

JUNE 2004

GCE ORDINARY LEVEL

MARK SCHEME

MAXIMUM MARK: 80

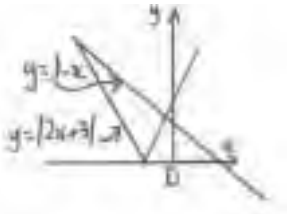
SYLLABUS/COMPONENT: 4037/01

**ADDITIONAL MATHEMATICS
Paper 1**

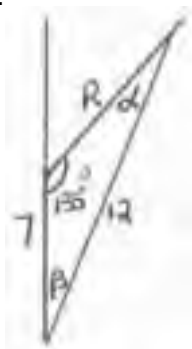


UNIVERSITY of CAMBRIDGE
International Examinations

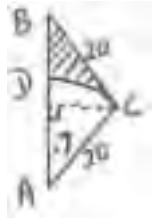
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1. (i) $y=(3x-2)(x^2+5)$ $dy/dx = \frac{(x^2+5)3 - (3x-2)2x}{(x^2+5)^2}$ (ii) Num = $15 + 4x - 3x^2 = 0$ when $\rightarrow x = -5/3$ or $x = 3$	M1 A1 M1 A1 [4]	Formula must be correct - allow unsimplified. Setting to 0 + attempt to solve. Both correct.
2. $x^3 = 5x-2$ $x^3 - 5x + 2 = 0$ Tries to find a value $x = 2$ fits $(x-2) \rightarrow x^2 + 2x - 1 = 0$ Solution $\rightarrow x = -1 \pm \sqrt{2}$	M1 A1 M1 DM1 A1 [5]	Equating + attempt at a value by TI Co - allow for $(x-2)$ or for $f(2)$ Must be by $(x-\text{his value})$ As by quadratic scheme Co
3. (i)  $y = 2x+3$ -ve then +ve slope Vertex at $(-h,0)$ $y = 1 - x$ Line, -ve m, $(k,0)$ (ii) $x + 2x + 3 = 1 \rightarrow x = -2/3$ $(-0.65 \text{ to } -0.70)$ $x - (2x+3) = 1 \rightarrow x = -4$ $(-3.9 \text{ to } -4.1)$	B1 DB1 B1 [3] B1 M1 A1 [3]	Must be 2 parts – ignore -2 to -1 V shape-Vertex on -ve x-axis + lines -ve slope, crosses axes at x,y +ve – allow if only in 1st or 2nd quadrants From graph, or calculation or guess B2 if correct. M mark for any method. Squares both sides M1 quadratic A1 Answers A1
4. $x = \text{asin}(bx)+c$ (i) $a = 2$ and $b = 3$ (ii) $c = 1$ (iii) 3 cycles (0 to 360) -1 to 3  Period 120° + all correct.	B1 B1 B1 B1 B1 DB1 [6]	Wrong way round - no marks. No labels - allow B1 if both correct. Co Even if starting incorrectly. Needs to be marked - allow for any trig graph. Everything in relatively correct position - needs both B's

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5. $xy + 24 = 0$ and $5y + 2x = 1$ Makes x or y the subject and subs $\rightarrow 5y^2 = y + 48$ or $2x^2 - x = 120$ Solution of quadratic = 0 $\rightarrow (8, -3)$ and $(-7.5, 3.2)$ $d = \sqrt{(15.5^2 + 6.2^2)} = 16.7$	M1 A1 DM1 A1 M1 A1 $\checkmark$ [6]	x or y removed completely – condone poor algebra. A1 co. By scheme for quadratic = 0 Co M mark ind of anything before. A1 $\checkmark$ on his 2 points.
6. $(300 \ 240) \begin{pmatrix} .6 & .3 & .1 \\ .5 & .4 & .1 \end{pmatrix} \begin{pmatrix} 4 \\ 6 \\ 8 \end{pmatrix}$ $\left[\text{or } (4 \ 6 \ 8) \begin{pmatrix} .6 & .5 \\ .3 & .4 \\ .1 & .1 \end{pmatrix} \begin{pmatrix} 300 \\ 240 \end{pmatrix} \right]$ $(300 \ 186 \ 54) \begin{pmatrix} 4 \\ 6 \\ 8 \end{pmatrix} \text{ or } (300 \ 240) \begin{pmatrix} 5 \\ 5.2 \end{pmatrix}$ Final answer $\rightarrow \\$2748$	B2, 1.0 M1 A1 M1 B1 [6]	For 3 correct matrices – independent of whether they are conformable – allow with or without the factor of 100. 1st product. Co. Matrices must be written in correct order – for M mark, the 2x3 or 3x2 must be used. 2nd product. By any method, inc numerical. Omission of 100 loses last B1 only.
7.  $\frac{\sin \alpha}{7} = \frac{\sin 135}{12}$ $\rightarrow \alpha = 24.4^\circ$ = 20.6°. Bearing is 020.6°	B1 M2 A1 A1 [5]	Correct triangle of velocities - must be 7, 12 and 135° opposite 12. Sine rule used in his triangle. If 45° or 135° between 7 and 12, allow M1 for cos rule, M1 for sine rule Co. Co. Allow 21°.

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8. $y = (ax+3)\ln x$ On x-axis, $y = 0$ $ax + 3 = 0 \rightarrow x$ is -ve $\rightarrow$ no soln But $\ln x = 0 \rightarrow x = 1$ $dy/dx = a\ln x + (ax+3).(1/x)$ Use of $m_1 m_2 = -1$ Gradient of tangent = -1 (-1/5) $\rightarrow a = 2$	M1 A1 M1 B1 M1 A1 A1 [7]	Needs an attempt at solution. Ignore other solutions at this stage. Correct use of "uv" formula. For $d/dx(\ln x)$, even if M0 given above. Could equate m with -1 (dy/dx) Co. Co.
9. (a) $\left(x - \frac{1}{2x^5}\right)^{18}$ ${}^{18}C_{15} (x)^{15} (1/2x^5)^3$ $\rightarrow 18.17.16(-1/8) \div 6$ $\rightarrow -102$ (b) $(1 + kx)^n$ Coeff of $x^2 = {}_n C_2 k^2$ Coeff of $x^3 = {}_n C_3 k^3$ Equating and changing to factorials $\rightarrow k = 3/(n-2)$ or equivalent without factorials	B1 B1 B1 [3] B1 B1 M1 A1 [4]	For ${}^{18}C_3$ or ${}^{18}C_{15}$ For $(\pm 1/2)^3$ – even if in $(1/2x)^3$ Co Co. Co. Needs attempt at nCr Co
10. (i) Area = Δ – sector BCA = $\pi - 1.4$ or height = $20\sin 0.7$ $\Delta = \frac{1}{2} \cdot 20^2 \sin(\pi - 1.4)$ or $\frac{1}{2}bh = 197.1$  Sector = $\frac{1}{2}20^2 \cdot 0.7 = 140$ $\rightarrow$ Area = 57.1 (ii) DC = $20 \times 0.7 (=14)$ AB = $2 \times 20\cos 0.7$ or cos rule BD = AB – 20 = 10.6 $\rightarrow$ Perimeter = 44.6 Could be [5] + [3] if AB used in part (i)	M1 M1 M1 A1 [4] M1 M1 M1 A1 [4]	Award for either of these. Correct method for area of Δ Use of $\frac{1}{2}r^2\theta$ Co Use of $s = r\theta$ Correct trig – could gain this in (i) Co

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11. (i) $m = -a/x^3 \rightarrow y = \frac{1}{2}ax^{-2} (+c)$ Puts in (2, 3.5) $\rightarrow 28 = a + 8c$ Puts in (5, 1.4) $\rightarrow 70 = a + 50c$ Solution $\rightarrow a = 20, c = -1$ (ii) $\int (10x^{-2} + 1)dx = -10x^{-1} + x$ $A = []^p - []^2 = -10/p + p + 3$ $B = []^5 - []^p = 10/p - p + 3$ $P = \sqrt{10}$ or 3.16	M1 A1 DM1 M1 A1 [5] M1 A1√ M1 M1 A1 [5]	Any attempt to integrate. Co. Substitutes one of his points – even if +c missing Correct method of soln. Both co. (beware fortuitous ans. $a = 20$ given) N.B: assumes $a = 20$ without checking that both points work (M1A0DM1M0A1) Integrates his "curve" Use of limits correctly in either A or B or in A+B (2 to 5). Award M1 for each. (Can get these if only one integration) co
12 EITHER 12 questions – 3 trig, 4 alg, 5 calc Answer 8 from 12. (a) (i) ${}_{12}C_8 = 495$ (ii) T and A $\rightarrow 0$ T and C $\rightarrow 1$ A and C $\rightarrow 9$ Total = 10 8 dresses, A $\rightarrow$ H (b) (i) ${}_8P_5 = 6720$ (ii) $\frac{1}{8}$ of (i) = 840 or ${}_7P_4$ (iii) $\frac{5}{8}$ of (i) = 4200 or 5 x (ii) or ${}_8P_5 - {}_7P_5$	M1 A1 M1 A1 [4] M1 A1 M1 A1√ M1 A1√ [6]	${}_{12}C_8$ gets M1. Answer only gets both marks. Needs to have considered 2 of the possibilities. Must be ${}_8P_5$ for M1 – co for A1. Any method ok. √ on (i) if appropriate Any method ok. √ on (i) or (ii)

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12 OR							
x	2	4	6	8	10		
y	9.8	19.4	37.4	74.0	144.4		
lgy	0.99	1.29	1.57	1.87	2.16		
(i) Finds values of lgy Draws graph accurately. (ii) $lgy = lgA + xlgb$ $m = lgb \rightarrow b = 1.4 (\pm 0.05)$ $c = lgA \rightarrow A = 5.0 (\pm 0.2)$ (iii) $lgy = xlg2$ i.e Straight line $Y = 0.301x$ $x = 4.5 (\pm 0.2)$ Use of simultaneous eqns in part (ii) gets B1 only, unless both points used are on his line, in which case allow marks if to correct accuracy.						M1	Knows what to do. Don't penalise incorrect scale. Points correct to $\frac{1}{2}$ small square. Anywhere – even if no graph Gradient measured + equated to lgb. Intercept measured + equated to lgA. Even if no line – give if line correct. Must be a line. To this accuracy.
						A1	
						[2]	
						B1	
						M1 A1	
						M1 A1	
						[5]	
						B1	
						M1	
						A1	
[3]							
DM 1 for quadratic equation. Equation must be set to 0 if using formula or factors.							
<u>Formula</u>						<u>Factors</u>	
Must be correct						Must attempt to put quadratic into 2 factors.	
– ignore arithmetic and algebraic slips.						Each factor then equated to 0.	