OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MATHEMATICS 4721

Core Mathematics 1

MARK SCHEME

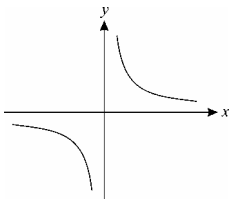
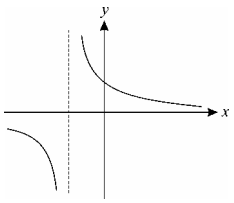
Specimen Paper

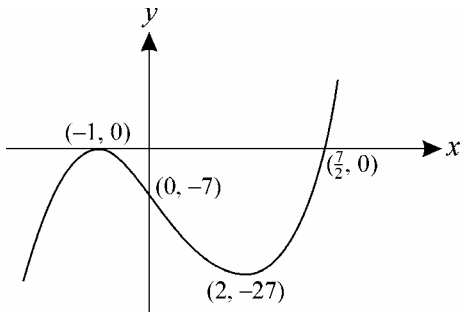
MAXIMUM MARK	72

This mark scheme consists of 4 printed pages.

Registered Charity Number: 1066969
[Turn over

1	**(i)**	$\frac{1}{16}$	B1 **1**	For correct value (fraction or exact decimal)
	(ii)	8	B1 **1**	For correct value 8 only
	(iii)	6	M1 A1 **2** **4**	For $1^3+2^3+3^3=36$ seen or implied For correct value 6 only
2	**(i)**	$x^2-8x+3=(x-4)^2-13$ i.e. $a=-4, b=-13$	B1 M1 A1 **3**	For $(x-4)^2$ seen, or statement $a=-4$ For use of (implied) relation $a^2+b=3$ For correct value of b stated or implied
	(ii)	Minimum point is $(4,-13)$	B1√ B1√ **2** **5**	For x-coordinate equal to their $(-a)$ For y-coordinate equal to their b
3	**(i)**	Discriminant is k^2-4k	M1 A1 **2**	For attempted use of the discriminant For correct expression (in any form)
	(ii)	For no real roots, $k^2-4k<0$ Hence $k(k-4)<0$ So $0<k<4$	M1 M1 A1 A1 **4** **6**	For stating their $\Delta<0$ For factorising attempt (or other soln method) For both correct critical values 0 and 4 seen For correct pair of inequalities
4	**(i)**	$\frac{dy}{dx}=12x^2$	M1 A1 **2**	For clear attempt at nx^{n-1} For completely correct answer
	(ii)	$y=x^4+2x^2$ Hence $\frac{dy}{dx}=4x^3+4x$	B1 M1 A1√ **3**	For correct expansion For correct differentiation of at least one term For correct differentiation of their 2 terms
	(iii)	$\frac{dy}{dx}=\frac{1}{2}x^{-\frac{1}{2}}$	M1 A1 **2** **7**	For clear differentiation attempt of $x^{\frac{1}{2}}$ For correct answer, in any form
5	**(i)**	$x^2-3x+2=3x-7 \Rightarrow x^2-6x+9=0$ Hence $(x-3)^2=0$ So $x=3$ and $y=2$	M1 A1 M1 A1 A1 **5**	For equating two expressions for y For correct 3-term quadratic in x For factorising, or other solution method For correct value of x For correct value of y
	(ii)	The line $y=3x-7$ is the tangent to the curve $y=x^2-3x+2$ at the point $(3,2)$	B1 B1 **2**	For stating tangency For identifying $x=3$, $y=2$ as coordinates
	(iii)	Gradient of tangent is 3 Hence gradient of normal is $-\frac{1}{3}$ Equation of normal is $y-2=-\frac{1}{3}(x-3)$ i.e. $x+3y-9=0$	B1 B1√ M1 A1 **4** **11**	For stating correct gradient of given line For stating corresponding perpendicular grad For appropriate use of straight line equation For correct equation in required form

6	**(i)**		B1 B1 **2**	For correct 1st quadrant branch For both branches correct and nothing else
	(ii)	Translation of 2 units in the negative x-direction	B1 B1 B1	For translation parallel to the x-axis For correct magnitude For correct direction
			B1√ B1 **5**	For correct sketch of new curve For some indication of location, e.g. $\frac{1}{2}$ at y-intersection or -2 at asymptote
	(iii)	Derivative is $-x^{-2}$	M1 A1 **2**	For correct power -2 in answer For correct coefficient -1
	(iv)	Gradient of $y=\frac{1}{x}$ at $x=2$ is required This is -2^{-2}, which is $-\frac{1}{4}$	B1 M1 A1 **3**	For correctly using the translation For substituting $x=2$ in their **(iii)** For correct answer
			12	
7	**(i)**	$AB^2=(10-2)^2+(3-9)^2=100$ Hence the radius is 5 Mid-point of AB is $\left(\frac{2+10}{2},\frac{9+3}{2}\right)$ Hence centre is $(6, 6)$	M1 A1 M1 A1 **4**	For correct calculation method for AB^2 For correct value for radius For correct calculation method for mid-point For both coordinates correct
	(ii)	Equation is $(x-6)^2+(y-6)^2=5^2$ This is $x^2-12x+36+y^2-12y+36=25$ i.e. $x^2+y^2-12x-12y+47=0$, as required	M1 A1 A1 **3**	For using correct basic form of circle equn For expanding at least one bracket correctly For showing given answer correctly
	(iii)	Gradient of AB is $\frac{3-9}{10-2}=-\frac{3}{4}$ Hence perpendicular gradient is $\frac{4}{3}$ Equation of tangent is $y-3=\frac{4}{3}(x-10)$ Hence C is the point $(\frac{31}{4}, 0)$	M1 A1 A1√ M1 M1 A1 **6**	For finding the gradient of AB For correct value $-\frac{3}{4}$ or equivalent For relevant perpendicular gradient For using their perp grad and B correctly For substituting $y=0$ in their tangent eqn For correct value $x=\frac{31}{4}$
			13	

8	**(i)**	$\frac{dy}{dx} = 6x^2 - 6x - 12$	M1	For differentiation with at least 1 term OK
			A1	For completely correct derivative
		Hence $x^2 - x - 2 = 0$	M1	For equating their derivative to zero
		$(x-2)(x+1) = 0 \Rightarrow x = 2$ or -1	M1	For factorising or other solution method
			A1	For both correct x-coordinates
		Stationary points are $(2, -27)$ and $(-1, 0)$	A1 **6**	For both correct y-coordinates
	(ii)	$\frac{d^2y}{dx^2} = 12x - 6 = \begin{cases} +18 \text{ when } x = 2 \\ -18 \text{ when } x = -1 \end{cases}$	M1	For attempt at second derivative and at least one relevant evaluation
		Hence $(2, -27)$ is a min and $(-1, 0)$ is a max	A1	For either one correctly identified
			A1 **3**	For both correctly identified (Alternative methods, e.g. based on gradients either side, are equally acceptable)
	(iii)	RHS $= (x^2 + 2x + 1)(2x - 7)$	M1	For squaring correctly and attempting complete expansion process
		$= 2x^3 - 7x^2 + 4x^2 - 14x + 2x - 7$		
		$= 2x^3 - 3x^2 - 12x - 7$, as required	A1 **2**	For obtaining given answer correctly
	(iv)		B1	For correct cubic shape
			B1	For maximum point lying on x-axis
			B1 **3**	For $x = \frac{7}{2}$ and $y = -7$ at intersections
			14	