Further Pure Maths: Logarithms and Exponential Equations

EDEXCEL 4PM1 · Calculators not allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Write $\log_3(81) = 4$ in index form.

(Total for Question 1 is 1 mark)

---

2 Solve $\log_5(x-1) = 2 - \log_5(x+1)$. Check any candidate solutions in the original equation.

(Total for Question 2 is 4 marks)

---

3 Solve $\log_2(x-1) + \log_2(x+2) = 3$. Check all candidates in the original equation.

(Total for Question 3 is 6 marks)

© Revision Library | revisionlibrary.co.uk

4 Solve $\log_3(x-1) + \log_3(x+1) = 2$. Check all candidates in the original equation.

(Total for Question 4 is 6 marks)

---

5 Write $2^5 = 32$ in logarithmic form.

(Total for Question 5 is 1 mark)

---

6 Simplify $\log_5(25) + \log_5(5)$. Give one logarithm.

(Total for Question 6 is 2 marks)

---

7 Simplify $2\log_3(27) - \log_3(9)$. Give one logarithm.

(Total for Question 7 is 2 marks)

---

8 Solve $2^x = 64$ and $3^y = 1/27$.

(Total for Question 8 is 3 marks)

© Revision Library | revisionlibrary.co.uk

9 Solve $4^{x-1} = 8$. Give an exact value for x.

(Total for Question 9 is 3 marks)

---

10 Solve $\log_2(x) + \log_2(x-2) = 3$. Check any candidate solutions in the original equation.

(Total for Question 10 is 4 marks)

---

11 Solve $\log_3(x+1) = \log_3(5-x)$. Check that your solution is in the domain.

(Total for Question 11 is 4 marks)

---

12 Solve $\log_2(x-1) + \log_2(x+1) = 3$. Check any candidate solutions in the original equation.

(Total for Question 12 is 4 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · Further Pure Maths: Logarithms and Exponential Equations

Question 1

$3^4 = 81$ stated correctly; accept equivalent forms and valid alternative methods for the corresponding marks	**B1**

Answer: $3^4 = 81$

Question 2

States $x>1$ and rewrites 2 as $\log_5(25)$	**M1**
Combines to $\log_5((x-1)(x+1))=\log_5(25)$	**M1**
Solves $x^2-1=25$ to obtain $x=\sqrt{26}$ or $x=-\sqrt{26}$; also award when a valid method restricted to the domain finds only the admissible root	**A1**
Rejects the negative candidate by the domain and gives $x=\sqrt{26}$; accept equivalent forms and valid alternative methods for the corresponding marks; also award a domain argument excluding all other roots without generating inadmissible candidates	**A1**

Answer: $x = \sqrt{26}$

Question 3

States the domain $x>1$	**M1**
Combines the logarithms as $\log_2((x-1)(x+2))=3$	**M1**
Forms $x^2+x-2=8$, hence $x^2+x-10=0$	**M1**
Solves to obtain $x=(-1+\sqrt{41})/2$ or $x=(-1-\sqrt{41})/2$; also award when a valid method restricted to the domain finds only the admissible root	**M1**
Rejects $(-1-\sqrt{41})/2$ because it is less than 1; also award a domain argument excluding all other roots without generating inadmissible candidates	**A1**
Gives $x=(-1+\sqrt{41})/2$ and verifies both arguments are positive; accept equivalent forms and valid alternative methods for the corresponding marks	**A1**

Answer: $x = (-1+\sqrt{41})/2$

Question 4

States the domain $x>1$	**M1**
Combines the logarithms as $\log_3((x-1)(x+1))=2$	**M1**
Forms $x^2-1=9$, hence $x^2=10$	**M1**
Finds candidates $x=\sqrt{10}$ and $x=-\sqrt{10}$; also award when a valid method restricted to the domain finds only the admissible root	**M1**
Rejects $-\sqrt{10}$ because it is below 1; also award a domain argument excluding all other roots without generating inadmissible candidates	**A1**
Gives $x=\sqrt{10}$ and verifies both arguments are positive; accept equivalent forms and valid alternative methods for the corresponding marks	**A1**

Answer: $x = \sqrt{10}$

Question 5

$\log_2(32) = 5$ stated correctly; accept equivalent forms and valid alternative methods for the corresponding marks	**B1**

Answer: $\log_2(32) = 5$

Question 6

Uses the product law to combine as $\log_5(25*5)$	**M1**
$\log_5(125)$; accept equivalent forms and valid alternative methods for the corresponding marks	**A1**

Answer: $\log_5(125)$

Question 7

Uses power and quotient laws to obtain $\log_3(27^2/9)$	**M1**
$\log_3(81)$; accept equivalent forms and valid alternative methods for the corresponding marks	**A1**

Answer: $\log_3(81)$

Question 8

Uses powers or logarithms to determine both exponents ($64=2^6$ and $1/27=3^{-3}$)	**M1**
$x=6$	**A1**
$y=-3$; accept equivalent forms and valid alternative methods for the corresponding marks	**A1**

Answer: $x = 6, y = -3$

Question 9

Writes both sides as powers of 2: $2^{2x-2}=2^3$, or takes logarithms to obtain $(x-1)\log(4)=\log(8)$	**M1**
Equates exponents: $2x-2=3$, or rearranges to $x=1+\log(8)/\log(4)$	**M1**
$x=5/2$; accept equivalent forms and valid alternative methods for the corresponding marks	**A1**

Answer: $x = 5/2$

Question 10

States domain $x>2$ and combines to $\log_2(x(x-2))=3$	**M1**
Obtains $x^2-2x=8$	**M1**
Finds candidates $x=4$ and $x=-2$; also award when a valid method restricted to the domain finds only the admissible root	**A1**
Rejects -2 because log arguments are not positive; accepts $x=4$; accept equivalent forms and valid alternative methods for the corresponding marks; also award a domain argument excluding all other roots without generating inadmissible candidates	**A1**

Answer: $x = 4$

Question 11

States $-1<x<5$	**M1**
Uses equal logarithms with the same base to set $x+1=5-x$	**M1**
Solves to obtain $x=2$	**A1**
Checks 2 is in the domain and both arguments equal 3; accept equivalent forms and valid alternative methods for the corresponding marks	**A1**

Answer: $x = 2$

© Revision Library | revisionlibrary.co.uk

Question 12

States $x>1$ and combines to $\log_2((x-1)(x+1))=3$ **M1**

Obtains $x^2-1=8$ **M1**

Finds candidates $x=3$ and $x=-3$; also award when a valid method restricted to the domain finds only the admissible root **A1**

Rejects -3 because the log arguments are negative; accepts $x=3$; accept equivalent forms and valid alternative methods for the corresponding marks; also award a domain argument excluding all other roots without generating inadmissible candidates **A1**

Answer: x = 3

© Revision Library | revisionlibrary.co.uk