

Mixed practice 7

In this exercise, you must show detailed reasoning.

- 1 Solve $\log_5(\sqrt{x^2 + 49}) = 2$.
- 2 If $8^x = 16$, then x equals:
 a $\log_{16} 8$ b $\sqrt[8]{16}$ c $\frac{16}{8}$ d $\frac{4}{3}$
- 3 Given that $a = \log x$, $b = \log y$ and $c = \log z$ (with all logs being to the base 10), express the following in terms of a , b , c and integers:
 a $\log \frac{x^2 \sqrt{y}}{z}$ b $\log \sqrt{0.1x}$ c $\log_{100} \left(\frac{y}{z} \right)$
- 4 Solve the equation $3e^{2x+1} = 17$, giving your answer to three s.f.
- 5 Solve the equation $4 \log_a x = \log_a 81$.
- 6 Given that $\log_x 4 = 9$, find the value of x correct to 3 s.f.
- 7 If $\log_a y + \log_a 7 = 4$, express y in terms of a .
- 8 The curve $y = 3^{2x-1}$ intersects the line $y = 4$ at the point P . Find the exact value of the x -coordinate of P .
- 9 Solve the simultaneous equations:
 $\ln x + \ln y^2 = 8$
 $\ln x^2 + \ln y = 6$
- 10 Given that $4 \log_b x - \log_b 9 = 2$, express b in terms of x .
- 11 Given that $\log_5 y = 8$, find the value of $\log_5 (125y)$.
- 12 If $y = \ln x - \ln(x+2) + \ln(4-x^2)$, express x in terms of y .
- 13 Solve, correct to 3 s.f., $3^{2x} - 3^{x+1} - 10 = 0$.
- 14 Solve the equation $\log(x^2 + 1) = 1 + 2 \log x$.
- 15 Use logarithms to solve the equation $3^{2x+1} = 5^{200}$, giving the value of x correct to 3 significant figures.

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- 16 a Given that $\log_a x = p$ and $\log_a y = q$, express the following in terms of p and q .
 i $\log_a(xy)$ ii $\log_a \left(\frac{a^2 x^3}{y} \right)$
 b i Express $\log_{10}(x^2 - 10) - \log_{10} x$ as a single logarithm.
 ii Hence solve the equation $\log_{10}(x^2 - 10) - \log_{10} x = 2 \log_{10} 3$.

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- 17 Find the exact value of x satisfying the equation $2^{3x-2} \times 3^{2x-3} = 36^{x-1}$ giving your answer in simplified form $\frac{\ln p}{\ln q}$ where $p, q \in \mathbb{Z}$.
- 18 Solve the equation $5 \times 4^{x-1} = \frac{1}{3^{2x}}$ giving your answer in the form $x = \frac{\ln p}{\ln q}$ where p and q are rational numbers.
- 19 Find the exact solutions to $e^x + e^{-x} = 4$.
- 20 Find the value of x for which $(\log_3 x)^2 = \log_3 x^3 - 2$.

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1 $x = \pm 24$

2 D

3 a $2a + \frac{b}{2} - c$ b $\frac{a-1}{2}$ c $\frac{b-c}{2}$

4 $x = 0.367$

5 $x = 3$

6 $x = 1.17$

7 $y = \frac{a^4}{7}$

8 $x = \frac{\log_3 4 + 1}{2}$

9 $x = e^{\frac{4}{3}} = 3.79, y = e^{\frac{10}{3}} = 28.0$

10 $b = \frac{x^2}{3}$

11 11

12 $x = 1 \pm \sqrt{1 - e^y}$

13 $x = 1.46$

14 $x = \frac{1}{3}$

15 $x = 146$

16 a i $p + q$

ii $2 + 3p - q$

b i $\log_{10} \left(\frac{x^2 - 10}{x} \right)$

ii $x = 10$

17 $x = \frac{\ln 3}{\ln 2}$

Solution 2 is correct.

18 $x = \frac{\ln \left(\frac{4}{5} \right)}{\ln 36}$

19 $x = \ln(2 \pm \sqrt{3})$

20 $x = 3, 9$