

## Year 10 Term 3 Homework

<b>Student Name:</b> _____	<b>Grade:</b> _____
<b>Date:</b> _____	<b>Score:</b> _____

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## 8 Year 10 Term 3 Week 8 Homework

### 8.1 Functions and Logarithms

#### 8.1.1 The Logarithm Law

- $\log_a xy = \log_a x + \log_a y$  ;
- $\log_a \left(\frac{x}{y}\right) = \log_a x - \log_a y$  ;
- $\log_a x^n = n \log_a x$  ;
- $\log_a 1 = 0$  ;  $\log_a a = 1$  ;  $\log_a a^x = x$  ;

#### Exercise 8.1.1

1. Simplify each of the following:

(a)  $2 \log x - 3 \log y + 4 \log z$  \_\_\_\_\_

(b)  $\frac{1}{2} \log a + \frac{1}{2} \log b - 2 \log c$  \_\_\_\_\_

(c)  $2 \log x + \log \frac{1}{x} - 2 \log y$  \_\_\_\_\_

2. Expand the following:

(a)  $\log \left(\frac{x^2 y}{z}\right)$  \_\_\_\_\_

(b)  $\log \left(\frac{x^2 \sqrt{y}}{\sqrt[3]{z^2}}\right)$  \_\_\_\_\_

(c)  $\log (\sqrt[3]{p^2 q})$  \_\_\_\_\_

3. Simplify the following:

(a)  $\frac{\log x^5}{\log x^2}$  \_\_\_\_\_

(b)  $\frac{\log \sqrt[3]{x^2}}{\log x}$  \_\_\_\_\_

(c)  $\frac{2 \log x^3}{3 \log \sqrt{x}}$  \_\_\_\_\_

4. Solve  $\log (x - 6) - \log 2 = \log (x + 2) - \log 3$

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**Exercise 8.1.2 Solve for x:**

1.  $\log x + \log(x - 3) = \log(7x - 25)$

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2.  $\log x - \log(x - 3) = \log 12 - \log(x - 1)$

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3.  $2 \log x = \log 2 + \log(x + 4)$

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4.  $\log x = \log 10 - \log(x - 3)$

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5.  $\log_5(3x + 13) - \log_5(x - 1) = 1$

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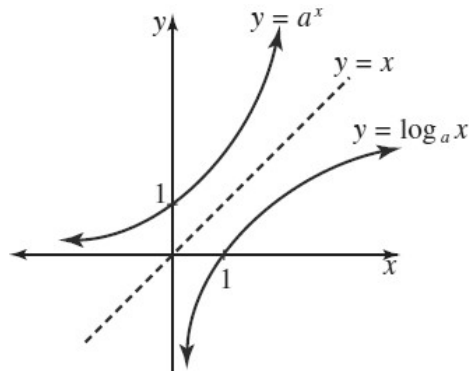
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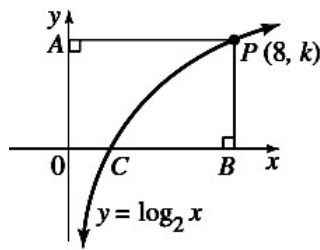
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**8.1.2 The Logarithmic graph**

Since  $y = a^x$  and  $y = \log_a x$  are inverses of each other, the inverse of a function can be drawn by reflecting the graph of the original function in the line  $y = x$  as show below:



**Exercise 8.1.3** The graph of  $y = \log_2 x$  is shown below:



1. Find the value of  $k$ .

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2. Find the co-ordinates of  $A$ ,  $B$  and  $C$ .

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3. Find the length of  $AC$ , in surd form.

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**8.1.3 Further exponential equations**

To solve an equation of the form  $a^x = b$  where  $b$  is not a power of  $a$ :

- take the logarithm to base 10 of both sides
- rewrite the LHS in the form  $x \log_{10} a$
- divide both sides by  $\log_{10} a$ .

**Example 8.1.1** Solve  $5^{x-1} = 3^{x+1}$ , correct to 3 decimal places.

**Solution:**

$$5^{x-1} = 3^{x+1}$$

$$\log_{10} 5^{x-1} = \log_{10} 3^{x+1}$$

$$(x-1) \log_{10} 5 = (x+1) \log_{10} 3$$

$$x \log_{10} 5 - \log_{10} 5 = x \log_{10} 3 + \log_{10} 3$$

$$x \log_{10} 5 - x \log_{10} 3 = \log_{10} 5 + \log_{10} 3$$

$$x = \frac{\log_{10} 5 + \log_{10} 3}{\log_{10} 5 - \log_{10} 3} = 5.301$$

**Exercise 8.1.4** Solve the following equations correct to 3 decimal spaces:

1.  $6^x = 41$

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2.  $2^x = 50$

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3.  $2^{2x} = 12$

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4.  $3^{2x-1} = 25$

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**Exercise 8.1.5 Solve the following equations correct to 3 decimal spaces:**

1.  $3^{x-1} = 35$

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2.  $3^{x+1} = 2^{x-1}$

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3.  $5^{2x} = 7^{x+2}$

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

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5.  $3^{2x+1} = 5^{3x-1}$

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**8.2 Miscellaneous exercise****Exercise 8.2.1**

1. Solve  $25^{3x} = 125^{x-3}$

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2. Solve  $3^{x-1} = 8^x$ .

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3. Solve  $0.5^x > 3$ , correct to 3 decimal places.

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4. Solve  $\log_2(2x + 6) - \log_2(x - 3) = 3$

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5.  $\log_a(2x - 4) - \log_a(x - 2) = \log_a 8$

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### 8.3 Maths challenge

#### Exercise 8.3.1

1. Given that  $a^2 + b^2 = 7ab$ , prove that  $\log_x \frac{a+b}{3} = \frac{1}{2} (\log_x a + \log_x b)$

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2. A number  $A$  which is divisible by 9 has 200 digits. The sum of all its digits is  $a$ , the sum of all digits of  $a$  is  $b$  and the sum of all digits of  $b$  is  $c$ . Find the value of  $c$ .

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3. If  $\frac{a-b}{a+b} = \frac{3}{5}$ , find the value of  $\frac{a^3}{b^3}$ .

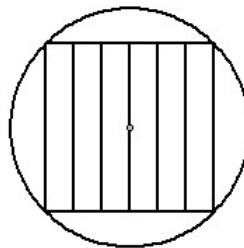
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4. The figure shown below is a square circumscribed by a circle. If this square is divided into six equal rectangles and each rectangle has perimeter 28 cm, find the area of the circle in terms of  $\pi$ .



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