FP1: Linear Laws

Past Paper Questions
2006 - 2013

Name:

6 [**Figure 1** and **Figure 2**, printed on the insert, are provided for use in this question.]

The variables x and y are known to be related by an equation of the form

$$y = kx^n$$

where k and n are constants.

Experimental evidence has provided the following approximate values:

x	4	17	150	300
y	1.8	5.0	30	50

(a) Complete the table in **Figure 1**, showing values of X and Y, where

$$X = \log_{10} x \quad \text{and} \quad Y = \log_{10} y$$

Give each value to two decimal places. *(3 marks)*

(b) Show that if $y = kx^n$, then X and Y must satisfy an equation of the form

$$Y = aX + b$$ *(3 marks)*

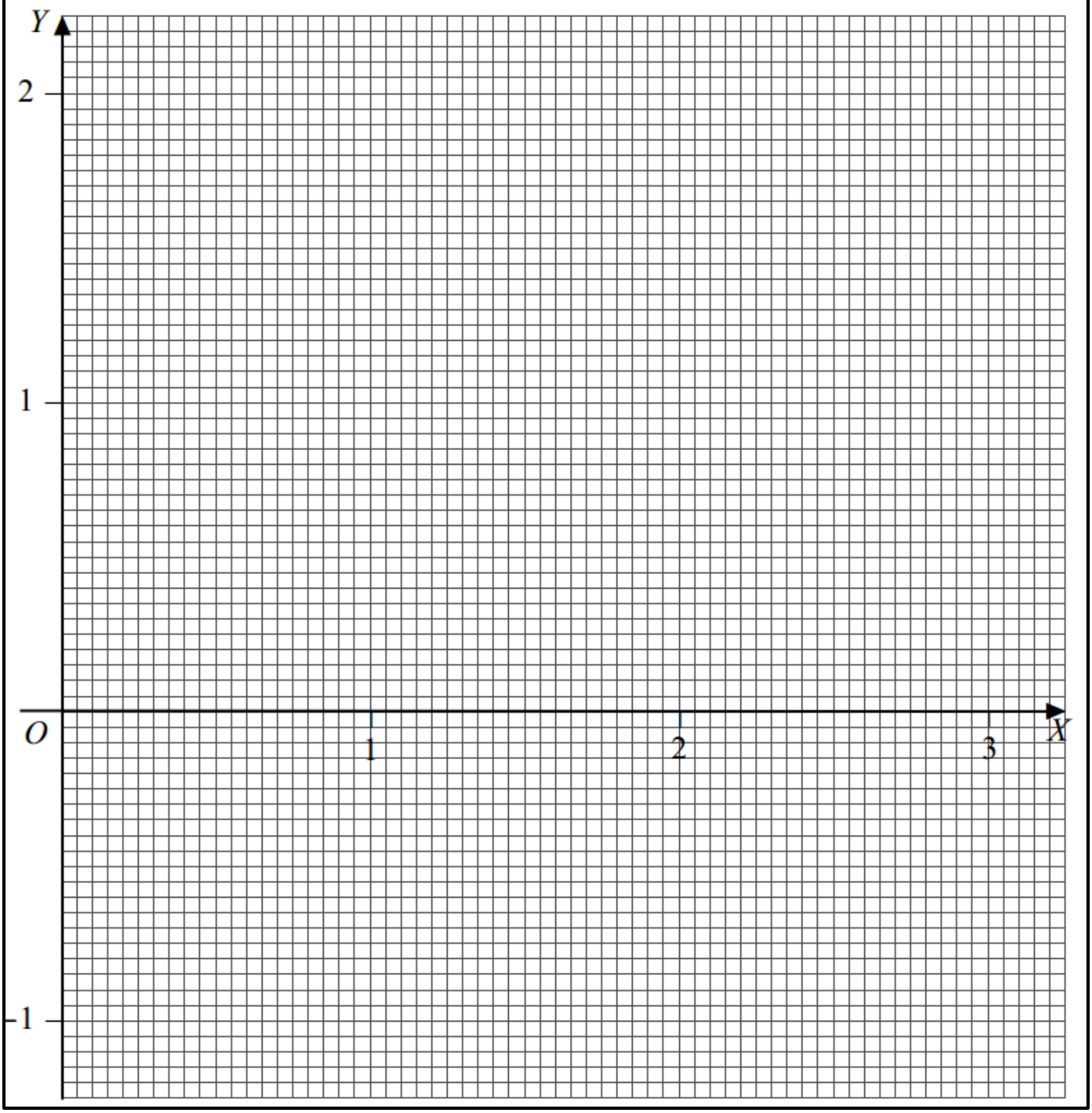
(c) Draw on **Figure 2** a linear graph relating X and Y. *(3 marks)*

(d) Find an estimate for the value of n. *(2 marks)*

Figure 1 (for use in Question 6)

X	0.60			2.48
Y	0.26			1.70

Figure 2 (for use in Question 6)



January 2007

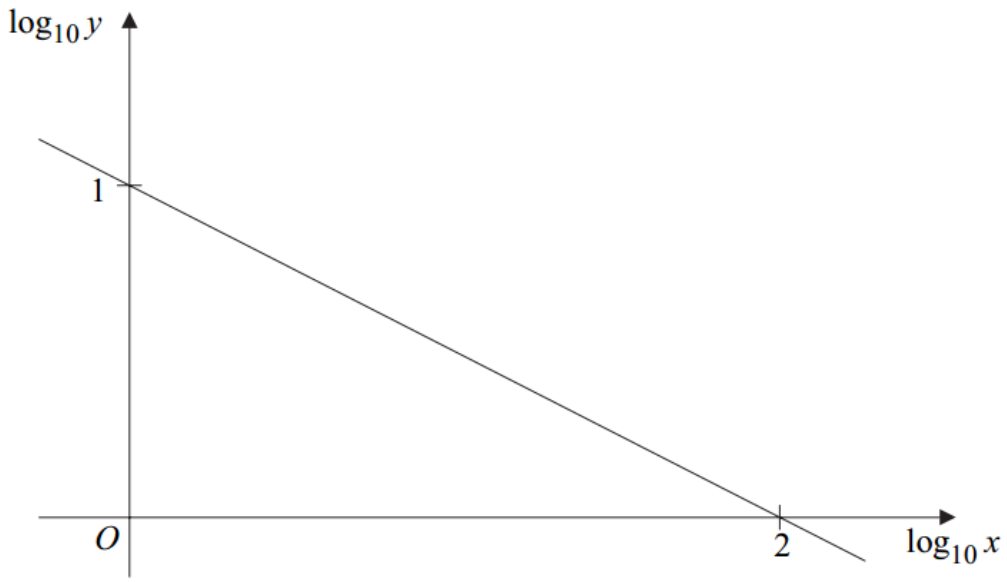
4 The variables x and y are related by an equation of the form

$$y = ax^b$$

where a and b are constants.

(a) Using logarithms to base 10, reduce the relation $y = ax^b$ to a linear law connecting $\log_{10} x$ and $\log_{10} y$. *(2 marks)*

(b) The diagram shows the linear graph that results from plotting $\log_{10} y$ against $\log_{10} x$.



Find the values of a and b. *(4 marks)*

June 2007

5 [**Figure 1** and **Figure 2**, printed on the insert, are provided for use in this question.]

The variables x and y are known to be related by an equation of the form

$$y = ab^x$$

where a and b are constants.

The following approximate values of x and y have been found.

x	1	2	3	4
y	3.84	6.14	9.82	15.7

(a) Complete the table in **Figure 1**, showing values of x and Y, where $Y = \log_{10} y$. Give each value of Y to three decimal places. *(2 marks)*

(b) Show that, if $y = ab^x$, then x and Y must satisfy an equation of the form

$$Y = mx + c$$ *(3 marks)*

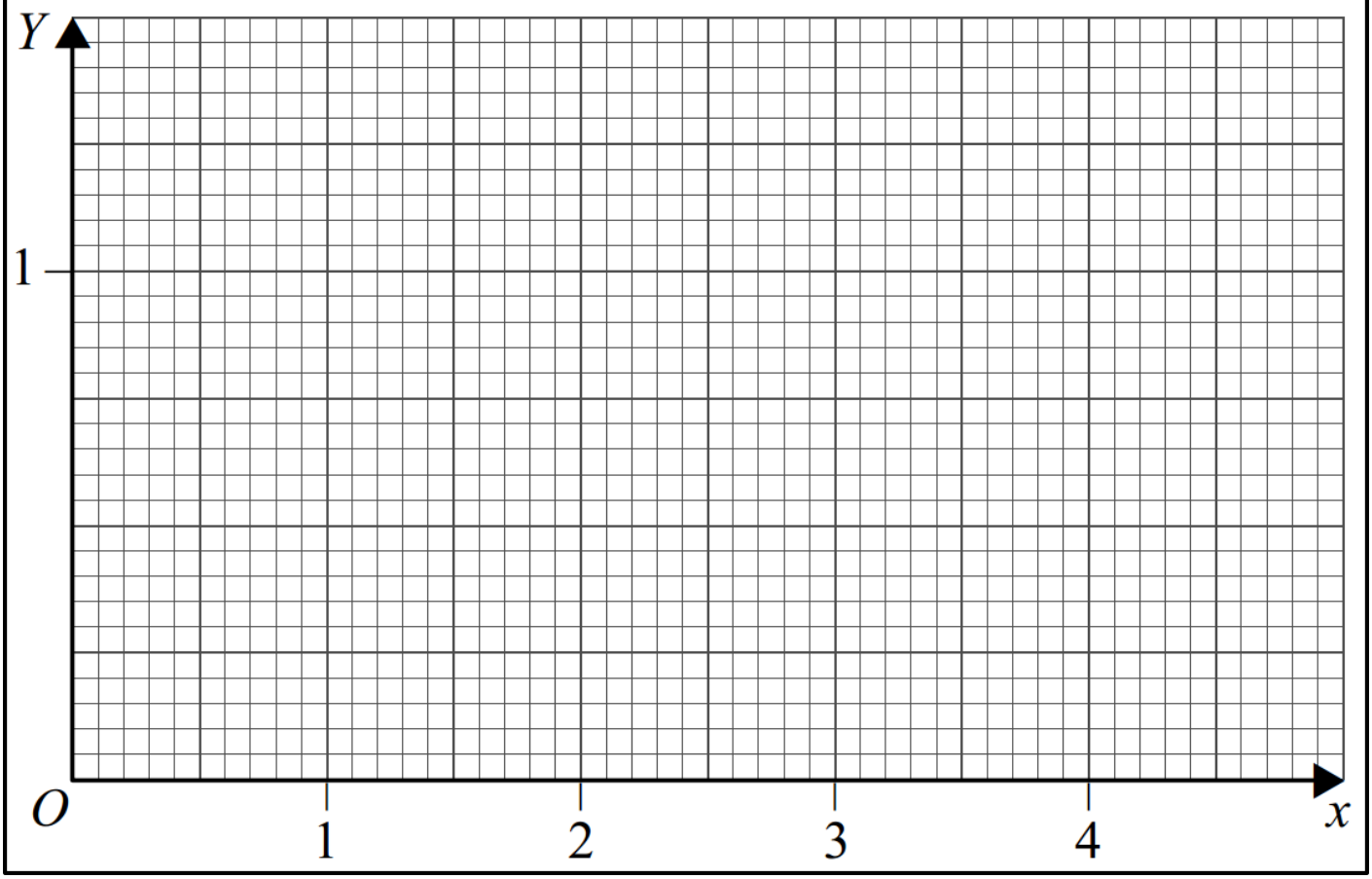
(c) Draw on **Figure 2** a linear graph relating x and Y. *(2 marks)*

(d) Hence find estimates for the values of a and b. *(4 marks)*

Figure 1 (for use in Question 5)

x	1	2	3	4
Y	0.584			

Figure 2 (for use in Question 5)



4 [**Figure 1** and **Figure 2**, printed on the insert, are provided for use in this question.]

The variables x and y are related by an equation of the form

$$y = ax + \frac{b}{x+2}$$

where a and b are constants.

(a) The variables X and Y are defined by $X = x(x+2)$, $Y = y(x+2)$.

Show that $Y = aX + b$. *(2 marks)*

(b) The following approximate values of x and y have been found:

x	1	2	3	4
y	0.40	1.43	2.40	3.35

(i) Complete the table in **Figure 1**, showing values of X and Y. *(2 marks)*

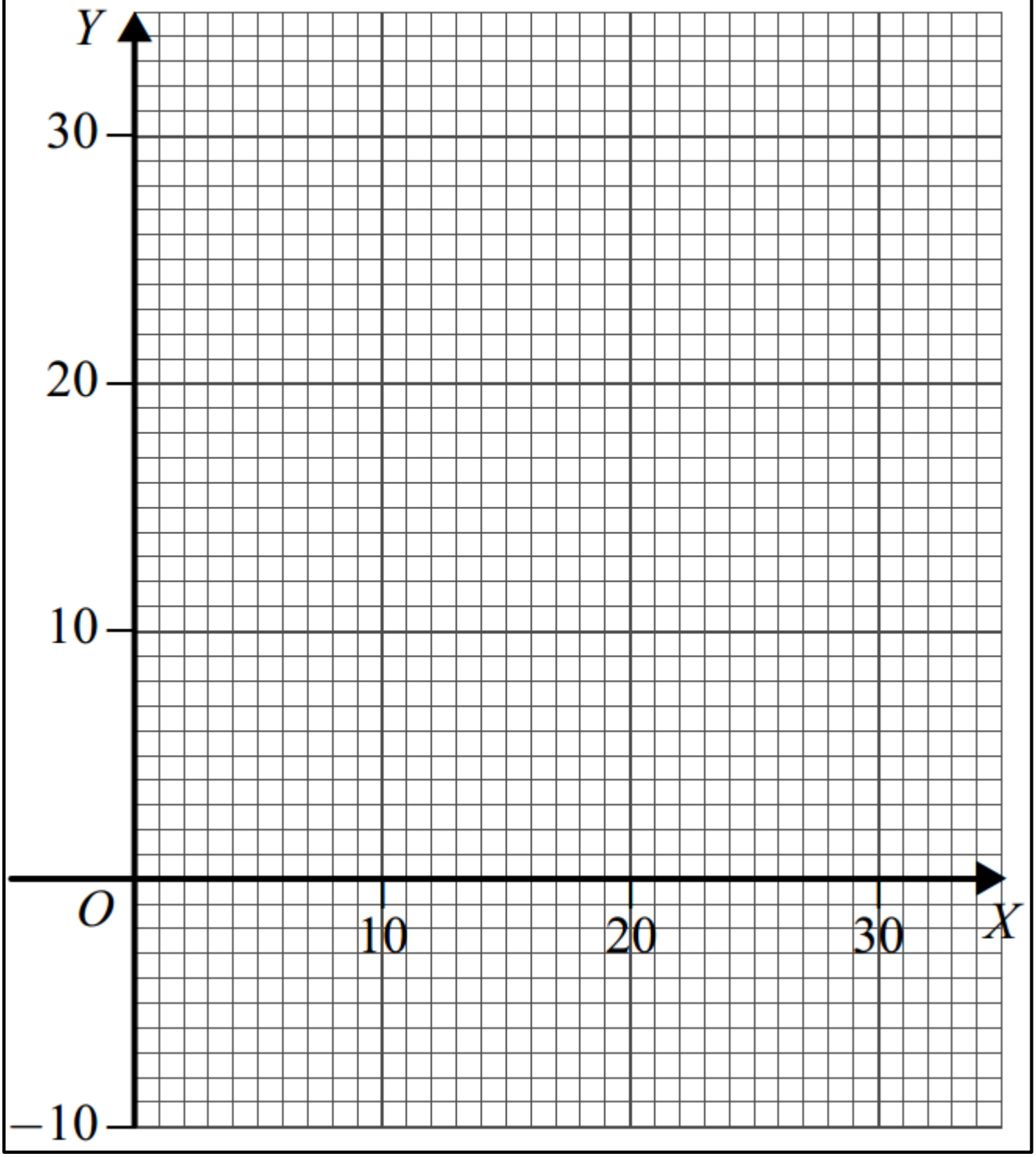
(ii) Draw on **Figure 2** a linear graph relating X and Y. *(2 marks)*

(iii) Estimate the values of a and b. *(3 marks)*

Figure 1 (for use in Question 4)

x	1	2	3	4
y	0.40	1.43	2.40	3.35
X	3			
Y	1.20			

Figure 2 (for use in Question 4)



4 The variables x and y are known to be related by an equation of the form

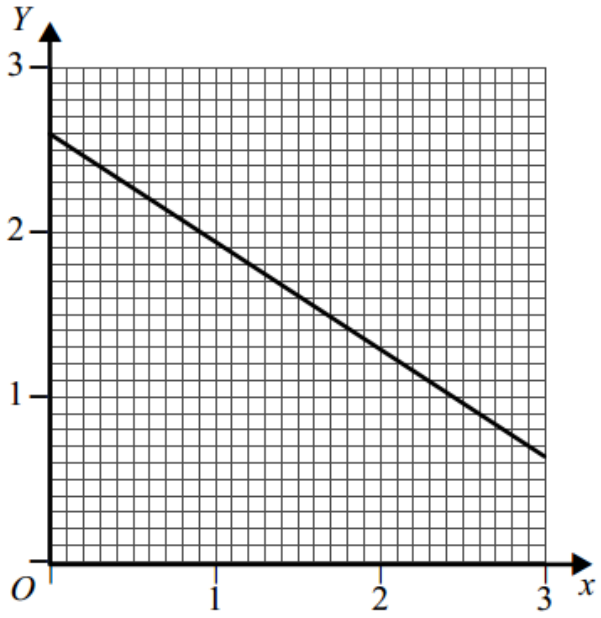
$$y = ab^x$$

where a and b are constants.

(a) Given that $Y = \log_{10} y$, show that x and Y must satisfy an equation of the form

$$Y = mx + c$$ *(3 marks)*

(b) The diagram shows the linear graph which has equation $Y = mx + c$.



Use this graph to calculate:

(i) an approximate value of y when $x = 2.3$, giving your answer to one decimal place;

(ii) an approximate value of x when $y = 80$, giving your answer to one decimal place.

(You are not required to find the values of m and c.) *(4 marks)*

4 The variables x and y are related by an equation of the form

$$y = ax^2 + b$$

where a and b are constants.

The following approximate values of x and y have been found.

x	2	4	6	8
y	6.0	10.5	18.0	28.2

(a) Complete the table below, showing values of X, where $X = x^2$. *(1 mark)*

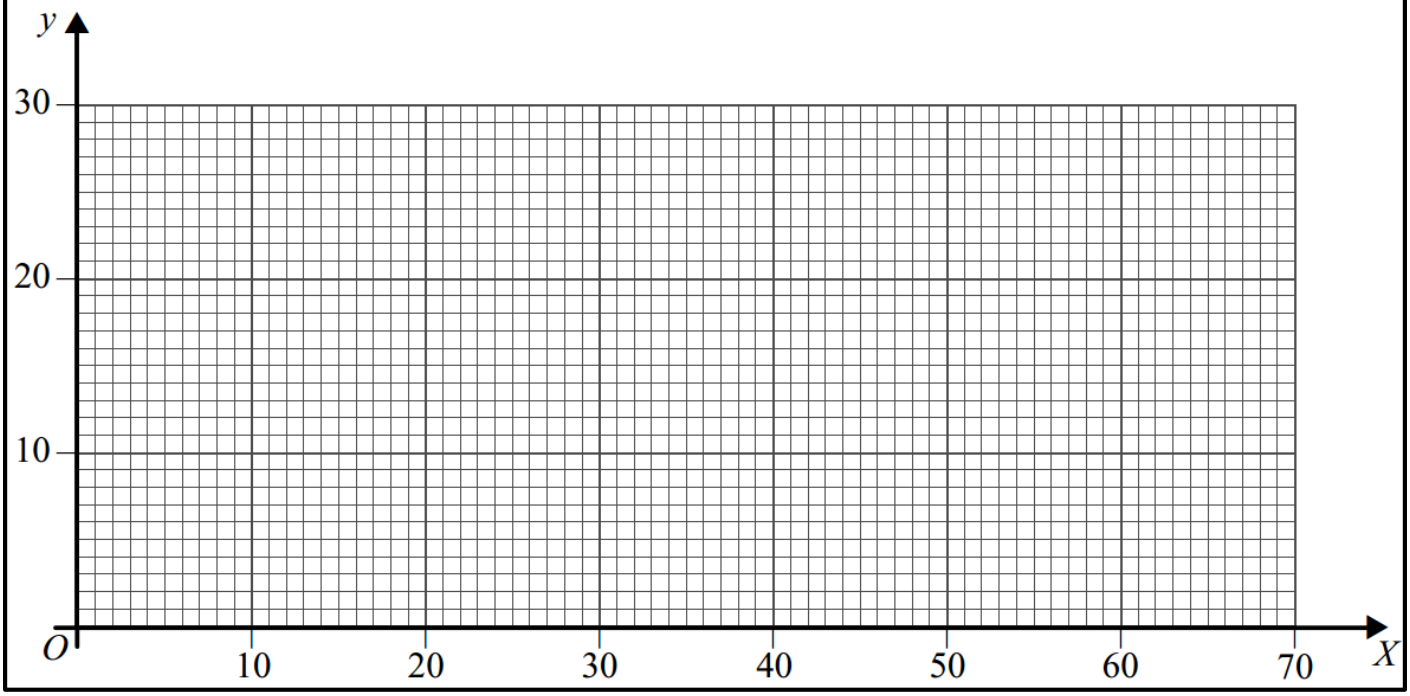
(b) On the diagram below, draw a linear graph relating X and y. *(2 marks)*

(c) Use your graph to find estimates, to two significant figures, for:

(i) the value of x when $y = 15$; *(2 marks)*

(ii) the values of a and b. *(3 marks)*

x	2	4	6	8
X				
y	6.0	10.5	18.0	28.2



June 2011

4 The variables x and Y, where $Y = \log_{10} y$, are related by the equation

$$Y = mx + c$$

where m and c are constants.

(a) Given that $y = ab^x$, express a in terms of c, and b in terms of m. *(3 marks)*

(b) It is given that $y = 12$ when $x = 1$ and that $y = 27$ when $x = 5$.

On the diagram opposite, draw a linear graph relating x and Y. *(3 marks)*

(c) Use your graph to estimate, to two significant figures:

(i) the value of y when $x = 3$; *(2 marks)*

(ii) the value of a. *(2 marks)*

January 2013

7 The variables y and x are related by an equation of the form

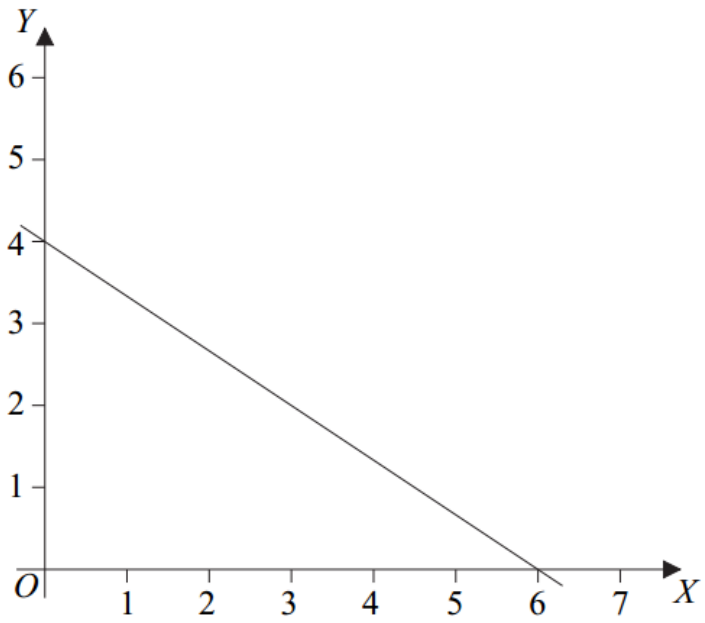
$$y = ax^n$$

where a and n are constants.

Let $Y = \log_{10} y$ and $X = \log_{10} x$.

(a) Show that there is a linear relationship between Y and X. *(3 marks)*

(b) The graph of Y against X is shown in the diagram.



Find the value of n and the value of a. *(4 marks)*