

# GRAPHICAL DETERMINATION OF LAWS

*KCSE 1989 – 2012 Form 3 Mathematics*

**1. 1990 Q24 P1**

The intensity **I** of a lamp was measured for various values of voltage **V** across it and the results tabulated as shown.

<b>V</b> (volts)	11.2	14.1	15.8	17.8	20.0	22.4
<b>I(Lux)</b>	281. 8	501. 2	562. 3	707. 9	891. 2	1122. 0

It is believed that **V** and **I** conform to a law of the form

**I = kV<sup>n</sup>** where **k** and **n** are constants . Draw a suitable linear graph and determine the values of **k** and **n** (8marks)

**2. 1991 Q23 P1**

In a experiment the volume **V** of a certain mass of a gas was measured at different pressures **P**, the temperature being constant. The results being obtained were as shown in the table below.

<b>P (N/cm<sup>2</sup>)</b>	1.4	1.75	2.1	2.8	3.5
<b>V (litres)</b>	2.6	2.0	1.75	1.3	1.02

The relationship between **P**, and **V** is known to be of the form  $P = \frac{k}{V}$  where **k** is a constant. By plotting **P** against  $\frac{1}{V}$  estimate the value of **k**.

$P = \frac{k}{V}$  where **k** is a constant. By plotting **P** against  $\frac{1}{V}$  estimate the value of **k**. (6marks)

**3. 1992 Q23 P2**

The relationship between the variables **x** and **y** is known to be of the form **y = kx<sup>n</sup>** where **k** and **n** are constants. For some fixed values of **x**, values of **y** were obtained experimentally.

The corresponding values of **x** and **log y** are given in that the table below;

Log **x** = 0.301    0.699    1.00    1.301  
 Log **y** = 1.398    0.602    0.00    1.398

(a) Draw the graph of **log y** against **log x** ( 4 marks)

(b) Use your graph to estimate the values of **k** and **n** ( 4 marks)

4. **1994 Q24 P2**

Two variables  $t$  and  $r$  are believed to obey a law of the form  $t = \frac{a}{\sqrt{r}} + b\sqrt{r}$

The table below shows the results obtained from an experiment involving  $t$  and  $r$ .

R	2	5	8	11	14
t	5.2	10.3	14.0	17.2	19.8

By plotting a suitable straight line graph on the grid provided, determine the values of  $a$  and  $b$ . (8marks)

5. **1995 Q20 P1**

The table shows the height metres of an object thrown vertically upwards varies with the time  $t$  seconds. The relationship between  $s$  and  $t$  is represented by the equations  $s = at^2 + bt + 10$  where  $a$  and  $b$  are constants.

t	0	1	2	3	4	5	6	7	8	9	10
s		45.1									

(a) (i) Using the information in the table, determine the values of  $a$  and  $b$

(ii) Complete the table ( 1 mark)

(b) (i) Draw a graph to represent the relationship between  $s$  and  $t$

( 3 marks)

(ii) Using the graph determine the velocity of the object when  $t = 5$  Seconds

(2 marks)

6 **1996 Q17 P1**

The data given below represents the average monthly expenditure,  $E$  in K£, on food in a certain village. The expenditure varies with number of dependants,  $D$  in the family.

Dependants	3	7	12	25	32
Expenditure E ( K£)	-210	250	305	440	500

(a) Using the grid provided, plot  $E$  against  $D$  and draw the line of the best fit

( 2 marks)

(b) Find the gradient and the  $E$ - intercept of the graph

( 3 marks)

(c) Write down an equation connecting  $E$  and  $D$  ( 1 mark)

(d) Estimate the cost of feeding a family with 9 dependants

( 2 marks)

7 **1996 Q24 P2**  
Data collected from an experiment involving two variables  $x$  and  $y$  was recorded as shown in the below.

X	1.1	1.2	1.3	1.4	1.5	1.6
Y	-0.3	0.5	1.4	2.5	3.8	5.2

The variables are known to satisfy a relation of the form  $y = ax^3 + b$  where  $a$  and  $b$  are constants.

- a) For each value of  $x$  in the table above, write down the value of  $x^3$ . (2marks)  
 b) (i) By drawing a suitable straight line graph, estimate the values of  $a$  and  $b$ . (5marks)  
 (ii) write down the relationship connecting  $y$  and  $x$

8 **1998 Q21 P2**  
Two variables  $R$  and  $V$  are known to satisfy a relation  $R = kV^n$ , where  $k$  and  $n$  are constants. The table below shows data collected from an experiment involving the two variables  $R$  and  $V$ .

V	3	4	5	6	7	8
R	2	4	75	108	14	192
	7	8			7	

- (a) Complete the table of  $\log V$  and  $R$  given below, by giving the value to 2 decimal places.

Log V	0.48	0.60	0.70	0.78	0.85	0.90
Log R	1.43	1.88	2.03	1.80	2.28	

- (b) On the grid provided draw a suitable straight line graph to represent the relation  $R = kV^n$   
 (c) (i) the gradient of the line  
 (ii) a relationship connecting  $R$  and  $V$ .

9 **2002 Q24 P1**  
Two quantities  $P$  and  $r$  are connected by the equation  $p = kr^n$ . The table of values of  $P$  and  $r$  is given below.

P	1.2	1.5	2.0	2.5	3.5	4.5
r	1.58	2.25	3.39	4.74	7.86	11.5

- a) State a linear equation connecting  $P$  and  $r$ .  
 b) Using the scale 2cm to represent 0.1 units on both axes, draw a suitable line graph on the grid provided. Hence estimate the values of  $K$  and  $n$ . (8mks)

10 **2002 Q16 P2**  
 The equation of a circle is given by  $x^2 + 4x + y^2 - 5 = 0$ .  
 Find the radius and the center of the circle.

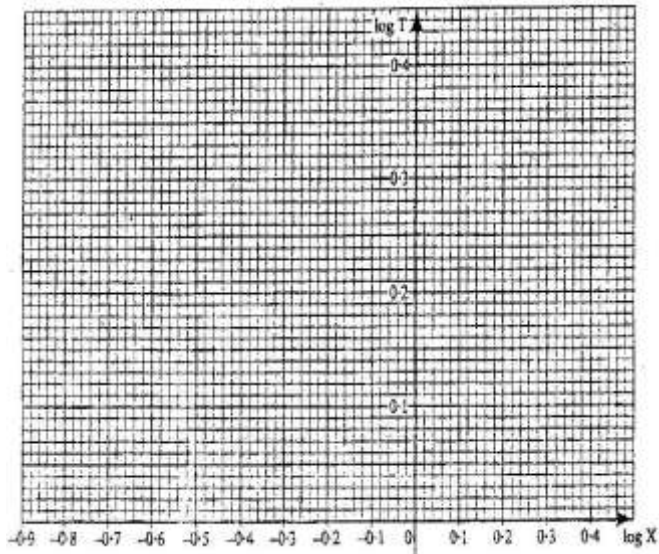
11 **2006 Q10**  
 The points which coordinates (5,5) and (-3,-1) are the ends of a diameter of a circle centre A  
 Determine:  
 (a) the coordinates of A ( 1 mark)  
 (b) The equation of the circle, expressing it in form  $x^2 + y^2 + ax + by + c = 0$  where a, b, and c are constants ( 3 marks)

12 **2007 Q16**  
 Find the radius and the coordinate of the centre of the circle whose equation is  $2x^2 + 2y^2 - 3x + 2y + \frac{1}{2} = 0$  ( 4 marks)

13 **2007 Q23**  
 The table below shows the values of the length X ( in metres ) of a pendulum and the corresponding values of the period T ( in seconds) of its oscillations obtained in an experiment.

X ( metres)	0.4	1.0	1.2	1.4	1.6
T ( seconds)	1.25	2.01	2.19	2.37	2.53

(a) Construct a table of values of log X and corresponding values of log T, correcting each value to 2 decimal places ( 2 marks)  
 (b) Given that the relation between the values of log X and log T approximate to a linear law of the form  $m \log X + \log a$  where a and b are constants  
 Use the axes on the grid provided to draw the line of best fit for the graph of log T against log X (2marks)



(ii) Use the graph to estimate the values of a and b (3marks)

(c) Find, to decimal places the length of the pendulum whose period is 1 second ( 3 marks)

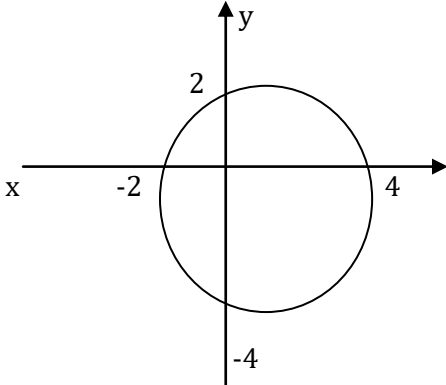
14 **2008 Q11 P2**  
 The equation of a circle is given by  $4x^2 + 4y^2 - 8x + 20y - 7 = 0$ . Determine the coordinates of the centre of the circle. (3mks)

15 **2009 Q24**  
 A solution was gently heated, its temperature readings taken at intervals of 1 minute and recorded as shown in the table below

Time (Min)	0	1	2	3	4	5
Temperature (°C)	4	5.2	8.4	14.3	16.8	17.5

(a) Draw the time temperature graph on the grid provided  
 (b) Use the graph to find the average rate of change in temperature between  $t = 1.8$  and  $t = 3.4$  (2 marks)

16 **2010 Q16 P2**  
 The circle shown below cuts the x-axis at  $(-2,0)$  and  $(4,0)$ . It also cuts y-axis at  $(0,2)$  and  $(0,-4)$ .



Determine the:

a) i) Coordinates of the centre; (1 mark)  
 ii) radius of the circle. (1 mark)

b) Equation of the circle in the form  $x^2 + y^2 + ax + by = c$  where a, b and c are constants (2 marks)

17 **2011 Q15 P2**  
 The equation of a circle centre  $(ab)$  is  $x^2 + y^2 - 6x - 10y + 30 = 0$ . Find the values of a and b (3marks)