



National  
Qualifications

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**X8477611**

**Mathematics  
Paper 1 (Non-Calculator)**

## **Marking Instructions**

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Please note that these marking instructions have not been standardised based on candidate responses. You may therefore need to agree within your centre how to consistently mark an item if a candidate response is not covered by the marking instructions.

## Section 1

Question			Generic scheme	Illustrative scheme	Max mark
1.			<ul style="list-style-type: none"> <li>•<sup>1</sup> use the discriminant</li> <li>•<sup>2</sup> apply condition and simplify</li> <li>•<sup>3</sup> determine the value of <math>k</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>3^2 - 4 \times k \times (-4)</math></li> <li>•<sup>2</sup> <math>9 + 16k = 0</math> or <math>9 = -16k</math></li> <li>•<sup>3</sup> <math>-\frac{9}{16}</math></li> </ul>	3

Question		Generic scheme	Illustrative scheme	Max mark
2.		<ul style="list-style-type: none"> <li>•<sup>1</sup> start to differentiate</li> <li>•<sup>2</sup> complete differentiation</li> <li>•<sup>3</sup> evaluate</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>5(x^2 + 1)^4 \dots</math></li> <li>•<sup>2</sup> <math>\dots \times 2x</math></li> <li>•<sup>3</sup> 160</li> </ul>	3

Question		Generic scheme	Illustrative scheme	Max mark
3.		<p style="text-align: center;"><b>Method 1</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> equate composite function to <math>x</math></li> <li>•<sup>2</sup> write <math>f(f^{-1}(x))</math> in terms of <math>f^{-1}(x)</math></li> <li>•<sup>3</sup> state inverse function</li> </ul>	<p style="text-align: center;"><b>Method 1</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> <math>f(f^{-1}(x)) = x</math></li> <li>•<sup>2</sup> <math>\frac{f^{-1}(x) + 3}{2} = x</math></li> <li>•<sup>3</sup> <math>f^{-1}(x) = 2x - 3</math></li> </ul>	<b>3</b>
		<p style="text-align: center;"><b>Method 2</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> write as <math>y = f(x)</math> and start to rearrange</li> <li>•<sup>2</sup> express <math>x</math> in terms of <math>y</math></li> <li>•<sup>3</sup> state inverse function</li> </ul>	<p style="text-align: center;"><b>Method 2</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> <math>y = f(x) \Rightarrow x = f^{-1}(y)</math> <math>2y = x + 3</math></li> <li>•<sup>2</sup> <math>x = 2y - 3</math></li> <li>•<sup>3</sup> <math>f^{-1}(y) = 2y - 3</math> <math>\Rightarrow f^{-1}(x) = 2x - 3</math></li> </ul>	

Question		Generic scheme	Illustrative scheme	Max mark
4.		<ul style="list-style-type: none"> <li>•<sup>1</sup> find gradient of first line</li> <li>•<sup>2</sup> find gradient of second line</li> <li>•<sup>3</sup> interpret results and state conclusion</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>-\frac{3}{2}</math></li> <li>•<sup>2</sup> <math>\frac{2}{3}</math></li> <li>•<sup>3</sup> <math>-\frac{3}{2} \times \frac{2}{3} = -1 \Rightarrow</math> lines are perpendicular.</li> </ul>	3

Question			Generic scheme	Illustrative scheme	Max mark
5.	(a)	(i)	<ul style="list-style-type: none"> <li>•<sup>1</sup> calculate <math>\sin p</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{3}{\sqrt{10}}</math></li> </ul>	1
		(ii)	<ul style="list-style-type: none"> <li>•<sup>2</sup> calculate adjacent side</li> <li>•<sup>3</sup> calculate <math>\cos q</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>2</sup> <math>\sqrt{6}</math></li> <li>•<sup>3</sup> <math>\sqrt{\frac{3}{5}}</math> or <math>\frac{\sqrt{3}}{\sqrt{5}}</math></li> </ul>	2
	(b)		<ul style="list-style-type: none"> <li>•<sup>4</sup> use addition formula</li> <li>•<sup>5</sup> calculate remaining trig ratios and substitute into formula</li> <li>•<sup>6</sup> calculate <math>\cos(p+q)</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>4</sup> <math>\cos p \cos q - \sin p \sin q</math> stated or implied by •<sup>5</sup></li> <li>•<sup>5</sup> <math>\frac{1}{\sqrt{10}} \times \frac{\sqrt{6}}{\sqrt{10}} - \frac{3}{\sqrt{10}} \times \frac{2}{\sqrt{10}}</math></li> <li>•<sup>6</sup> <math>\frac{\sqrt{6}-6}{10}</math></li> </ul>	3

Question		Generic scheme	Illustrative scheme	Max mark
6.	(a)	<ul style="list-style-type: none"> <li>•<sup>1</sup> interpret notation</li> <li>•<sup>2</sup> state expression for <math>f(g(x))</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>f(x^2 - 2x)</math></li> <li>•<sup>2</sup> <math>2(x^2 - 2x) + 5</math></li> </ul>	2
	(b)	<ul style="list-style-type: none"> <li>•<sup>3</sup> state expression for <math>g(f(x))</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>3</sup> <math>(2x+5)^2 - 2(2x+5)</math></li> </ul>	1
	(c)	<ul style="list-style-type: none"> <li>•<sup>4</sup> express <math>g(f(x)) - f(g(x))</math> in standard quadratic form</li> <li>•<sup>5</sup> identify common factor</li> <li>•<sup>6</sup> complete the square</li> <li>•<sup>7</sup> process for <math>c</math> and write in required form</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>4</sup> <math>2x^2 + 20x + 10</math></li> <li>•<sup>5</sup> <math>2(x^2 + 10x \dots</math> stated or implied by •<sup>6</sup></li> <li>•<sup>6</sup> <math>2(x+5)^2 \dots</math></li> <li>•<sup>7</sup> <math>2(x+5)^2 - 40</math></li> </ul>	4

Question			Generic scheme	Illustrative scheme	Max mark
7.			<ul style="list-style-type: none"> <li>•<sup>1</sup> start to integrate</li> <li>•<sup>2</sup> complete integration</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>6 \sin\left(3x + \frac{\pi}{4}\right) \dots</math></li> <li>•<sup>2</sup> <math>\dots \times \frac{1}{3} + c</math></li> </ul>	2

Question		Generic scheme	Illustrative scheme	Max mark
8.		<ul style="list-style-type: none"> <li>•<sup>1</sup> use <math>m = \tan \theta</math></li> <li>•<sup>2</sup> evaluate exact value</li> <li>•<sup>3</sup> determine equation</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>m = \tan \frac{2\pi}{3}</math> stated or implied by •<sup>2</sup></li> <li>•<sup>2</sup> <math>-\sqrt{3}</math></li> <li>•<sup>3</sup> <math>y = -\sqrt{3}x + 4\sqrt{3}</math></li> </ul>	3

Question		Generic scheme	Illustrative scheme	Max mark
9.	(a)	<ul style="list-style-type: none"> <li>•<sup>1</sup> set <math>y = y</math> and arrange in standard form</li> <li>•<sup>2</sup> factorise and state <math>x</math>-coordinate of A</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>6x^2 - 18x = 0</math></li> <li>•<sup>2</sup> <math>x = 3</math></li> </ul>	2
	(b)	<ul style="list-style-type: none"> <li>•<sup>3</sup> know to integrate and interpret limits</li> <li>•<sup>4</sup> use 'upper – lower'</li> <li>•<sup>5</sup> integrate</li> <li>•<sup>6</sup> substitute limits</li> <li>•<sup>7</sup> evaluate</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>3</sup> <math>\int_0^3 \dots dx</math></li> <li>•<sup>4</sup> <math>\int_0^3 ((x^3 - 7x^2 + 12x + 3) - (x^3 - x^2 - 6x + 3)) dx</math></li> <li>•<sup>5</sup> <math>-\frac{6}{3}x^3 + \frac{18}{2}x^2</math></li> <li>•<sup>6</sup> <math>(-2 \times 3^3 + 9 \times 3^2) - 0</math></li> <li>•<sup>7</sup> 27 (units<sup>2</sup>)</li> </ul>	5

Question		Generic scheme	Illustrative scheme	Max mark
10.		<ul style="list-style-type: none"> <li>•<sup>1</sup> know to use (synthetic) division or substitution</li>   <li>•<sup>2</sup> complete process using a root</li>   <li>•<sup>3</sup> identify quadratic factor</li> <li>•<sup>4</sup> express in fully factorised form</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> eg <math display="block">\dots \begin{array}{r rrrr} 6 &amp; -13 &amp; 0 &amp; 4 \\ &amp; 6 &amp; &amp; \end{array}</math></li> <li>OR</li> <li><math display="block">6 \times (\dots)^3 - 13 \times (\dots)^2 + 4</math></li>   <li>•<sup>2</sup> eg <math display="block">2 \begin{array}{r rrrr} 6 &amp; -13 &amp; 0 &amp; 4 \\ &amp; 12 &amp; -2 &amp; -4 \\ \hline 6 &amp; -1 &amp; -2 &amp; 0 \end{array}</math></li> <li>OR</li> <li><math display="block">6 \times (2)^3 - 13 \times (2)^2 + 4 = 0</math></li>   <li>•<sup>3</sup> <math>6x^2 - x - 2</math></li> <li>•<sup>4</sup> <math>(x - 2)(3x - 2)(2x + 1)</math></li> </ul>	4

Question			Generic scheme	Illustrative scheme	Max mark
11.	(a)		• <sup>1</sup> state maximum value	• <sup>1</sup> 7	1
	(b)	(i)	• <sup>2</sup> state maximum value	• <sup>2</sup> 13	1
		(ii)	• <sup>3</sup> state value of $x$	• <sup>3</sup> 10	1

Section 2

Part A

Question			Generic scheme	Illustrative scheme	Max mark
12.	(a)	(i)	<ul style="list-style-type: none"> <li>•<sup>1</sup> identify components of <math>\overrightarrow{AB}</math></li> <li>•<sup>2</sup> find <math> \overrightarrow{AB} </math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> eg <math>\begin{pmatrix} 3 \\ -6 \\ 6 \end{pmatrix}</math> or <math>\sqrt{3^2 + (-6)^2 + 6^2}</math></li> <li>•<sup>2</sup> 9</li> </ul>	2
		(ii)	<ul style="list-style-type: none"> <li>•<sup>3</sup> state ratio</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>3</sup> 3:2</li> </ul>	1
	(b)		<ul style="list-style-type: none"> <li>•<sup>4</sup> determine coordinates</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>4</sup> (9, -8, 5)</li> </ul>	1

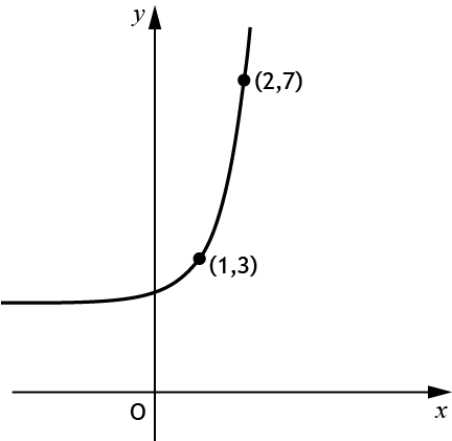
Question		Generic scheme	Illustrative scheme	Max mark
13.	(a)	<ul style="list-style-type: none"> <li>•<sup>1</sup> begin to find <math>u_6</math></li> <li>•<sup>2</sup> determine <math>u_5</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>20 = \frac{2}{3}u_6 + 8</math></li> <li>•<sup>2</sup> <math>u_5 = 15</math></li> </ul>	2
	(b)	<ul style="list-style-type: none"> <li>•<sup>3</sup> know how to find limit</li> <li>•<sup>4</sup> evaluate limit</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>3</sup> <math>L = \frac{2}{3}L + 8</math> or <math>L = \frac{8}{1 - \frac{2}{3}}</math></li> <li>•<sup>4</sup> 24</li> </ul>	2

Question		Generic scheme	Illustrative scheme	Max mark
14.		<ul style="list-style-type: none"> <li>•<sup>1</sup> expand</li> <li>•<sup>2</sup> calculate <math>u.u</math> or <math>u.v</math></li> <li>•<sup>3</sup> calculate <math>u.v</math> or <math>u.u</math> and complete calculation</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>u.u + u.v</math></li> <li>•<sup>2</sup> 16 or <math>-10</math></li> <li>•<sup>3</sup> <math>-10</math> or 16 leading to 6</li> </ul>	3

Part B

Question		Generic scheme	Illustrative scheme	Max mark
15.		<ul style="list-style-type: none"> <li>•<sup>1</sup> determine radius of circle</li> <li>•<sup>2</sup> find coordinates of P</li> <li>•<sup>3</sup> state equation of circle</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> 2 stated or implied by •<sup>3</sup></li> <li>•<sup>2</sup> (8,7) stated or implied by •<sup>3</sup></li> <li>•<sup>3</sup> <math>(x-8)^2 + (y-7)^2 = 4</math></li> </ul>	3

Question		Generic scheme	Illustrative scheme	Max mark
16.		<ul style="list-style-type: none"> <li>•<sup>1</sup> use laws of logarithms</li> <li>•<sup>2</sup> use laws of logarithms</li> <li>•<sup>3</sup> use laws of logarithms</li> <li>•<sup>4</sup> evaluate expression</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\log_2 3^2</math> stated or implied by •<sup>3</sup></li> <li>•<sup>2</sup> <math>\log_2 (12 \times 6)</math> stated or implied by •<sup>3</sup></li> <li>•<sup>3</sup> <math>\log_2 \frac{12 \times 6}{3^2}</math></li> <li>•<sup>4</sup> 3</li> </ul>	4

Question		Generic scheme	Illustrative scheme	Max mark
17.	(a)	<ul style="list-style-type: none"> <li>•<sup>1</sup> in first quadrant, graph reflected in <math>y = x</math> passing through <math>(1,3)</math> and <math>(2,7)</math></li> <li>•<sup>2</sup> in second quadrant, graph approaching <math>y = 2</math> from above</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup>, •<sup>2</sup></li> </ul> 	2
	(b)	<p style="text-align: center;"><b>Method 1</b></p> <ul style="list-style-type: none"> <li>•<sup>3</sup> interpret information and start to solve</li> <li>•<sup>4</sup> solve and state coordinates</li> </ul> <p style="text-align: center;"><b>Method 2</b></p> <ul style="list-style-type: none"> <li>•<sup>3</sup> determine <math>f^{-1}(x)</math></li> <li>•<sup>4</sup> evaluate <math>f^{-1}(0)</math> and state coordinates</li> </ul>	<p style="text-align: center;"><b>Method 1</b></p> <ul style="list-style-type: none"> <li>•<sup>3</sup> <math>\log_5(x-2)+1=0</math> leading to <math>\log_5(x-2)=-1</math></li> <li>•<sup>4</sup> <math>\left(0, \frac{11}{5}\right)</math></li> </ul> <p style="text-align: center;"><b>Method 2</b></p> <ul style="list-style-type: none"> <li>•<sup>3</sup> <math>5^{(x-1)}+2</math></li> <li>•<sup>4</sup> <math>\left(0, \frac{11}{5}\right)</math></li> </ul>	2

[END OF MARKING INSTRUCTIONS]