

TOPICAL PAST PAPER QUESTIONS WORKSHEETS

AS & A Level Mathematics (9709) Paper 1
[Pure Mathematics 1]

Exam Series: February/March 2017 - October/November 2024

Format Type A:

Answers to all questions are provided as an appendix



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Introduction

Each Topical Past Paper Questions Compilation contains a comprehensive collection of hundreds of questions and corresponding answer schemes, presented in worksheet format. The questions are carefully arranged according to their respective chapters and topics, which align with the latest IGCSE or AS/A Level subject content. Here are the key features of these resources:

1. The workbook covers a wide range of topics, which are organized according to the latest syllabus content for Cambridge IGCSE or AS/A Level exams.
2. Each topic includes numerous questions, allowing students to practice and reinforce their understanding of key concepts and skills.
3. The questions are accompanied by detailed answer schemes, which provide clear explanations and guidance for students to improve their performance.
4. The workbook's format is user-friendly, with worksheets that are easy to read and navigate.
5. This workbook is an ideal resource for students who want to familiarize themselves with the types of questions that may appear in their exams and to develop their problem-solving and analytical skills.

Overall, Topical Past Paper Questions Workbooks are a valuable tool for students preparing for IGCSE or AS/A level exams, providing them with the opportunity to practice and refine their knowledge and skills in a structured and comprehensive manner. To provide a clearer description of this book's specifications, here are some key details:

- Title: Cambridge AS & A Level Mathematics (9709) Paper 1 Topical Past Papers
- Subtitle: Exam Practice Worksheets With Answer Scheme
- Examination board: Cambridge Assessment International Education (CAIE)
- Subject code: 9709
- Years covered: February/March 2017 - October/November 2024
- Paper: 1
- Number of pages: 1285
- Number of questions: 606

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Chapter 1

Quadratics

2. 9709_s22_qp_11 Q: 1

(a) Express $x^2 - 8x + 11$ in the form $(x + p)^2 + q$ where p and q are constants. [2]

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(b) Hence find the exact solutions of the equation $x^2 - 8x + 11 = 1$. [2]

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6. 9709_s21_qp_12 Q: 1

(a) Express $16x^2 - 24x + 10$ in the form $(4x + a)^2 + b$. [2]

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(b) It is given that the equation $16x^2 - 24x + 10 = k$, where k is a constant, has exactly one root.

Find the value of this root. [2]

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7. 9709_s20_qp_11 Q: 5

The equation of a line is $y = mx + c$, where m and c are constants, and the equation of a curve is $xy = 16$.

(a) Given that the line is a tangent to the curve, express m in terms of c . [3]

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(b) Given instead that $m = -4$, find the set of values of c for which the line intersects the curve at two distinct points. [3]

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8. 9709_s19_qp_13 Q: 1

The function f is defined by $f(x) = x^2 - 4x + 8$ for $x \in \mathbb{R}$.

- (i) Express $x^2 - 4x + 8$ in the form $(x - a)^2 + b$. [2]

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- (ii) Hence find the set of values of x for which $f(x) < 9$, giving your answer in exact form. [3]

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Chapter 2

Functions

Appendix A

Answers

1. 9709_s23_ms_12 Q: 4

Question	Answer	Marks	Guidance
	$[8x^6 + 215x^3 - 27 = 0]$ leading to $(8x^3 - 1)(x^3 + 27) = 0$ OR $\frac{-215 \pm \sqrt{215^2 - 4 \cdot 8 \cdot -27}}{2 \cdot 8}$ or $\frac{-215 \pm \sqrt{47089}}{2 \cdot 8}$	M1	OE If a substitution is used then the correct coefficients must be retained. Condone substitution of $x = x^3$.
	$\frac{1}{8}, -27$	A1	Both correct values seen. SC: if M0 scored SC B1 is available for sight of $\frac{1}{8}$ and -27 OE
	$\frac{1}{2}$ or $0.5, -3$	A1	SC: if M0SCB1 scored then SCB1 is available for the correct answers and no others. Do not ISW if answers given as a range.
		3	

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2. 9709_s22_ms_11 Q: 1

Question	Answer	Marks	Guidance
(a)	$x^2 - 8x + 11 = (x - 4)^2 \dots$ or $p = -4$	B1	If p and q -values given after <i>their</i> completed square expression, mark the expression and ISW.
	$\dots -5$ or $q = -5$	B1	
		2	
(b)	$(x - 4)^2 - 5 = 1$ so $(x - 4)^2 = 6$ so $x - 4 = [\pm]\sqrt{6}$	M1	Using <i>their</i> p and q values or by quadratic formula
	$x = 4 \pm \sqrt{6}$ or $\frac{8 \pm \sqrt{24}}{2}$	A1	Or exact equivalent. No FT; must have \pm for this mark. ISW decimals 1.55, 6.45 if exact answers seen. If M0, SC B1 possible for correct answers.
		2	

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3. 9709_w22_ms_11 Q: 1

Question	Answer	Marks	Guidance
	$(3x+2)(x-1)=2 \Rightarrow 3x^2-x-4 [=0]$	M1	OE Multiply by denominator and obtain a quadratic.
	$(3x-4)(x+1)[=0]$	M1	Solve by factorising, formula or completing the square.
	$[x =] -1, \frac{4}{3}$	A1	Allow 1.33 If M1 M0, SC B1 possible for two correct answers.
		3	

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4. 9709_m21_ms_12 Q: 2

Question	Answer	Marks	Guidance
	$u = 2x - 3$ leading to $u^4 - 3u^2 - 4 [=0]$	M1	Or $u = (2x-3)^2$ leading to $u^2 - 3u - 4 [=0]$
	$(u^2 - 4)(u^2 + 1) [=0]$	M1	Or $(u-4)(u+1) [=0]$
	$2x - 3 = [\pm]2$	A1	
	$x = \frac{1}{2}, \frac{5}{2}$ only	A1	
		4	

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5. 9709_s21_ms_11 Q: 6

Question	Answer	Marks	Guidance
	$(2k-3)x^2 - kx - (k-2) = 3x - 4$	*M1	Equating curve and line
	$(2k-3)x^2 - (k+3)x - (k-6) = 0$	DM1	Forming a 3-term quadratic
	$(k+3)^2 + 4(2k-3)(k-6) = 0$	DM1	Use of discriminant (dependent on both previous M marks)
	$9k^2 - 54k + 81 = 0$ [leading to $k^2 - 6k + 9 = 0$]	M1	Simplifying and solving <i>their</i> 3-term quadratic in k
	$k = 3$	A1	
Alternative method for Question 6			
	$(2k-3)x^2 - kx - (k-2) = 3x - 4$	*M1	Equating curve and line
	$2(2k-3)x - k = 3 \Rightarrow x = \frac{k+3}{4k-6}$ or $k = \frac{3+6x}{4x-1}$	DM1	Differentiating and solving for x or k
	Either $(2k-3)\left(\frac{k+3}{4k-6}\right)^2 - k\left(\frac{k+3}{4k-6}\right) - (k-2) = 3\left(\frac{k+3}{4k-6}\right) - 4$ Or $4x\left(\frac{3x^2+3x-6}{2x^2-x-1}\right) - 6x - \left(\frac{3x^2+3x-6}{2x^2-x-1}\right) = 3$	DM1	Substituting <i>their</i> x into equation or <i>their</i> $k = \frac{3x^2+3x-6}{2x^2-x-1}$ or $k = \frac{3x+6}{2x+1}$ into derivative equation (dependent on both previous M marks)
	$9k^2 - 54k + 81 = 0$ [leading to $k^2 - 6k + 9 = 0$]	M1	Simplifying and solving <i>their</i> 3-term quadratic in k (or solving for x)
	$k = 3$	A1	
			SC If M0, B1 for differentiating, equating to 3 and solving for x or k
		5	

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6. 9709_s21_ms_12 Q: 1

Question	Answer	Marks	Guidance
(a)	$(4x-3)^2$ or $(4x+(-3))^2$ or $a = -3$	B1	$k(4x-3)^2$ where $k \neq 1$ scores B0 but mark final answer, allow recovery.
	$+1$ or $b = 1$	B1	
		2	
(b)	[For one root] $k = 1$ or 'their b '	B1 FT	Either by inspection or solving or from $24^2 - 4 \times 16 \times (10-k) = 0$ WWW
	[Root or $x = \frac{3}{4}$ or 0.75	B1	SC B2 for correct final answer WWW.
		2	

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7. 9709_s20_ms_11 Q: 5

(a)	$x(mx + c) = 16 \rightarrow mx^2 + cx - 16 = 0$	B1
	Use of $b^2 - 4ac = c^2 + 64m$	M1
	Sets to 0 $\rightarrow m = \frac{-c^2}{64}$	A1
		3
(b)	$x(-4x + c) = 16$	M1
	Use of $b^2 - 4ac \rightarrow c^2 - 256$	
	$c > 16$ and $c < -16$	A1 A1
		3

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8. 9709_s19_ms_13 Q: 1

	Answer	Mark	Partial Marks
(i)	$[(x-2)^2] [+4]$	B1 DB1	2nd B1 dependent on 2 inside bracket
		2	
(ii)	$(x-2)^2 < 5 \rightarrow -\sqrt{5} < x-2$ and/or $x-2 < \sqrt{5}$	M1	Allow e.g. $x-2 < \pm\sqrt{5}$, $x-2 = \pm\sqrt{5}$ and decimal equivalents for $\sqrt{5}$ For M1, ft from <i>their</i> (i). Also allow $\sqrt{13}$ instead of $\sqrt{5}$ for clear slip
	$2 - \sqrt{5} < x < 2 + \sqrt{5}$	A1A1	A1 for each inequality – allow two separate statements but there must be 2 inequalities for x. Non-hence methods, if completely correct, score SC 1/3. Condone \leq
		[3]	

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9. 9709_s18_ms_13 Q: 1

	Answer	Mark	Partial Marks
	$[3] [(x-2)^2] [-5]$	B1B1B1	OR $a = 3, b = -2, c = -5$. 1st mark is dependent on the form $(x+a)^2$ following 3
		3	

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10. 9709_w18_ms_11 Q: 1

	Answer	Mark	Partial Marks
	$(4x^{3/2} - 3)(x^{3/2} - 2)$ oe soi Alt: $4x + 6 = 11\sqrt{x} \Rightarrow 16x^2 - 73x + 36$	M1	Attempt solution for $x^{3/2}$ or sub $u = x^{3/2}$
	$x^{3/2} = 3/4$ or 2 $(16x-9)(x-4)$	A1	Reasonable solutions for $x^{3/2}$ implies M1 ($x = 2, 3/4, M1A0$)
	$x = 9/16$ oe or 4	A1	Little or no working shown scores SCB3, spotting one solution, B0
		3	

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11. 9709_m17_ms_12 Q: 1

	Answer	Mark	Partial Marks
	$(3k)^2 - 4 \times 2 \times k$	M1	Attempt $b^2 - 4ac$
	$9k^2 - 8k > 0$ soi Allow $9k^2 - 8k \geq 0$	A1	Must involve correct inequality. Can be implied by correct answers
	0, 8/9 soi	A1	
	$k < 0, k > 8/9$ (or 0.889)	A1	Allow $(-\infty, 0), (8/9, \infty)$
	Total:	4	

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12. 9709_m24_ms_12 Q: 9

Question	Answer	Marks	Guidance
(a)	Attempt to form expression for $gf(x)$	*M1	Expect $5((3x-2)^2 + k) - 1$; $fg(x)$ is M0. Do not allow algebraic errors.
	Obtain $5(3x-2)^2 + 5k - 1$	A1	OE e.g. $45x^2 - 60x + 5k + 19$.
	Their $5k - 1 = 39$ or $5k - 1 \geq 39$	DM1	Or use $b^2 - 4ac = 0$ (must be '=' 0', could be implied later) on $45x^2 - 60x + 5k + 19 - 39 \geq 0$ OE.
	Obtain $k = 8$	A1	Do not accept $k \geq 8$.
		4	
(b)	Obtaining $(3(5x-1)-2)^2 + \text{their } k$	M1	May simplify and/or use k at this stage; k may have come from an inequality in (a).
	Conclude $[fg(x)] \geq 8$ allow $[y] \geq 8$	A1 FT	OE Following <i>their</i> value of k ; must be \geq , not $>$. Allow an accurate written description.
		2	
(c)	State $g^{-1}(x) = \frac{1}{5}(x+1)$	B1	OE $\frac{1}{5}(x+1)$ must be indicated as the inverse.
	$[h(x) =]7x+4$	B1B1	If $7x+4$ only, it must be clear that this is $h(x)$.
		3	

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