Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2003

MATHEMATICS – HIGHER LEVEL

PAPER 2 (300 marks)

MONDAY, 9 JUNE – MORNING, 9:30 to 12:00

Attempt **ALL** questions.

Each question carries 50 marks.

Graph paper may be obtained from the superintendent.

The symbol ✍ indicates that supporting work must be shown to obtain full marks.

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1. **(a)** ✍ A solid cone has vertical height 4 cm. The radius of its base is 3 cm. Find, in terms of π, the volume of the cone.

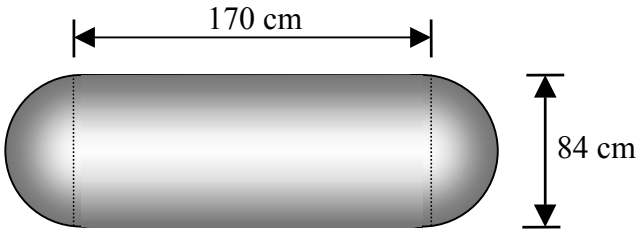
(b) A solid rectangular metal block has length 12 cm and width 5 cm. The volume of the block is 90 cm^3.

(i) ✍ Find the height of the block in cm.

(ii) ✍ Find the total surface area of the block in cm^2.

(iii) ✍ Each cm^3 of the metal has mass 8·4 g.
The total mass of a number of these metal blocks is 113·4 kg.
How many blocks are there?

(c)

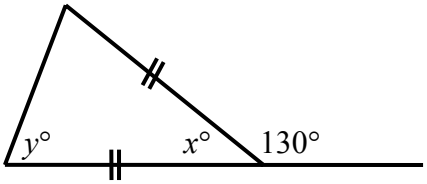


A capsule is made up of a cylindrical section and two hemispherical ends.
The length of the cylindrical section is 170 cm and the diameter is 84 cm.

(i) ✍ Find the surface area of the capsule in cm^2.
Give your answer correct to two significant figures.

(ii) ✍ Find the volume of the capsule in m^3.
Give your answer correct to two decimal places.

2. **(a)** Calculate the value of x
and the value of y in the diagram.



(b) $a(2, 3)$ and $b(5, -1)$ are two points.
The translation $\overrightarrow{ab}$ maps the point $p(6, 7)$ to the point q.

(i) ✍ Find the co-ordinates of q.

(ii) ✍ Verify that $|ab| = |pq|$.

(c) L is the line $x - 2y - 3 = 0$.

(i) ✍ Find the slope of L.

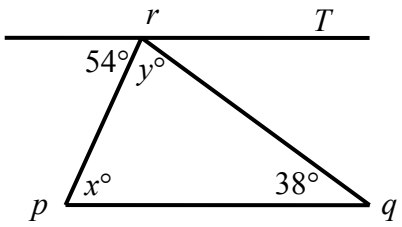
(ii) ✍ Find the equation of the line K through $(-2, 5)$ which is perpendicular to L.

(iii) ✍ Find the co-ordinates of the point of intersection of L and K.

(iv) ✍ Hence, or otherwise, find the co-ordinates of the image of $(-2, 5)$ under the axial symmetry in L.

3. **(a)** The line T passes through r and is parallel to pq.

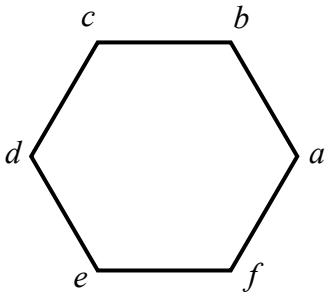
Calculate the value of x and the value of y in the diagram.



(b) **(i)** Construct a triangle xyz in which $|xy| = 10$ cm, $|yz| = 7$ cm and $|xz| = 5$ cm.

(ii) ✍ Prove that an exterior angle of a triangle equals the sum of the two interior opposite angles in measure.

(c) The diagram shows a regular hexagon.
(A regular hexagon has six equal sides and six equal angles.)



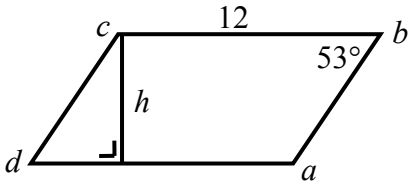
(i) How many axes of symmetry has the hexagon?

(ii) Copy the diagram into your answerbook and draw in the axes of symmetry.

(iii) $[ad]$ and $[cf]$ intersect at o.
What is the measure of the angle of the rotation, about o, which maps a onto c?

(iv) Describe one transformation which maps $[af]$ to $[cd]$.

4. **(a)** In the parallelogram *abcd*,
$|\angle abc| = 53°$ and $|bc| = 12$ cm.

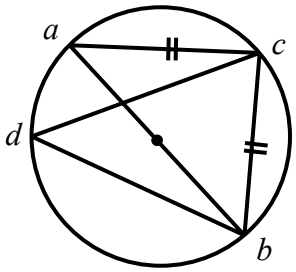


(i) Find $|\angle bcd|$.

(ii) ✍ Find the perpendicular height, *h*,
given that the area of *abcd* is 90 cm^2.

(b) ✍ Prove that if two sides of a triangle are equal in measure, then the angles opposite these sides are equal in measure.

(c) *a*, *d*, *b*, *c* are points on a circle, as shown.
[*ab*] is a diameter of the circle.
$|ab| = 12$ cm and $|ac| = |cb|$.



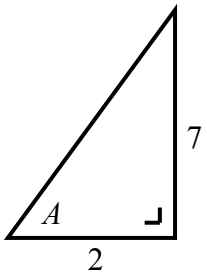
(i) ✍ Write down $|\angle bca|$, giving a reason for your answer.

(ii) ✍ Find $|\angle cdb|$.

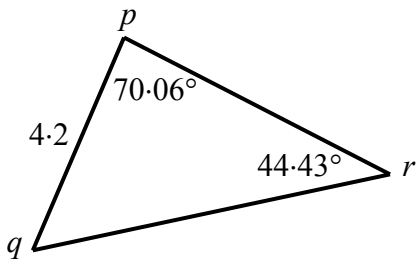
(iii) ✍ Find $|bc|$.

(iv) ✍ Find the area of $\Delta\, abc$.

5. **(a)** ✍ Use the information given in the diagram to find sin A and cos A.
Give your answers in surd form.



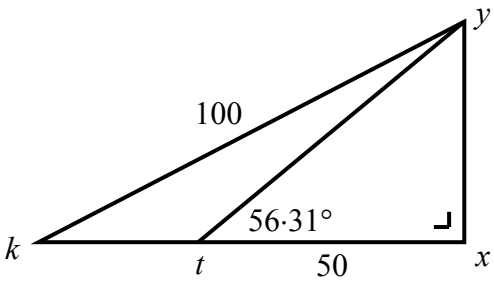
(b) In the triangle pqr,
$|\,pq\,| = 4{\cdot}2$ cm, $|\,\angle rpq\,| = 70\cdot06°$
and $|\,\angle qrp\,| = 44\cdot43°$.



(i) ✍ Find $|\,qr\,|$, giving your answer correct to two decimal places.

(ii) ✍ Hence, or otherwise, find the area of $\Delta\, pqr$.
Give your answer correct to two decimal places.

(c) A vertical mast $[xy]$ stands on level ground.
A straight wire joins y, the top of the mast, to t, a point on the ground. t is 50 m from x, the bottom of the mast.



(i) ✍ If $|\,\angle ytx\,| = 56\cdot31°$, find $|\,xy\,|$, the height of the mast.

(ii) ✍ A second straight wire joins y to k, another point on the ground.
If the length of this wire is 100 m, find $|\,\angle ykx\,|$, correct to the nearest degree.

6. **(a)** **(i)** ✍ Show that 13 is the mean of the numbers 6, 11, 15, 16, 17.

(ii) ✍ 14 is the mean of the numbers 6, 11, 15, 16, 17, x.
Find the value of x.

(b) The duration of each log-on to the internet in a public library was recorded over a certain period.

The results are summarised in the following table:

Duration (minutes)	0 – 3	3 – 6	6 – 9	9 – 15	15 – 21	21 – 30
Number of log-ons	3	5	9	20	21	12

[Note: 3 – 6 means 3 minutes or more but less than 6 minutes, etc.]

(i) Draw a histogram to illustrate the data in the table.

(ii) ✍ What was the total number of log-ons made?

(iii) ✍ In which class interval does the median lie?

(c) **(i)** Copy the following cumulative frequency table into your answerbook and use the table in part **(b)** to complete it:

Duration (minutes)	< 3	< 6	< 9	< 15	< 21	< 30
Number of log-ons						

(ii) On graph paper construct the ogive.

Use your graph to estimate:

(iii) ✍ the median

(iv) ✍ the number of log-ons lasting at least 10 minutes.