $\log_3 y$ For correct simplified answer 1 3 3 7
4 (i) $r = \frac{2400}{3000} = 0.8$ Forecast for week 20 is $3000 \times 0.8^{19} \approx 43$ ----- (ii) $\frac{3000(1 - 0.8^{20})}{1 - 0.8} = 14\,827$ ----- (iii) $\frac{3000}{1 - 0.8} = 15\,000$	B1 M1 A1 M1 A1 M1 A1	For the correct value of r For correct use of ar^{n-1} For correct (integer) answer For correct use of $\frac{a(1-r^n)}{1-r}$ For correct answer (3sf is acceptable) For correct use of $\frac{a}{1-r}$ For correct answer 3 2 2 7
5 (i) LHS is $15(1 - \sin^2 \theta^\circ)$ Hence equation is $15\sin^2 \theta^\circ + \sin \theta^\circ - 2 = 0$ ----- (ii) $(5\sin \theta^\circ + 2)(3\sin \theta^\circ - 1) = 0$ Hence $\sin \theta^\circ = -\frac{2}{5}$ or $\frac{1}{3}$ So $\theta = 19.5, 160.5, 203.6, 336.4$	M1 A1 M1 A1 M1 A1 A1✓ A1✓	For using the relevant trig identity For correct 3-term quadratic For factorising, or other solution method For both correct values For any relevant inverse sine operation For any one correct value For corresponding second value For both remaining values 2 2 6 8

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

<p>9 (i) $8 + 4a + 2b - 6 = -8 + 4a - 2b - 6$</p> <p>Hence $4b = -16 \Rightarrow b = -4$</p>	<p>M1 A1 A1</p>	<p>For equating $f(2)$ and $f(-2)$ For correct equation 3 For showing given answer correctly</p>
<p>(ii) $1 + a - 4 - 6 = 0$</p> <p>Hence $a = 9$</p>	<p>M1 A1</p>	<p>For equating $f(1)$ to 0 (<i>not</i> $f(-1)$) 2 For correct value</p>
<p>(iii) $f(x) = (x-1)(x^2 + 10x + 6)$</p>	<p>M1 A1 A1</p>	<p>For quadratic factor with x^2 and/or $+6$ OK For trinomial with both these terms correct 3 For completely correct factorisation</p>
<p>(iv) The discriminant of the quadratic is 76 Hence there are 3 real roots altogether</p>	<p>M1 M1 A1</p>	<p>For evaluating the discriminant For using positive discriminant to deduce that there are 2 roots from the quadratic factor 3 For completely correct explanation of 3 roots</p> <p style="text-align: center;">11</p>