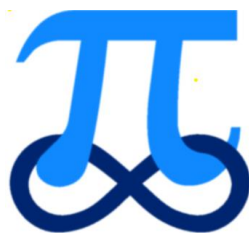# Edexcel

Pure Mathematics

Year 1

Logarithms

Past paper questions from C2 and IAL C12

Edited by: K V Kumaran

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)
   (Q3, C2 Jan 2005)

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)
   (Q2, C2 June 2005)

3. (i) Write down the value of $\log_6 36$.

   (1)

   (ii) Express $2\log_a 3 + \log_a 11$ as a single logarithm to base a.

   (3)
   (Q3, C2 May 2006)

4. Solve the equation $5^x = 17$, giving your answer to 3 significant figures.

   (3)

   (Q4, C2 Jan 2007)

5. (a) Find, to 3 significant figures, the value of x for which $8^x = 0.8$.

   (2)

   (b) Solve the equation

   $$2\log_3 x - \log_3 7x = 1.$$

   (4)

   (Q6, C2 May 2007)

6. Given that a and b are positive constants, solve the simultaneous equations

   $$a = 3b,$$

   $$\log_3 a + \log_3 b = 2.$$

   Give your answers as exact numbers.

   (6)
   (Q5, C2 Jan 2008)

7. (*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)

(Q4, C2 June 2008)

8. Given that $0 < x < 4$ and

$$\log_5 (4 - x) - 2 \log_5 x = 1,$$

find the value of x.

(6)

(Q4, C2 Jan 2009)

9. (*a*) Find the value of y such that

$$\log_2 y = -3.$$

(2)

(*b*) Find the values of x such that

$$\frac{\log_2 32 + \log_2 16}{\log_2 x} = \log_2 x.$$

(5)

(Q8, C2 June 2009)

10. (*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)

(Q5, C2 Jan 2010)

11. (*a*) Given that

$$2 \log_3 (x - 5) - \log_3 (2x - 13) = 1,$$

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

(5)

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

(2)

(Q7, C2 June 2010)

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

(2)

(*b*) Solve the equation

$$7^{2x} - 4(7^x) + 3 = 0,$$

giving your answers to 2 decimal places where appropriate.

(6)

(Q8, C2 Jan 2011)

13. Find, giving your answer to 3 significant figures where appropriate, the value of x for which

(a) $5^x = 10$,

(2)

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

(2)

14. Given that $y = 3x^2$,

(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)

15. Find the values of x such that

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

(5)

16. 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 the equation $2 \log_2 (x + 15) - \log_2 x = 6$.

(2)

17. (i) Find the exact value of x for which

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

(4)

(ii) Given that

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

express y in terms of a.

Give your answer in its simplest form.

(3)

18. Given that $\log_3 x = a$, find in terms of a,

(a) $\log_3 (9x)$

(2)

(b) $\log_3 \left(\dfrac{x^5}{81} \right)$

(3)

giving each answer in its simplest form.

(c) Solve, for x,

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

giving your answer to 4 significant figures.

(4)

(Q6, C2 May 2013_R)

19. (a) Sketch the graph of

$$y = 3^x, \ x \in \mathbb{R},$$

showing the coordinates of any points at which the graph crosses the axes.

(2)

(b) Use algebra to solve the equation $3^{2x} - 9(3^x) + 18 = 0$, giving your answers to 2 decimal places where appropriate.

(5)

(Q8, C2 May 2014)

20. (i) Solve

$$5^y = 8$$

giving your answers to 3 significant figures.

(2)

(ii) Use algebra to find the values of x for which

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

(6)

(Q8, C2 May 2014_R)

21. (i) Use logarithms to solve the equation $8^{2x+1} = 24$, giving your answer to 3 decimal places.

(3)

(ii) Find the values of y such that

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

(6)

(Q7, C2 May 2015)

22. (i) Given that

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

express b in terms of a.

(3)

(ii) Solve the equation

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

giving your answer to 2 decimal places.

(4)

(Q8, C2 May 2016)

23. (i) $2 \log(x + a) = \log(16a^6)$, where a is a positive constant

Find x in terms of a, giving your answer in its simplest form.

(3)

(ii) $\log_3(9y + b) - \log_3(2y - b) = 2$, where b is a positive constant

Find y in terms of b, giving your answer in its simplest form.

(4)

(Q7, C2 May 2017)

24. (i) Find the value of y for which

$$1.01^{y - 1} = 500$$

Give your answer to 2 decimal places.

(2)

(ii) Given that

$$2 \log_4 (3x + 5) = \log_4 (3x + 8) + 1, \qquad x > -\frac{5}{3}$$

(*a*) show that

$$9x^2 + 18x - 7 = 0$$

(4)

(*b*) Hence solve the equation

$$2 \log_4 (3x + 5) = \log_4 (3x + 8) + 1, \qquad x > -\frac{5}{3}$$

(2)

(Q7, C2 May 2018)

25. (i) Find the real value of x such that

$$\log_x 600 = 3$$

Give your answer to 2 decimal places.

(2)

(ii) Solve the equation

$$\log_9 (3x) + \log_9 \left(\frac{x^4}{81} \right) = 2$$

giving the exact answer in the form $x = 3^k$, where k is a rational number.

(5)

(Q8, C2 May 2019)

26. Given that a and b are positive constants, solve the simultaneous equations

$$ab = 25$$

$$\log_4 a - \log_4 b = 3$$

Show each step of your working, giving exact values for a and b.

(6)

(Q6, IAL C12 Jan 2014)

27. Solve, giving each answer to 3 significant figures, the equations

(*a*) $4^a = 20$

(2)

(*b*) $3 + 2\log_2 b = \log_2 (30b)$

(5)

(Q3, IAL C12 May 2014)

28. Given that

$$2\log_4(2x+3) = 1 + \log_4 x + \log_4(2x-1), \ \ x > \frac{1}{2}$$

(*a*) Show that

$$4x^2 - 16x - 9 + 0$$

(5)

(*b*) Hence solve the equation

$$2\log_4(2x+3) = 1 + \log_4 x + \log_4(2x-1), \ \ x > \frac{1}{2}$$

(2)

(Q6, IAL C12 Jan 2015)

29. (i) Find, giving your answer to 3 significant figures, the value of y for which

$$3^y = 12$$

(2)

(ii) Solve, giving an exact answer, the equation

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

(You should show each step in your working.)

(4)

(Q5, IAL C12 May 2015)

30. (i) Given that

$$\log_a x + \log_a 3 = \log_a 27 - 1, \text{ where } a \text{ is a positive constant}$$

find, in its simplest form, an expression for x in terms of a.

(4)

(ii) Solve the equation

$$(\log_5 y)^2 - 7(\log_5 y) + 12 = 0$$

showing each step of your working.

(4)

(Q14, IAL C12 Jan 2016)

31. (*a*) Show that the equation

$$2\log_2 y = 5 - \log_2 x \qquad x > 0, y > 0$$

may be written in the form $y^2 = \dfrac{k}{x}$ where k is a constant to be found.

(3)

(*b*) Hence, or otherwise, solve the simultaneous equations

$$2\log_2 y = 5 - \log_2 x$$

$$\log_x y = -3$$

for $x > 0, y > 0$

(5)

(Q13, IAL C12 May 2016)

32. Find, giving your answer to 3 significant figures where appropriate, the value of x for which

(*a*) $7^{2x} = 14$

(3)

(*b*) $\log_5(3x + 1) = -2$

(2)

(Q2, IAL C12 Oct 2016)

33. (*a*) Given that

$$y = \log_3 x$$

find expressions in terms of y for

(i) $\log_3 \left(\dfrac{x}{9} \right)$

(ii) $\log_3 \sqrt{x}$

Write each answer in its simplest form. **(3)**

(*b*) Hence or otherwise solve

$$2\log_3 \left(\dfrac{x}{9} \right) - \log_3 \sqrt{x} = 2$$

(4)

(Q5, IAL C12 Jan 2017)

34. (i) Find the exact value of x for which

$$2\log_{10}(x-2) - \log_{10}(x+5) = 0$$

(5)

(ii) Given

$$\log_p(4y+1) - \log_p(2y-2) = 1 \qquad p > 2, y > 1$$

express y in terms of p.

(5)

(Q9, IAL C12 May 2017)

35. (i) Use the laws of logarithms to solve the equation

$$3\log_8 2 + \log_8(7-x) = 2 + \log_8 x$$

(5)

(ii) Using algebra, find, in terms of logarithms, the exact value of y for which

$$3^{2y} + 3^{y+1} = 10$$

(5)

(Q10, IAL C12 Jan 2018)

36. Find the exact values of x for which

$$2\log_5(x+5) - \log_5(2x+2) = 2$$

Give your answers as simplified surds. **(7)**

(Q6, IAL C12 May 2018)

37. (i) Find the value of x for which

$$4^{3x+2} = 3^{600}$$

giving your answer to 4 significant figures.

(3)

(ii) Given that

$$\log_a(3b-2) - 2\log_a 5 = 4, \qquad a > 0, a \neq b > \frac{2}{3}$$

find an expression for b in terms of a. **(4)**

(Q13, IAL C12 Oct 2018)

38. (i) Given that x is a positive real number, solve the equation

$$\log_x 324 = 4$$

writing your answer as a simplified surd.

(3)

(ii) Given that

$$\log_a(5y-4) - \log_a(2y) = 3 \qquad y > 0.8, 0 < a < 1$$

express y in terms of a.

(5)

(Q11, IAL C12 Jan 2019)

39. Given that $p = \log_a 9$ and $q = \log a\ 10$, where a is a constant, find in terms of p and q,

(*a*) $\log a\ 900$

(3)

(*b*) $\log a\ 0.3$

(3)

(Q13, IAL C12 May 2017)

40. (i) Given that p is a positive constant and

$$\log_p 2x - \log_p 5 = 3 + \log_p 8$$

find, in its simplest form, an expression for x in terms of p.

(4)

(ii) Solve the equation

$$2\left(\log_2 y\right)^2 + 7\log_2 y - 15 = 0$$

Show each step in your working and write your answers as simplified surds where
appropriate.

(5)

(Q12, IAL C12 Oct 2019)