Solving Equations Using Logarithms

Specification: AQA 7357: F4, F5 · Edexcel 9MA0: 6.4, 6.5

INDEPENDENT

You do

A · $a^x = b$ and change of base

1 Solve, giving each answer to 3 s.f.:
(a) $2^x = 50$
(b) $6^x = 15$
(c) $0.8^x = 0.3$
(d) $10^x = 0.04$

2 Solve, giving each answer to 3 s.f.:
(a) $3^{2x} = 70$
(b) $5^{x-4} = 12$
(c) $2^{3x+1} = 100$
(d) $7^{1-2x} = 30$

3 Use the change of base formula to find, to 4 s.f.:
(a) $\log_3 17$
(b) $\log_5 0.7$
(c) $\log_{12} 1000$

B · x in two powers

4 Solve, to 4 d.p.:
(a) $3^x = 2^{x+2}$
(b) $6^{x-1} = 5^x$

5 Solve $5^{x+1} = 8^x$, giving an exact answer and the answer to 3 s.f.

C · Quadratics in disguise

Give exact answers, and decimals to 3 s.f.

6 Solve $2^{2x} - 9(2^x) + 8 = 0$.

7 Solve $3^{2x} - 4(3^x) - 5 = 0$, giving your answer exactly and to 3 s.f.

8 Solve $5^{2x} - 8(5^x) + 12 = 0$, giving your answers exactly and to 3 s.f.

9 Solve $2^{2x+1} - 7(2^x) + 3 = 0$, giving your answers exactly and to 3 s.f.

D · Reasoning

10 Explain why $4^x + 2^x + 1 = 0$ has no real solutions.

11 Show that the solution of $3^x = 5$ can be written as $\frac{\ln 5}{\ln 3}$ and as $\frac{\log 5}{\log 3}$. Why do both give the same answer?

12 Find the exact solution of $2^{3x-1} = 3$.

E · Exam-style question

AQA-style. Use the mark scheme to self-assess.

13 (a) Show that the equation $9^x - 3^{x+2} + 14 = 0$ can be written as $y^2 - 9y + 14 = 0$, where $y = 3^x$. [2 marks]
(b) Hence solve $9^x - 3^{x+2} + 14 = 0$. Give your answers in exact form and to 3 s.f. [4 marks]