

Name: \_\_\_\_\_

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# Exponential and Log Equations

Date:

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Time:

Total marks available: 75

Total marks achieved: \_\_\_\_\_

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## Questions

**Q1.**

Given that

$$2\log_2(x + 15) - \log_2x = 6$$

(a) Show that

$$x^2 - 34x + 225 = 0$$

(5)

(b) Hence, or otherwise, solve the equation

$$2\log_2(x + 15) - \log_2x = 6$$

(2)

**(Total 7 marks)**

**Q2.**

(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)

**(Total 7 marks)**

**Q3.**

(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)

**(Total 8 marks)**

**Q4.**

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)

**(Total 6 marks)**

**Q5.**

$$f(x) = 2x^3 - 5x^2 + ax + 18$$

where  $a$  is a constant.

Given that  $(x - 3)$  is a factor of  $f(x)$ ,

(a) show that  $a = -9$

(2)

(b) factorise  $f(x)$  completely.

(4)

Given that

$$g(y) = 2(3^{3y}) - 5(3^{2y}) - 9(3^y) + 18$$

(c) find the values of  $y$  that satisfy  $g(y) = 0$ , giving your answers to 2 decimal places where appropriate.

(3)

**(Total 7 marks)**

**Q6.**

(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)

**(Total 7 marks)**

**Q7.**

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

(a)  $\log_3 (9x)$

(2)

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

(3)

giving each answer in its simplest form.

(c) Solve, for  $x$ ,

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

giving your answer to 4 significant figures.

(4)

**(Total 9 marks)**



**Q8.**

(a) Sketch the graph of

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

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)

**(Total 7 marks)**

**Q9.**

(i) Solve

$$5^y = 8$$

giving your answer 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)

**(Total 8 marks)**

**Q10.**

(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

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

(6)

**(Total for question = 9 marks)**