

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

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

MATHEMATICS

4721

Core Mathematics 1

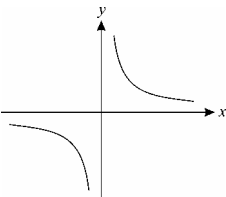
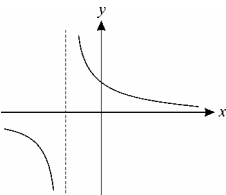
MARK SCHEME

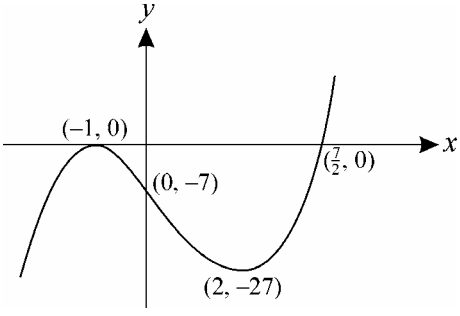
Specimen Paper

MAXIMUM MARK	72
---------------------	-----------

This mark scheme consists of 4 printed pages.

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