

Y1P1 XMQs and MS

(Total: 9 marks)

1. P1(AS)_2020 Q3 . 6 marks - Y1P1 Algebraic expressions
2. P1(AS)_2021 Q2 . 3 marks - Y1P1 Algebraic expressions

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3.

In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(i) Solve the equation

$$x\sqrt{2} - \sqrt{18} = x$$

writing the answer as a surd in simplest form.

(3)

(ii) Solve the equation

$$4^{3x-2} = \frac{1}{2\sqrt{2}}$$

(3)

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Question	Scheme	Marks	AOs
3 (i)	$x\sqrt{2} - \sqrt{18} = x \Rightarrow x(\sqrt{2} - 1) = \sqrt{18} \Rightarrow x = \frac{\sqrt{18}}{\sqrt{2} - 1}$	M1	1.1b
	$\Rightarrow x = \frac{\sqrt{18}}{\sqrt{2} - 1} \times \frac{\sqrt{2} + 1}{\sqrt{2} + 1}$	dM1	3.1a
	$x = \frac{\sqrt{18}(\sqrt{2} + 1)}{1} = 6 + 3\sqrt{2}$	A1	1.1b
		(3)	
(ii)	$4^{3x-2} = \frac{1}{2\sqrt{2}} \Rightarrow 2^{6x-4} = 2^{-\frac{3}{2}}$	M1	2.5
	$6x - 4 = -\frac{3}{2} \Rightarrow x = \dots$	dM1	1.1b
	$x = \frac{5}{12}$	A1	1.1b
		(3)	
(6 marks)			

Notes

(i)

M1: Combines the terms in x , factorises and divides to find x . Condone sign slips and ignore any attempts to simplify $\sqrt{18}$

Alternatively squares both sides $x\sqrt{2} - \sqrt{18} = x \Rightarrow 2x^2 - 12x + 18 = x^2$

dM1: Scored for a complete method to find x . In the main scheme it is for making x the subject and then multiplying both numerator and denominator by $\sqrt{2} + 1$
In the alternative it is for squaring both sides to produce a 3TQ and then factorising their quadratic equation to find x . (usual rules apply for solving quadratics)

A1: $x = 6 + 3\sqrt{2}$ only following a correct intermediate line. Allow $\frac{6 + 3\sqrt{2}}{1}$ as an intermediate line.

In the alternative method the $6 - 3\sqrt{2}$ must be discarded.

(ii)

M1: Uses correct mathematical notation and attempts to set both sides as powers of 2 or 4.

Eg $2^{ax+b} = 2^c$ or $4^{dx+e} = 4^f$ is sufficient for this mark.

Alternatively uses logs (base 2 or 4) to get a linear equation in x .

$$4^{3x-2} = \frac{1}{2\sqrt{2}} \Rightarrow \log_2 4^{3x-2} = \log_2 \frac{1}{2\sqrt{2}} \Rightarrow 2(3x-2) = \log_2 \frac{1}{2\sqrt{2}}$$

$$\text{Or } 4^{3x-2} = \frac{1}{2\sqrt{2}} \Rightarrow 3x-2 = \log_4 \frac{1}{2\sqrt{2}}$$

$$\text{Or } 4^{3x-2} = \frac{1}{2\sqrt{2}} \Rightarrow 4^{3x} = 4\sqrt{2} \Rightarrow 3x = \log_4 4\sqrt{2}$$

dM1: Scored for a complete method to find x .

Scored for setting the indices of 2 or 4 equal to each other and then solving to find x .

There must be an attempt on both sides.

You can condone slips for this mark Eg bracketing errors $4^{3x-2} = 2^{2 \times 3x-2}$ or $\frac{1}{2\sqrt{2}} = 2^{-1+\frac{1}{2}}$

In the alternative method candidates cannot just write down the answer to the rhs.

So expect some justification. E.g. $\log_2 \frac{1}{2\sqrt{2}} = \log_2 2^{-\frac{3}{2}} = -\frac{3}{2}$

or $\log_4 \frac{1}{2\sqrt{2}} = \log_4 2^{-\frac{3}{2}} = -\frac{3}{2} \times \frac{1}{2}$ condoning slips as per main scheme

or $3x = \log_4 4\sqrt{2} \Rightarrow 3x = 1 + \frac{1}{4}$

A1: $x = \frac{5}{12}$ with correct intermediate work

2.

In this question you should show all stages of your working.

Solutions relying on calculator technology are not acceptable.

Given

$$\frac{9^{x-1}}{3^{y+2}} = 81$$

express y in terms of x , writing your answer in simplest form.

(3)

DO NOT WRITE IN THIS AREA

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Question	Scheme	Marks	AOs
2	$\frac{9^{x-1}}{3^{y+2}} = 81 \Rightarrow \frac{3^{2x-2}}{3^{y+2}} = 3^4$ or $\frac{9^{x-1}}{3^{y+2}} = 81 \Rightarrow \frac{9^{x-1}}{9^{\frac{1}{2}(y+2)}} = 9^2$	M1	1.1b
	$\Rightarrow 2x - 2 - y - 2 = 4 \Rightarrow y =$ or $\Rightarrow x - 1 - \frac{1}{2}y - 1 = 2 \Rightarrow y =$	dM1	1.1b
	$\Rightarrow y = 2x - 8$	A1	1.1b
		(3)	
Alt	Eg. $\log_3 \left(\frac{9^{x-1}}{3^{y+2}} \right) = \log_3 81$	M1	1.1b
	$\Rightarrow (x-1)\log_3(9^{x-1}) - (y+2)\log_3(3^{y+2}) = 4$ $\Rightarrow 2(x-1) - y - 2 = 4 \Rightarrow y =$	dM1	1.1b
	$\Rightarrow y = 2x - 8$	A1	1.1b
(3 marks)			
Notes			
<p>M1: Attempts to set 9^{x-1} and 81 as powers of 3. Condone $9^{x-1} = 3^{2x-1}$ and $9^{x-1} = 3^{3x-3}$. Alternatively attempts to write each term as a logarithm of base 3 or 9. You must see the base written to award this mark.</p> <p>dM1: Attempts to use the addition (or subtraction) index law, or laws or logarithms, correctly and rearranges the equation to reach y in terms of x. Condone slips in their rearrangement.</p> <p>A1: $y = 2x - 8$</p>			