

## Sample PAPER 1

Paper 1 contains 15 questions, and each question is marked out of 6, for a total of 90 marks. You have 1 hour 30 minutes for this paper, which means 1 mark a minute.

1. Jupiter is the largest of all the planets in our solar system. It has a radius of 71 492 kilometres at the equator and a radius of 66 854 kilometres at the two poles.

(a) Round the radius of Jupiter at the poles to

(i) 3 significant figures

[1 mark]

(ii) the nearest 1000 km

[1 mark]

(b) Use the radius of Jupiter at the equator to calculate an estimate of the volume of the planet in  $\text{km}^3$ .

Write your answer in the form  $a \times 10^k$  where  $1 \leq a < 10$  and  $k \in \mathbb{Z}$ .

[4 marks]

2. A curve has the equation  $y = x^3 - x^2 - 4x + 7$ .

(a) Find  $\frac{dy}{dx}$  in terms of  $x$ .

[2 marks]

Two points, A and B, lie on the curve. The gradient of the curve at both points is  $-3$ .

(b) Show that the  $x$ -coordinates of A and B satisfy the equation  $3x^2 - 2x - 1 = 0$ .

[2 marks]

(c) Hence find the  $x$ -coordinates of the two points.

[2 marks]

3. Monique has written a wish list for her 18th birthday. Her list includes a laptop computer, an iPad and a mobile phone.

The propositions  $p$ ,  $q$  and  $r$  are defined as follows.

$p$ : Dad buys her a laptop

$q$ : Dad buys her an iPad

$r$ : Mum buys her a mobile phone

(a) Write the following logic statements in words.

(i)  $\neg q \Rightarrow p$

[1 mark]

(ii)  $\neg p \Rightarrow (r \wedge q)$

[2 marks]

(b) Complete the truth table below for the propositions given.

$p$	$q$	$\neg p$	$\neg q$	$p \Rightarrow \neg q$	$\neg p \Rightarrow q$	$(p \Rightarrow \neg q) \vee (\neg p \Rightarrow q)$
T	T	F	F			
T	F	F	T			
F	T	T	F			
F	F	T	T			

[3 marks]

4. The following list shows the number of downloads (in thousands) of a free application for mobile phones in ten consecutive weeks.

Week	1	2	3	4	5	6	7	8	9	10
Downloads (thousands)	31	31	32	33	34	35	37	46	49	64

- (a) Find the mean number of downloads in a week. [2 marks]
- (b) Find the median and the quartiles of the data and calculate the interquartile range. [3 marks]
- (c) What is the standard deviation of the weekly downloads? [1 mark]

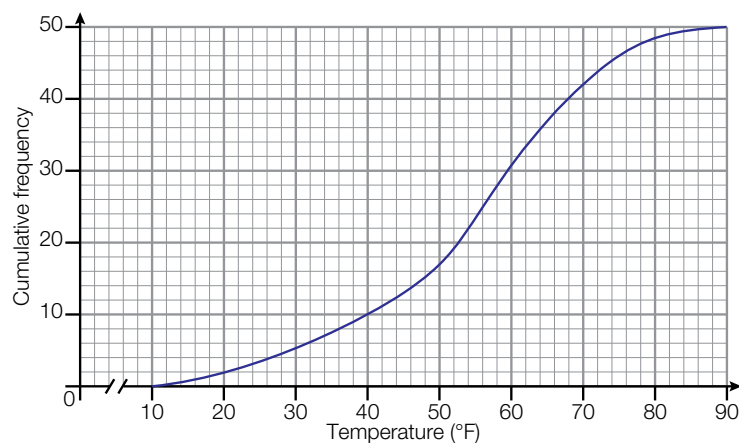
5. The straight line  $l_1$  has equation  $y = 7x - 10$  and the straight line  $l_2$  has equation  $5x + 4y - 26 = 0$ . The two lines intersect at the point P.

- (a) Find the coordinates of P. [3 marks]

The line  $l_3$  passes through P and is perpendicular to line  $l_1$ .

- (b) Find the equation of line  $l_3$ . Give your answer in the form  $ax + by + c = 0$  where  $a$ ,  $b$  and  $c$  are integers. [3 marks]

6. The diagram below shows a cumulative frequency curve of the average daily temperatures in 50 tourist cities.



- (a) Write down the median daily temperature. [1 mark]
- (b) Calculate the interquartile range of the daily temperatures. [2 marks]
- (c) Estimate how many of the cities had an average daily temperature between  $50^{\circ}\text{F}$  and  $70^{\circ}\text{F}$ . [2 marks]
- (d) Use the diagram to estimate the minimum daily temperature of the warmest 10% of the cities. [1 mark]
7. A mathematics revision handout was uploaded onto the internet in January 2010. The number of downloads of the handout can be modelled by the polynomial

$$N = 15172 + 702t - 9t^2$$

where  $N$  is the total number of downloads in the  $t$ th month after January 2010.

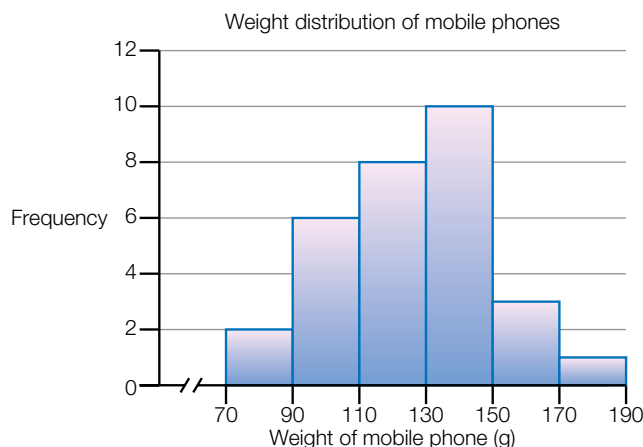
- (a) How many times had the file been downloaded in the sixth month after it was uploaded? [2 marks]
- (b) Calculate the number of times the file had been downloaded in January 2011. [2 marks]
- (c) In which month was the file downloaded 25 540 times? [2 marks]
8. Penny has a collection of old music CDs and DVDs, which she decides to sell at a car boot sale. The total number of CDs and DVDs is 53.
- (a) Assuming Penny had  $c$  CDs and  $v$  DVDs, write an equation in terms of  $c$  and  $v$  for Penny's collection. [2 marks]

Penny sells each CD for 40 pence and each DVD for 70 pence. She sold all her items and earned a total of £25.70.

(b) Based on Penny's sales, write a second equation in terms of  $c$  and  $v$ . [2 marks]

(c) Solve the two equations from parts (a) and (b) to find the number of CDs and the number of DVDs that Penny sold. [2 marks]

9. The diagram shows the distribution of weights of a sample of mobile phones.



(a) Write down the class interval in which you would find:

(i) the modal weight [1 mark]

(ii) the median weight [2 marks]

(b) Calculate an estimate of the mean weight of the mobile phones. [2 marks]

(c) Give an estimate for the standard deviation of the weights of the phones. [1 mark]

10. The following data represents the physical activity level of a group of children between 11 and 14 years of age. The level of activity is classified as high, medium or low. The table shows the number of boys and girls at each level of activity.

	Level of activity		
	High	Medium	Low
Boys	85	27	18
Girls	63	42	33

Carlos wants to determine whether the level of activity is associated with gender. He carries out a  $\chi^2$  test at the 5% significance level.

(a) Write a suitable null hypothesis for the  $\chi^2$  test. [1 mark]

(b) State the number of degrees of freedom. [1 mark]

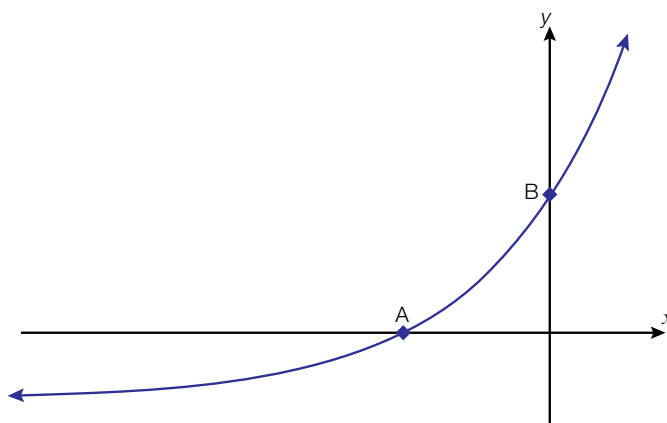
(c) Use your GDC to find the  $\chi^2$  test statistic for the data. [2 marks]

The critical value at the 5% level of significance is 5.99.

(d) State, with reasons, whether Carlos should accept or reject the null hypothesis. [2 marks]

11. The diagram shows the graph of the function  $y = 2 \times 3^{x+1} - 1$ .

The curve passes through the points A and B with coordinates  $(a, 0)$  and  $(0, b)$ , respectively.



- (a) Write down the values of  $a$  and  $b$ .

[2 marks]

- (b) Write down the equation of the horizontal asymptote.

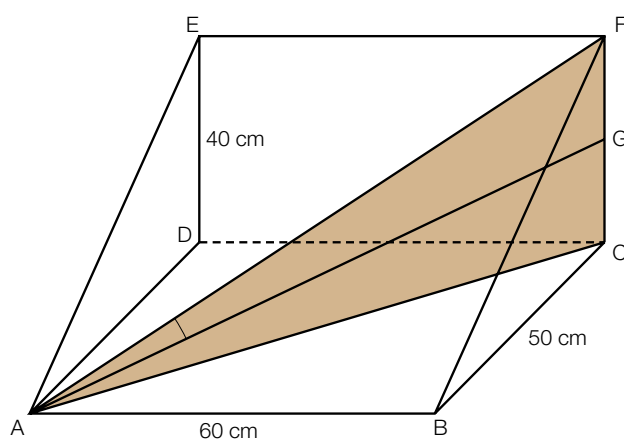
[2 marks]

The curve passes through another point  $C(1.5, c)$ .

- (c) Find the value of  $c$ .

[2 marks]

12. ABCDEF is a triangular prism. G is the midpoint of CF.  $\angle BCF$  is a right angle.  $AB = DC = EF = 60$  cm,  $AD = BC = 50$  cm and  $DE = CF = 40$  cm.



- (a) Calculate the length of

- (i) AC

[2 marks]

- (ii) AF

[2 marks]

- (b) Calculate the size of the angle between AF and AG.

[2 marks]

13. The sixth, seventh and eighth terms of an arithmetic sequence are,  $7x + 5$ ,  $9x$  and  $10x + 1$ , respectively.

- (a) Calculate the value of  $x$ .

[2 marks]

- (b) Find:

- (i) the common difference

[1 mark]

- (ii) the first term of the sequence.

[1 mark]

- (c) Calculate the 26th term of the sequence.

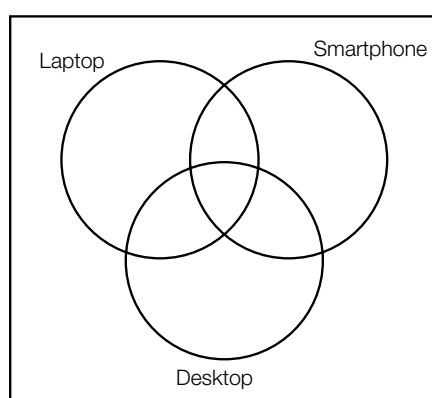
[2 marks]

14. Seb and Gabby carried out a survey of 100 students from their sixth-form college. They asked: Do you visit the college website regularly? If you do, how do you access the website?

All 100 students in the sample regularly visited the website. The results of the survey are shown below:

Methods of accessing website	Number of students
laptop, smartphone and desktop	5
laptop and smartphone only	7
laptop and desktop only	$x$
smartphone and desktop only	7
laptop only	35
desktop only	23
smartphone only	15

- (a) Use the information from above to complete the given Venn diagram.



[4 marks]

- (b) Find the value of  $x$ .

[2 marks]

15. Señora Mercado participates in a pension scheme. In the first year she paid in \$300. Her payments increased by 4% each year in a geometric sequence.

- (a) Calculate the amount she paid in the 10th year of the scheme.

[3 marks]

Señora Mercado adjusted her payments in the 11th year. She paid in a sum of £450, and plans to reduce her payment by 2% every year until her final payment, in the 20th year.

- (b) How much will she be paying in the 20th year of the scheme?

[3 marks]