

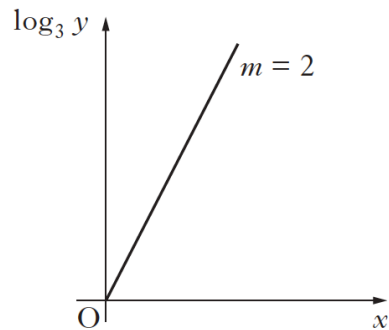
## Higher Mathematics

### Exponential & Logarithm - Questions - 2013-2017

Marks are indicated in brackets after each question number

#### 2013 Paper 1 Question 20, (2)

The graph of  $\log_3 y$  plotted against  $x$  is a line through the origin with gradient 2, as shown.



Express  $y$  in terms of  $x$ .

#### 2013 Paper 2 Question 5, (4)

Solve the equation

$$\log_5(3-2x) + \log_5(2+x) = 1, \text{ where } x \text{ is a real number.}$$

**2013 Paper 2 Question 9, (4) (3)**

The concentration of the pesticide,  $X_{pesto}$ , in soil can be modelled by the equation

$$P_t = P_0 e^{-kt}$$

where:

- $P_0$  is the initial concentration;
- $P_t$  is the concentration at time  $t$ ;
- $t$  is the time, in days, after the application of the pesticide.

(a) Once in the soil, the half-life of a pesticide is the time taken for its concentration to be reduced to one half of its initial value.

If the half-life of  $X_{pesto}$  is 25 days, find the value of  $k$  to 2 significant figures.

(b) Eighty days after the initial application, what is the percentage decrease in concentration of  $X_{pesto}$ ?

**2014 Paper 1 Question 3, (2)**

If  $\log_4 12 - \log_4 x = \log_4 6$ , what is the value of  $x$ ?

**2014 Paper 1 Question 20, (2)**

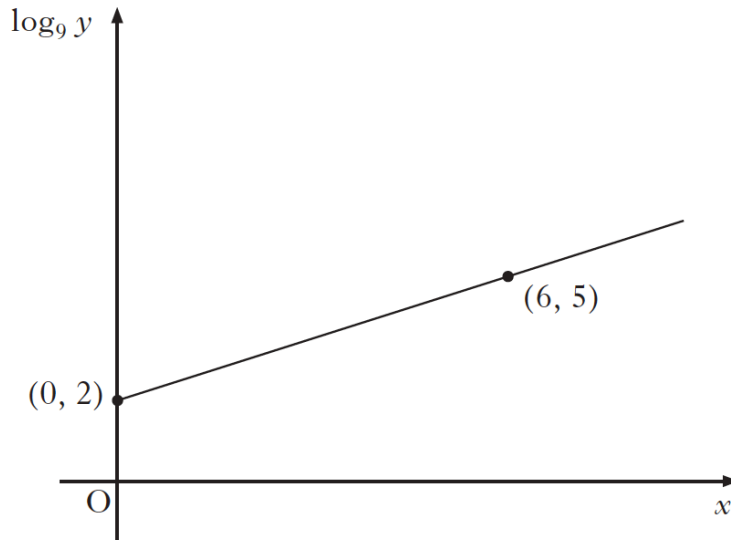
Evaluate  $2 - \log_5 \frac{1}{25}$ .

2014 Paper 1 Question 24, (5)

Two variables,  $x$  and  $y$ , are related by the equation

$$y = ka^x.$$

When  $\log_9 y$  is plotted against  $x$ , a straight line passing through the points  $(0, 2)$  and  $(6, 5)$  is obtained, as shown in the diagram.



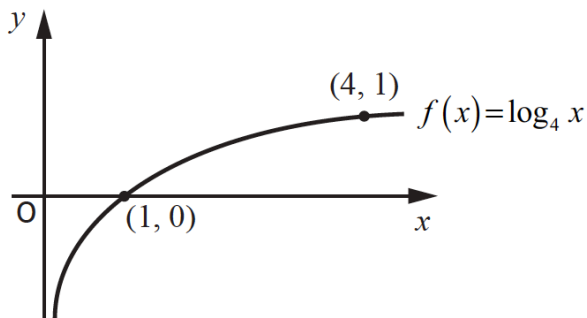
Find the values of  $k$  and  $a$ .

2015 Paper 1 Question 6, (3)

Evaluate  $\log_6 12 + \frac{1}{3} \log_6 27$ .

2016 Paper 1 Question 10, (2)

The diagram below shows the graph of the function  $f(x) = \log_4 x$ , where  $x > 0$ .



The inverse function,  $f^{-1}$ , exists.

On the diagram in your answer booklet, sketch the graph of the inverse function.

2016 Paper 1 Question 14, (1) (5)

(a) Evaluate  $\log_5 25$ .

(b) Hence solve  $\log_4 x + \log_4 (x - 6) = \log_5 25$ , where  $x > 6$ .

2016 Paper 2 Question 6, (1) (4)

Scientists are studying the growth of a strain of bacteria. The number of bacteria present is given by the formula

$$B(t) = 200e^{0.107t},$$

where  $t$  represents the number of hours since the study began.

(a) State the number of bacteria present at the start of the study.

(b) Calculate the time taken for the number of bacteria to double.

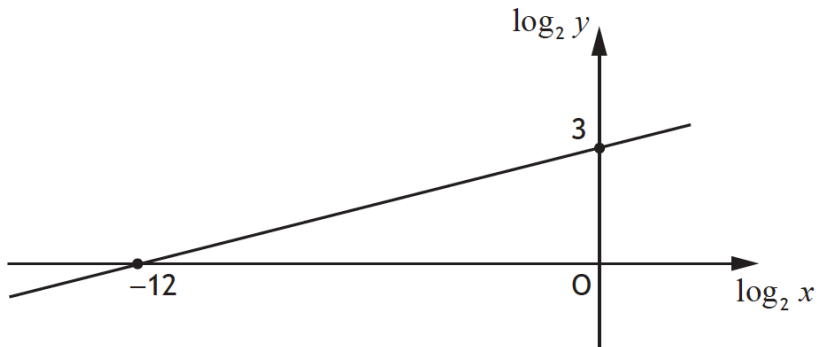
2017 Paper 1 Question 12, (3)

Given that  $\log_a 36 - \log_a 4 = \frac{1}{2}$ , find the value of  $a$ .

2017 Paper 2 Question 9, (5)

Two variables,  $x$  and  $y$ , are connected by the equation  $y = kx^n$ .

The graph of  $\log_2 y$  against  $\log_2 x$  is a straight line as shown.



Find the values of  $k$  and  $n$ .