

Dr Oliver Mathematics
Mathematics
Logarithms Part 1
Past Examination Questions

This booklet consists of 24 questions across a variety of examination topics.

The total number of marks available is 150.

Note: there are some problems (such those involving a geometric series) that have not been included here.

1. Find, giving your answer to 3 significant figures where appropriate, the value of x for which
 - (a) $3^x = 5$, (3)
 - (b) $\log_2(2x + 1) - \log_2 x = 2$. (4)
2. Solve
 - (a) $5^x = 8$, giving your answer to 3 significant figures, (3)
 - (b) $\log_2(x + 1) - \log_2 x = \log_2 7$. (3)
3. The first term of a geometric series is 120. The common ratio is $\frac{3}{4}$. The sum of the first n terms of the series is greater than 300. Calculate the smallest possible value of n .
4. (a) Write down the value of $\log_6 36$. (1)
(b) Express $2 \log_a 3 + \log_a 11$ as a single logarithm to base a . (3)
5. Solve the equation $5^x = 17$, giving your answer to 3 significant figures. (3)
6. (a) Find, to 3 significant figures, the value of x for which $8^x = 0.8$. (3)
(b) Solve the equation (3)
$$2 \log_3 x - \log_3 7x = 1.$$
7. Given that a and b are positive constants, solve the simultaneous equations (6)
$$a = 3b$$
$$\log_3 a + \log_3 b = 2.$$

Give your answers as exact numbers.

8. (a) Find, to 3 significant figures, the value of x for which $5^x = 7$. (2)
(b) Solve the equation $5^{2x} - 12(5^x) + 35 = 0$. (4)

9. Given that $0 < x < 4$ and $\log_5(4 - x) - 2 \log_5 x = 1$, (6)

find the value of x .

10. (a) Find the value of y such that $\log_2 y = -3$. (2)

(b) Find the value of x such that $\frac{\log_2 32 + \log_2 16}{\log_2 x} = \log_2 x$. (5)

11. (a) Find the positive value of x such that $\log_x 64 = 2$. (2)

(b) Solve for x $\log_2(11 - 6x) = 2 \log_2(x - 1) + 3$. (6)

12. (a) Given that $2 \log_3(x - 5) - \log_3(2x - 13) = 1$, (5)

show that $x^2 - 16x + 64 = 0$.

(b) Hence, or otherwise, solve $2 \log_3(x - 5) - \log_3(2x - 13) = 1$. (2)

13. (a) Sketch the graph of $y = 7^x$, $x \in \mathbb{R}$, showing the coordinates of any points at which the graph crosses the axis. (2)

(b) Solve the equation $7^{2x} - 4(7^x) + 3 = 0$, (6)

giving your answers to 2 decimal places where appropriate.

14. Find, giving your answer to 3 significant figures, the value of x for which (2)

(a) $5^x = 10$, (2)

(b) $\log_3(x - 2) = -1$. (2)

15. Given that $y = 3x^2$, (3)

(a) show that $\log_3 y = 1 + 2 \log_3 x$. (3)

(b) Hence, or otherwise, solve the equation $1 + 2 \log_3 x = \log_3(28x - 9)$. (3)

16. Find the values of x such that (5)

$$2 \log_3 x - \log_3(x - 2) = 2.$$

17. Given that

$$2 \log_2(x + 15) - \log_2 x = 6,$$

(a) show that $x^2 - 34x + 225 = 0$. (5)

(b) Hence, or otherwise, solve $2 \log_2(x + 15) - \log_2 x = 6$. (2)

18. (a) Find the exact value of x for which (4)

$$\log_2(2x) = \log_2(5x + 4) - 3.$$

(b) Given that (3)

$$\log_a y + 3 \log_a 2 = 5,$$

express y in terms of a . Give your answer in its simplest form.

19. Given that $\log_3 x = a$, find in terms of a , giving each answer in its simplest form,

(a) $\log_3(9x)$, (2)

(b) $\log_3\left(\frac{x^5}{81}\right)$. (3)

(c) Solve, for x , (4)

$$\log_3(9x) + \log_3\left(\frac{x^5}{81}\right) = 3,$$

giving your answer to 4 significant figures.

20. (a) Sketch the graph of $y = 3^x$, $x \in \mathbb{R}$, showing the coordinates of any points at which the graph crosses the axis. (2)

(b) Solve the equation (6)

$$3^{2x} - 9(3^x) + 18 = 0,$$

giving your answers to 2 decimal places where appropriate.

21. (a) Solve (2)

$$5^y = 8,$$

giving your answer to 3 significant figures.

(b) Use algebra to find the values for which (6)

$$\log_2(x + 15) - 4 = \frac{1}{2} \log_2 x.$$

22. (a) Use logarithms to solve the equation (3)

$$8^{2x+1} = 24,$$

giving your answer to 3 decimal places.

- (b) Find the values of y such that (5)

$$\log_2(11y - 3) - \log_2 3 - 2\log_2 y = 1, y > \frac{3}{11}.$$

23. (a) Given that (3)

$$\log_3(3b + 1) - \log_3(a - 2) = -1, a > 2,$$

express b in terms of a .

- (b) Solve the equation (4)

$$2^{2x+5} - 7(2^x) = 0,$$

giving your answer to 2 decimal places.

24.

$$2\log(x + a) = \log(16a^6), \text{ where } a \text{ is a positive constant.}$$

- (a) Find x in terms of a , giving your answer in its simplest form. (3)

$$\log_3(9y + b) - \log_3(2y - b) = 2, \text{ where } b \text{ is a positive constant.}$$

- (b) Find y in terms of b , giving your answer in its simplest form. (4)