

# Past-paper walk-through

## Logarithmic and exponential functions ■ 3.2

eXercise

## Questions in this set

- 9709/31 N25 Q2 ■ 5 marks
- 9709/31 J25 Q2 ■ 3 marks
- 9709/32 J25 Q1 ■ 5 marks

## Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

## Question 2

9709/31 N25 ■ Q2 ■ 5 marks

**(a)** Show that the equation  $\log_4(2x + 1) = 2\log_4(3x - 1) - 2$  can be written as a quadratic equation in  $x$ . **[3]**

**(b)** Hence solve the equation  $\log_4(2x + 1) = 2\log_4(3x - 1) - 2$ . **[2]**

## Solution 2

(a)

## Mark scheme

■  $2\log_4(3x-1) - 2 = \log_4 \frac{(3x-1)^2}{16}$ , so

$$2x+1 = \frac{(3x-1)^2}{16} \Rightarrow 16(2x+1) = (3x-1)^2 \Rightarrow 9x^2 - 38x - 15 = 0.$$

## Solution 2

(b)

## Mark scheme

- $9x^2 - 38x - 15 = 0 \Rightarrow x = \frac{19 \pm 4\sqrt{31}}{9}$ . Only  $x = \frac{19 + 4\sqrt{31}}{9} \approx 4.59$  is valid (need  $3x - 1 > 0$ ).

## Question 2

9709/31 J25 ■ Q2 ■ 3 marks

It is given that  $2 \ln p + \ln(p - 1) - \frac{1}{2} \ln(q + 1) = 3$ . Find  $q$  in terms of  $p$ . **[3]**

## Solution 2

## Mark scheme

$$\blacksquare \ln \frac{p^2(p-1)}{\sqrt{q+1}} = 3 \Rightarrow p^2(p-1) = e^3 \sqrt{q+1}, \text{ so } q = \left( \frac{p^2(p-1)}{e^3} \right)^2 - 1.$$

## Question 1

9709/32 J25 ■ Q1 ■ 5 marks

Solve the equation  $\frac{e^x + 2e^{-x}}{e^x - 3} = 4$ . Give your answer correct to 3 decimal places. **[5]**

## Solution 1

## Mark scheme

- Let  $u = e^x$ :  $3u^2 - 12u - 2 = 0 \Rightarrow u = \frac{12 + \sqrt{168}}{6} = 4.160$  (positive root).  
 $x = \ln 4.160 = 1.426$  (3 d.p.).