Maths D3
363

UNIVERSITY OF LONDON

General Certificate of Education Examination

JUNE 1973 **ORDINARY LEVEL**

Mathematics 3

Syllabus D

Two hours

Answer ALL questions in Section A and any FOUR questions in Section B.

All necessary working must be shown.

Candidates are reminded of the necessity for good English and orderly presentation in their answers.

Mathematical formulae and tables are provided.

Section A

1. Calculate the exact value of $\frac{0 \cdot 18582}{3 \cdot 26}$ and express the answer in the form $B\ 10^{-n}$, where B is a number between 1 and 10, and n is an integer. **(4 marks)**

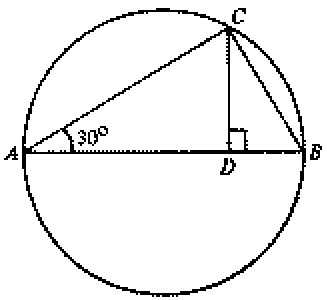
2. A train is travelling at a uniform speed of 90 km/h. Calculate the time, in seconds, it takes to travel 600 m. **(3 marks)**

3. £979 is to be divided into three parts in the proportions $1 : \frac{1}{2} : \frac{1}{3}$. Calculate the value of the smallest part. **(4 marks)**

PSE 72/499 12/3/100/R49,000

Turn over

4.



Point D lies on diameter AB of a circle of radius 10 cm. Given that $\angle CAB = 30°$ and $\angle CDB = 90°$, calculate the lengths of CB and CD. **(4 marks)**

---

5. Solve the simultaneous equations

$$x - 2y = 1,$$
$$xy - y = 8.$$

(5 marks)

---

6. Given that $\sin^2 x = 0{\cdot}2652$, find the value of the acute angle x, correct to the nearest degree. **(3 marks)**

---

7. Express as a single fraction in its lowest terms,

$$\frac{5}{x^2-1} + \frac{2}{(x-1)^2}.$$

(4 marks)

---

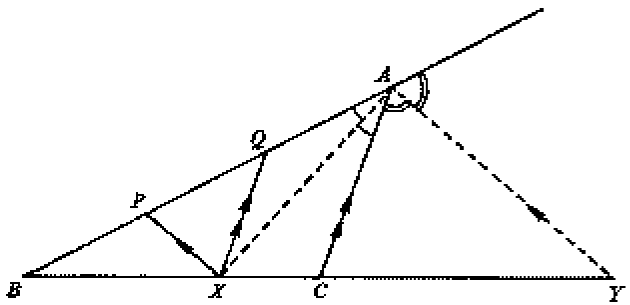
8. Construct a $\triangle ABC$ in which $AB = 12$ cm, $AC = 8$ cm and $BC = 10$ cm.

On the same diagram construct a $\triangle ABD$, equal in area to $\triangle ABC$, such that $\angle ABD = 98°$. Measure the length of BD, giving your answer correct to the nearest mm. **(5 marks)**

Section B

Answer any FOUR questions from this section and take π as 3·142 when required.

9. Prove that the internal bisector of an angle of a triangle divides the opposite side in the ratio of the sides containing the angle.



In the figure, the internal and external bisectors of the angle A of $\triangle ABC$ meet BC and BC produced at X and Y respectively. Given that $AB = 8$ cm, $AC = 4$ cm, and $BC = 6$ cm, calculate the lengths of BX and BY.

If, also, XP is drawn parallel to YA, and XQ is drawn parallel to CA, meeting AB at P and Q respectively, prove that $BP = PQ = QA$. **(17 marks)**

---

10. In a factory, x metal hooks and $(x + 4)$ plastic hooks are produced every minute. Write down expressions for the times, in seconds, to produce one metal hook and one plastic hook respectively.

If a metal hook takes $1\frac{1}{2}$ seconds longer to produce than a plastic hook, form an equation in x and solve it.

Calculate the total number of hooks produced altogether in 8 minutes. **(17 marks)**

Turn over

11. The curve whose equation is $y = 2x - x^2$ intersects the x-axis at the origin and again at P.

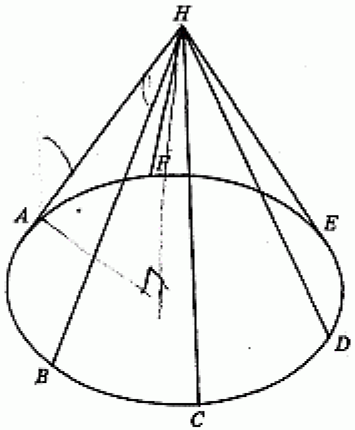
(*a*) Calculate the x coordinate of P.

(*b*) *Sketch* the graph of $y = 2x - x^2$.

(*c*) Calculate the coordinates of the point on the curve at which the gradient equals 1.

(*d*) The area bounded by the curve and the x-axis is rotated completely about the x-axis. Calculate the volume of the solid of revolution generated. **(17 marks)**

12.



The figure shows a horizontal ring of radius 1 m suspended from a point H by six wires, each of length 2 m, attached to points A, B, C, D, E and F equally spaced around the ring. Calculate

(*a*) the height, to the nearest cm, of H above the plane of the ring,

(*b*) the angle which the wire HA makes with the vertical,

(*c*) the angle between the wires HA and HB,

(*d*) the angle which the plane AHB makes with the plane of the ring. **(17 marks)**

---

13. Since a city typist moved to the coast, both the railway and the bus fares for her journeys have increased. Each year for her rail travel she buys three quarterly season tickets, one monthly season ticket and two weekly season tickets.

The quarterly tickets have increased from £45·50 each to £53·00, the monthly tickets from £16·50 each to £19·70 and the weekly tickets from £4·60 each to £5·40.

During each of the 45 weeks she travels, she takes ten bus rides, each of which has increased from 9p to 12p. Calculate

(*a*) the original annual cost of her travel,

(*b*) the increase in annual cost,

(*c*) the increase in annual cost expressed as a percentage of the original annual cost, correct to 3 significant figures. **(17 marks)**

---

14. A model globe of the earth is constructed to a scale of 1:49000000. Taking the earth to be a sphere of radius 6370 km, calculate

(*a*) the radius, in cm, of the model,

(*b*) the shortest distance, in km, on the surface of the earth between two towns if the corresponding distance between them on the model is 5 cm,

(*c*) the distance, to the nearest mm, measured along the equator on the model from the Greenwich meridian to a place which lies on the equator and on the meridian 60°W.

If the distance measured on the model from the Greenwich meridian eastwards along the parallel of latitude 30°N to a town A is 22·6 cm, calculate the longitude of town A, to the nearest degree. **(17 marks)**

Add Maths 5

372/374/375

UNIVERSITY OF LONDON

General Certificate of Education Examination

JUNE 1973 **ORDINARY LEVEL**

Additional Mathematics 5

STATISTICS 1

Two hours

Answer any SIX questions. All questions carry equal marks. All necessary working must be shown.

Candidates are reminded of the necessity for good English and orderly presentation in their answers.

Mathematical formulae and tables are provided.

1. (i) Explain how it is possible for a group of workers to have a mean salary of £1 500 and yet the range in their salaries to be £5 000. (Answers should explain the general idea, not merely give a numerical example.)

(ii) The arithmetic mean of the annual earnings of a civil servant for the calendar years 1968-1971 was £2 100. If she earned £2 500 in 1972, calculate her arithmetic mean annual earnings over the five-year period.

(iii) A family man's annual expenditure increased in the calendar years 1969-1971 on average by 10 per cent each year. If his 1972 expenditure was 20 per cent more than that in 1971, calculating the appropriate geometric mean, find his annual average percentage increase over the four-year period.

TSE 72/244 10/3/3/3/2/100/4750

Turn over

2. In an examination candidates had to answer six questions out of the eight questions set on the paper. Every question carried an equal number of marks. Table 1 shows the percentage of candidates who attempted each question and the arithmetic mean mark gained by those who attempted the question.

Question Number	*Percentage of candidates attempting the question (to nearest whole number)*	*Mean mark gained (to 1 decimal place)*
1	75	9·4
2	96	11·5
3	27	3·2
4	81	5·6
5	94	11·1
6	77	4·4
7	68	8·1
8	46	2·6

TABLE 1

(*a*) Use Table 1 to suggest a reason why most candidates attempted question 2 and so few attempted question 3.

(*b*) Rank the questions according to 'popularity' giving question 2 rank 1 and question 3 rank 8. In addition, rank the questions according to 'success' giving question 2 rank 1. Present in tabular form both sets of ranks together with the question numbers.

(*c*) Examine Fig. 2 on page 7 (which should be detached from the question paper and fastened to your answer book) on which the data of Table 1 has been plotted and label the eight points with the appropriate question number.

(*d*) Giving reasons based on Fig. 2 state which question(s) appear to have been more difficult than the candidates expected.

(*e*) Support your answer to (*d*) by reasons based on your answer to (*b*).

3. A survey of pocket money amongst a group of children showed that the least weekly amount was 30p and the greatest was under a pound.

Eight children had less than 50p, 13 children had less than 60p, 20 children had less than 80p and 12 children had 60p or more.

Giving accurate labels, make a frequency table of this data.

Estimate, by calculation, the mean weekly pocket money with each of the following assumptions:

(*a*) no child's pocket money involved a halfpenny,

(*b*) no child's pocket money involved a coin of lower value than fivepence.

4. (i) Entries were invited for a small sports meeting in which the girls' events were 3 track events (100 metres, 200 metres, 100 metres hurdles) and high jump and long jump.

(*a*) Joan entered for one event only. Under what assumption could it be said that 'the probability that she entered for a track event is 3/5'?

(*b*) Kathleen entered for two events. Under what assumption could it be said that 'the probability that she entered for both the long jump and the high jump is 1/10'?

(ii) Using the data given in Table 1, *and showing all necessary working*, calculate

(*a*) the greatest possible percentage of candidates who answered both question 1 and question 2,

(*b*) the least possible percentage of candidates who answered both question 1 and question 2,

(*c*) the likely percentage of candidates who answered both question 1 and question 2.

Turn over

5. (i) From the following list:

median, histogram, inter-quartile range, variance, relative frequency polygon, range,

write down the names of

(*a*) the measures of dispersion,

(*b*) the measures which can be obtained from a cumulative frequency curve.

(ii) The lengths of surnames was investigated by M. J. R. Healy and reported in the Journal of the Royal Statistical Society in 1968. He selected one name from each page of the London Telephone directory and obtained the results given in Table 2.

Number of letters	*Frequency*	*Cumulative frequency (per cent)*
2	3	0·1
3	40	1·5
4	279	11·6
5	532	30·7
6	687	55·4
7	563	75·7
8	342	88·0
9	189	94·8
10	77	97·5
11	35	98·8
12	20	99·5
13	6	99·7
14	4	99·9
15	2	99·9
16	1	100
17	0	
18	0	
19	1	
	2 781	

Table 2: Length of Surnames.
(*M. J. R. Healy, J. R. Stat. Soc.*)

Calculate, for the data of Table 2, each of the following measures and state what each indicates:

(*a*) range,

(*b*) median,

(*c*) lower quartile,

(*d*) inter-quartile range.

6. (i) Explain what is meant by a *time series*, and give *two* examples of general interest.

For what *kind* of time series is it useful to calculate *moving averages?* Explain the advantage of the series obtained by taking moving averages over the raw data.

(ii) Consider the surnames having 14 or more letters in the data given in Table 2. For these, calculate the mean and standard deviation of the number of letters.

7. (i) An urn contains four balls, labelled 1 to 4 respectively. After mixing, a ball is drawn and its number (X) recorded. This ball is not replaced, but two more are drawn and their sum (Y) recorded.

Write down all the ordered pairs (X, Y) which are possible for this random experiment (i.e. list the possibility space), and calculate the probability of the event

(*a*) $X = 2$ or 3,

(*b*) $Y = 5$.

Show that these events are independent.

(ii) Consider the random experiment in part (i) of this question and the events

C: X is an odd number

D: Y is an odd number

E: $Y = 4$

F: $Y = 2X$.

(*a*) State two pairs of mutually exclusive events.

(*b*) If the events D, E and G are a set of exhaustive events list the members of G.

8. (i) The histogram in Fig. 1 shows the number of cars of various ages found at a car sale.

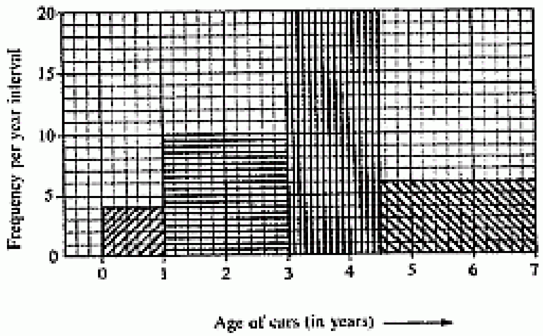


Fig. 1

(*a*) Explain why the vertical axis cannot be labelled 'frequency'.

(*b*) Evaluate the total number of cars in the car sale.

(ii) Table 3 shows the relative frequency distribution of the number of seeds in a pod for a certain plant.

Number of seeds per pod	4	5	6	7
Relative frequency	0·20	0·54	0·15	0·11

TABLE 3

If a pod is selected at random, calculate the expected value of the number of seeds in the pod.

Centre Number	Candidate Number	Surname

If question 2 is attempted, this page is to be detached, if used, and fastened to the answer book.

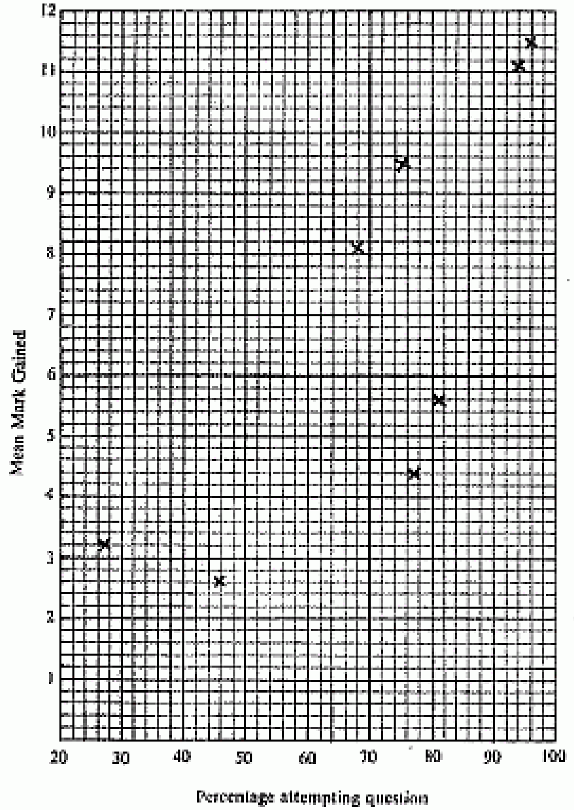


Fig. 2