Additional materials:
Answer paper
Electronic calculator
Geometrical instruments
Graph paper (2 sheets)
Mathematical tables (optional)

TIME   2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Write your answers and working on the separate answer paper provided.

Show all your working on the same page as the rest of the answer.

Omission of essential working will result in loss of marks.

Section A

Answer **all** questions.

Section B

Answer any **four** questions.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 100.

You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.


This question paper consists of 9 printed pages and 3 blank pages.

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Local Examinations Syndicate

[Turn over

Section A [52 marks]

Answer **all** questions in this section.

1   Denise, Elaine and Michelle went on holiday to America.

(a) The exchange rate between American dollars ($) and British pounds (£) was $1.60 = £1.
Denise changed £400 into dollars.
Calculate how many dollars she received.   [1]

(b) To change the money, the bank charged a fixed amount of £3 plus 2% of the number of pounds changed.

(i)   Calculate the amount the bank charged Denise to change her £400.   [1]

(ii) The bank then charged Elaine £15 to change her money.
Calculate the number of pounds she changed.   [2]

(c) While in America they spent a total of $450 on food.
The amounts spent by Denise, Elaine and Michelle were in the ratio 7 : 6 : 5.
Calculate how much Denise spent on food.   [2]

(d) Michelle bought a watch for $135.
This price included a tax of 8%.
Calculate the **tax** that was paid.   [3]

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2 **(a)** Remove the brackets and simplify $(q+3r)(2q-r)$.   [2]

(b) Given that $m = -2$ and $n = 4$, evaluate

(i) $5m^3$,   [1]

(ii) $\dfrac{m}{n} + \dfrac{n}{m}$.   [1]

(c) Factorise completely $3y^2-3$.   [2]

(d) Peter has Rs200 and Paul has Rs2120.
When they are each given Rsx, Paul has 5 times as much as Peter.
Write down an equation in x and solve it.   [3]

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3 The diagram shows a vertical mast, *TB*, of height 18 m.
A, *B* and *C* are three points on horizontal ground.
TA and *TC* are two straight wires.
TC has length 27 m and $A\hat{T}B = 31°$.

(a) Calculate

  (i) $B\hat{C}T$, [2]
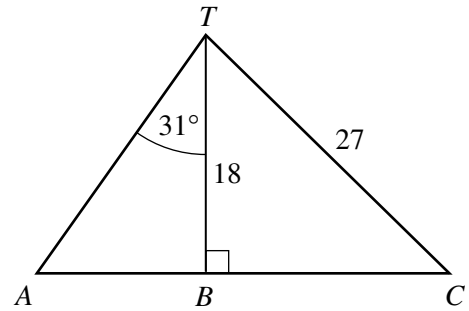
  (ii) the length of *TA*. [3]

(b) A third straight wire, *TD*, joins *T* to a point *D* on the same horizontal ground.
Given that $D\hat{T}B = 51°$, find the angle of elevation of *T* from *D*. [1]

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4 **(a)** Show that the interior angle of a regular hexagon is 120°. [2]

(b) In the diagram, *ABCDEF*
is a regular hexagon.
ABPQ and *FARS* are two
squares.
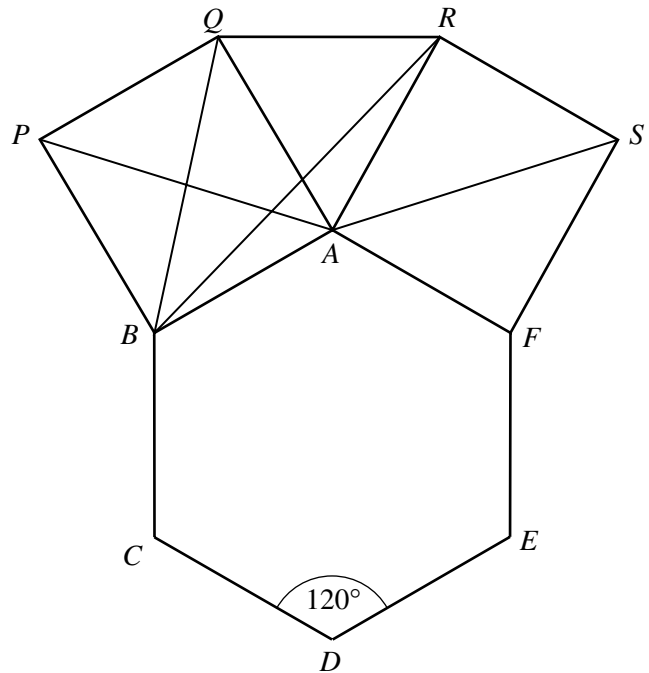
  (i) Calculate

    (a) reflex $P\hat{B}C$, [1]

    (b) obtuse $P\hat{A}S$, [2]

    (c) acute $R\hat{B}A$. [2]

  (ii) What is the special name given to triangle *AQR*? [1]

[Turn over

5 [**The value of π is 3.142, correct to three decimal places.**]

[The volume of a sphere is $\frac{4}{3}\pi r^3$.]
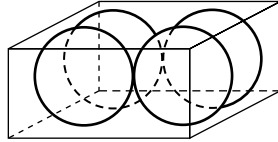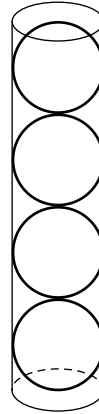

Diagram I   **Diagram II**

The diagrams show two ways of packaging 4 identical balls.
The radius of each ball is 3 cm.

Diagram I shows a closed rectangular box with a square base.
Each ball touches the top, the bottom and two sides of the box.
Each ball also touches two other balls.

Diagram II shows a closed cylinder.
The balls touch the ends and the side of the cylinder.

(a) (i) Write down the dimensions of the rectangular box. [1]

    (ii) Calculate the **total** surface area of the outside of this box. [2]

(b) Calculate the **total** surface area of the outside of the cylinder. [2]

(c) Calculate the **total** volume of the 4 balls. [2]

(d) Calculate, correct to three decimal places, the value of

$$\frac{\text{volume of the cylinder}}{\text{volume of the box}}.$$

  [2]

(e) Hence state which of the two containers has more space **not** occupied by the balls. [1]

6 **Answer the whole of this question on a sheet of graph paper.**

The masses of 80 parcels sent out by a garden centre are given in the table below.

Mass (m kilograms)	$0 < m \leqslant 2$	$2 < m \leqslant 4$	$4 < m \leqslant 6$	$6 < m \leqslant 10$	$10 < m \leqslant 15$
Frequency	12	18	20	20	10

(a) Using a scale of 1 cm to represent 1 kg, draw a horizontal axis for $0 \leqslant m \leqslant 15$.
Choose a suitable scale for the vertical axis and draw a histogram to represent this data. [3]

(b) Estimate the number of parcels which had a mass greater than 9 kg. [1]

(c) Calculate an estimate of the mean mass. [3]

(d) One parcel was chosen at random and not replaced.
A second parcel was chosen at random from the remainder.
Giving each answer as a fraction in its lowest terms, find the probability that

  (i) both parcels were chosen from the $6 < m \leqslant 10$ group, [1]

  (ii) one parcel was chosen from the $6 < m \leqslant 10$ group and the other parcel was **not** chosen from the $6 < m \leqslant 10$ group. [2]

[Turn over

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 [**The value of π is 3.142, correct to three decimal places.**]

Diagram I shows a sector, *ADB*, of a circle.
The centre of the circle is *C* and its radius is 6 cm.
$A\hat{C}B = 120°$.

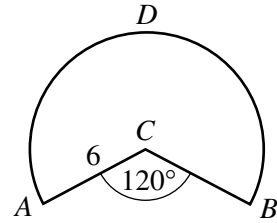**(a)** Calculate the length of the major arc *ADB*.

Diagram I

[2]

(b) Two tangents are drawn to touch the circle at *A* and *B*.
The tangents meet at *T*, to form the shape shown in
Diagram II.

(i)   Explain why $A\hat{T}B = 60°$.   [1]

(ii) Calculate the length of *AT*.   [2]

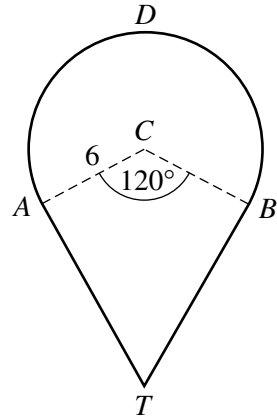(iii) Calculate the perimeter of the shape *ADBT*.   [2]

Diagram II

(c) Four of the shapes shown in Diagram II
are arranged to form the figure shown
in Diagram III.

This figure has rotational symmetry
of order 4.
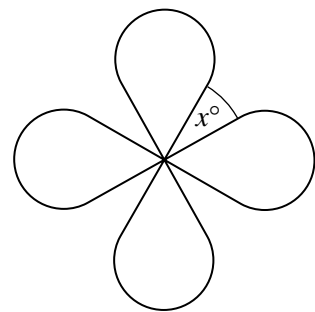
Diagram III

(i)   Write down the number of lines of symmetry in this figure.   [1]

(ii) Calculate the angle (marked as *x*° in Diagram III) between each shape.   [1]

(iii) Every second, the figure turns through 40° about its centre.
      Calculate the time it takes to make 108 revolutions.
      Give your answer in minutes and seconds.   [3]

**8** **Answer the whole of this question on a sheet of graph paper.**

The table below gives some values of x and the corresponding values of y, where

$$y = 30 - 18x + x^3.$$

x	-4	-3	-2	-1	0	1	2	3	4
y	38	57	58	47	30	13	2	3	22

(a) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $-4 \leqslant x \leqslant 4$.
   Using a scale of 2 cm to represent 10 units, draw a vertical y-axis for $0 \leqslant y \leqslant 60$.
   On your axes, plot the points given in the table and join them with a smooth curve.   [3]

(b) Use your graph to find

    (i) the largest value of $30 - 18x + x^3$ in the interval $-4 \leqslant x \leqslant 4$,   [1]

    (ii) the smallest value of x for which $30 - 18x + x^3 = 50$.   [1]

(c) By drawing a tangent, find the gradient of the curve when $x = 1$.   [2]

(d) A is the point $(0, 27)$ and B is the point $(3, 3)$.

    (i) Draw, on the axes used in part **(a)**, the line which passes through A and B.   [1]

    (ii) Find the equation of AB.   [2]

    (iii) The x coordinates of the points where the line AB intersects the curve are the solutions of the equation $x^3 + ax + b = 0$.
   Find the value of a and the value of b.   [2]

[Turn over

9
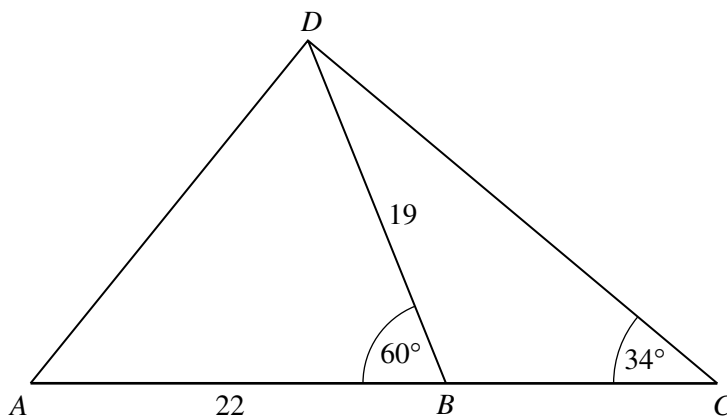
The diagram shows a straight line *ABC* and a point *D*.
$AB = 22$ cm, $BD = 19$ cm, $A\hat{B}D = 60°$ and $B\hat{C}D = 34°$.

Calculate

(a) the length of *BC*,   [4]

(b) the length of *AD*,   [4]

(c) the area of triangle *ABD*,   [2]

(d) the shortest distance from *B* to *AD*.   [2]

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10 The distance between two houses, *P* and *Q*, is 200 km.
Joe travelled by car from *P* to *Q* at an average speed of *x* km/h.

(a) Write down an expression, in terms of *x*, for the number of hours he took to travel from *P* to *Q*.   [1]

(b) He returned from *Q* to *P* at an average speed of $(x + 5)$ km/h.
Write down an expression, in terms of *x*, for the number of hours he took to travel from *Q* to *P*.   [1]

(c) The **total** time he took to go from *P* to *Q* and to return from *Q* to *P* was 8 hours.

    (i) Write down an equation in *x* and show that it simplifies to

$$x^2 - 45x - 125 = 0.$$ [4]

    (ii) Solve the equation $x^2 - 45x - 125 = 0$, giving each answer correct to 2 decimal places.   [4]

    (iii) Calculate, correct to the nearest minute, the time he took to travel from *P* to *Q*.   [2]

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11 **(a)** $\overrightarrow{OP} = \begin{pmatrix} -9 \\ 40 \end{pmatrix}$ and $\overrightarrow{OQ} = \begin{pmatrix} 3 \\ -16 \end{pmatrix}$.

Find

   (i) $|\overrightarrow{OP}|$, [2]

   (ii) $\overrightarrow{PQ}$. [1]

(b) In the diagram, *ABC* and *EBD*
are two straight lines.

Angle *EAB* = angle *CDB*.

AB = 2 cm, *BC* = 6 cm and *BD* = 4 cm.
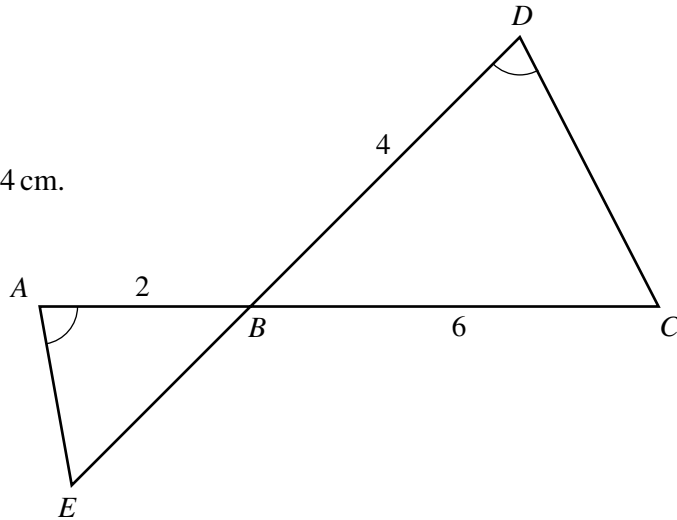
   (i) Explain why triangle *ABE* is similar to triangle *DBC*. [1]

   (ii) Explaining your working fully, show that *BE* = 3 cm. [2]

   (iii) Write down, as a fraction in its lowest terms, the value of

$$\frac{\text{area of triangle } ABE}{\text{area of triangle } DBC}.$$ [1]

   (iv) It is given that $\overrightarrow{AB} = \mathbf{p}$ and $\overrightarrow{DB} = \mathbf{q}$.
Express each of the following in terms of **p** and/or **q**

     (a) $\overrightarrow{BC}$, [1]

     (b) $\overrightarrow{BE}$, [1]

     (c) $\overrightarrow{AE}$, [1]

     (d) $\overrightarrow{DC}$. [1]

   (v) Use your answers to parts **(iv)(c)** and **(d)** to explain why *AE* is **not** parallel to *DC*. [1]

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