

CIE A LEVEL  
Topical Past Papers

# **PURE MATHEMATICS 3**

## **9709**

2017 — 2024

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# CHAPTER 1

Algebra

1 - (9709/31\_Summer\_2017\_Q1)

**ANSWER**Solve the inequality  $|2x + 1| < 3|x - 2|$ .

[4]

2 - (9709/31\_Summer\_2017\_Q2)

**ANSWER**Expand  $\frac{1}{\sqrt[3]{1+6x}}$  in ascending powers of  $x$ , up to and including the term in  $x^3$ , simplifying the coefficients.

[4]

3 - (9709/32\_Summer\_2017\_Q2)

**ANSWER**Solve the inequality  $|x - 3| < 3x - 4$ .

[4]

4 - (9709/32\_Summer\_2017\_Q8)

**ANSWER**Let  $f(x) = \frac{5x^2 - 7x + 4}{(3x + 2)(x^2 + 5)}$ .(i) Express  $f(x)$  in partial fractions.

[5]

(ii) Hence obtain the expansion of  $f(x)$  in ascending powers of  $x$ , up to and including the term in  $x^2$ .

[5]

5 - (9709/33\_Summer\_2017\_Q2)

**ANSWER**Expand  $(3 + 2x)^{-3}$  in ascending powers of  $x$  up to and including the term in  $x^2$ , simplifying the coefficients.

[4]

6 - (9709/31\_Winter\_2017\_Q1)

**ANSWER**Find the quotient and remainder when  $x^4$  is divided by  $x^2 + 2x - 1$ .

[3]

## 1 - (9709/31\_Summer\_2017\_Q1)



<b>EITHER:</b> State or imply non-modular inequality $(2x + 1)^2 < (3(x - 2))^2$ , or corresponding quadratic equation, or pair of linear equations $(2x + 1) = \pm 3(x - 2)$	
Make reasonable solution attempt at a 3-term quadratic e.g. $5x^2 - 40x + 35 = 0$ or solve two linear equations for $x$	
Obtain critical values $x = 1$ and $x = 7$	
State final answer $x < 1$ and $x > 7$	
<b>OR:</b> Obtain critical value $x = 7$ from a graphical method, or by inspection, or by solving a linear equation or inequality	
Obtain critical value $x = 1$ similarly	
State final answer $x < 1$ and $x > 7$	
<b>Total:</b>	<b>4</b>

## 2 - (9709/31\_Summer\_2017\_Q2)



<b>EITHER:</b> State a correct unsimplified version of the $x$ or $x^2$ or $x^3$ term in the expansion of $(1 + 6x)^{-\frac{1}{3}}$	
State correct first two terms $1 - 2x$	
Obtain term $8x^2$	
Obtain term $-\frac{112}{3}x^3$ $\left(37\frac{1}{3}x^3\right)$ in final answer	
<b>OR:</b> Differentiate expression and evaluate $f(0)$ and $f'(0)$ , where $f'(x) = k(1 + 6x)^{-\frac{4}{3}}$	
Obtain correct first two terms $1 - 2x$	
Obtain term $8x^2$	
Obtain term $-\frac{112}{3}x^3$ in final answer	
<b>Total:</b>	<b>4</b>

## 3 - (9709/32\_Summer\_2017\_Q2)



<i>EITHER:</i> State or imply non-modular inequality $(x-3)^2 < (3x-4)^2$ , or corresponding equation	
Make reasonable attempt at solving a three term quadratic	
Obtain critical value $x = \frac{7}{4}$	
State final answer $x > \frac{7}{4}$ only	
<i>OR1:</i> State the relevant critical inequality $3-x < 3x-4$ , or corresponding equation	
Solve for $x$	
Obtain critical value $x = \frac{7}{4}$	
State final answer $x > \frac{7}{4}$ only	
<i>OR2:</i> Make recognizable sketches of $y =  x-3 $ and $y = 3x-4$ on a single diagram	
Find $x$ -coordinate of the intersection	
Obtain $x = \frac{7}{4}$	
State final answer $x > \frac{7}{4}$ only	
<b>Total:</b>	<b>4</b>

## 4 - (9709/32\_Summer\_2017\_Q8)



(i)	State or imply the form $\frac{A}{3x+2} + \frac{Bx+C}{x^2+5}$	
	Use a relevant method to determine a constant	
	Obtain one of the values $A = 2, B = 1, C = -3$	
	Obtain a second value	
	Obtain the third value	
	<b>Total:</b>	<b>5</b>

(ii)	Use correct method to find the first two terms of the expansion of $(3x + 2)^{-1}$ , $(1 + \frac{3}{2}x)^{-1}$ , $(5 + x^2)^{-1}$ or $(1 + \frac{1}{5}x^2)^{-1}$ [Symbolic coefficients, e.g. $\binom{-1}{2}$ are not sufficient]	
	Obtain correct unsimplified expansions up to the term in $x^2$ of each partial fraction. The FT is on A, B, C. from part (i)	
	Multiply out up to the term in $x^2$ by $Bx + C$ , where $BC \neq 0$	
	Obtain <b>final answer</b> $\frac{2}{5} - \frac{13}{10}x + \frac{237}{100}x^2$ , or equivalent	
	<b>Total:</b>	<b>5</b>

## 5 - (9709/3. \_Summer\_2017\_Q2)



<p><i>EITHER:</i> State a correct unsimplified version of the <math>x</math> or <math>x^2</math> term in the expansion of <math>(1 + \frac{2}{3}x)^{-3}</math> or <math>(3 + 2x)^{-3}</math> [Symbolic binomial coefficients, e.g. <math>\binom{-3}{2}</math>, are not sufficient for <b>M1</b>.]</p>	
State correct first term $\frac{1}{27}$	
Obtain term $-\frac{2}{27}x$	
Obtain term $\frac{8}{81}x^2$	
<p><i>OR:</i> Differentiate expression and evaluate <math>f(0)</math> and <math>f'(0)</math>, where <math>f'(x) = k(3 + 2x)^{-4}</math></p>	
State correct first term $\frac{1}{27}$	
Obtain term $-\frac{2}{27}x$	
Obtain term $\frac{8}{81}x^2$	
<b>Total:</b>	<b>4</b>

## 6 - (9709/31\_Winter\_2017\_Q1)



Commence division and reach a partial quotient $x^2 + kx$	
Obtain quotient $x^2 - 2x + 5$	
Obtain remainder $-12x + 5$	
	<b>3</b>

## 7 - (9709/32\_Winter\_2017\_Q8)



(i)	State or imply the form $\frac{A}{1-x} + \frac{B}{2x+3} + \frac{C}{(2x+3)^2}$	
	Use a relevant method to determine a constant	
	Obtain one of the values $A = 1, B = -2, C = 5$	
	Obtain a second value	
	Obtain the third value	
		<b>5</b>
	[Mark the form $\frac{A}{1-x} + \frac{Dx+E}{(2x+3)^2}$ , where $A = 1, D = -4, E = -1$ , <b>B1M1A1A1A1</b> as above.]	
(ii)	Use a correct method to find the first two terms of the expansion of $(1-x)^{-1}$ , $(1+\frac{2}{3}x)^{-1}$ , $(2x+3)^{-1}$ , $(1+\frac{2}{3}x)^{-2}$ or $(2x+3)^{-2}$	
	Obtain correct unsimplified expansions up to the term in $x^2$ of each partial fraction	
	Obtain final answer $\frac{8}{9} + \frac{19}{27}x + \frac{13}{9}x^2$ , or equivalent	
		<b>5</b>