Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2011

MATHEMATICS – HIGHER LEVEL

PAPER 2 (300 marks)

MONDAY, 13 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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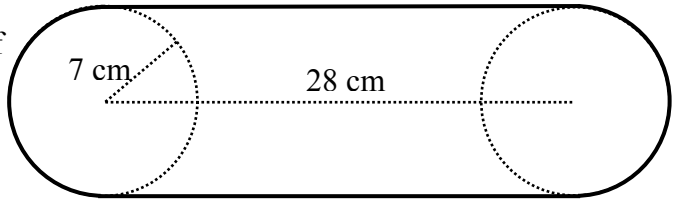
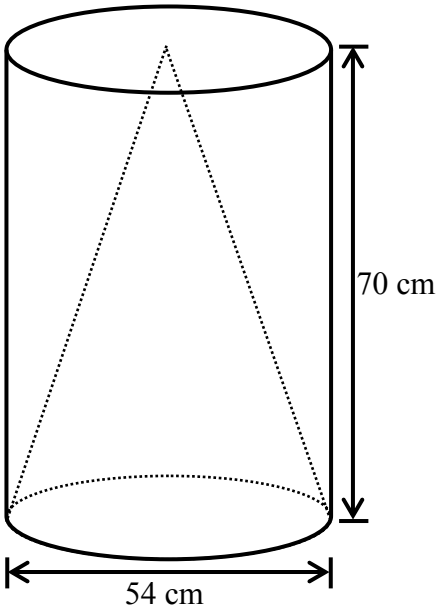
1. **(a)** The diagram shows two pulley wheels of equal size, connected by a drive belt.
The radius of each wheel is 7 cm and the distance between the centres is 28 cm.



✍ Calculate the length of the belt.
Give your answer correct to the nearest whole number.

(b) The diagram shows a solid cylinder of diameter 54 cm and of height 70 cm.
A cone, of the same diameter and height as the cylinder, is cut from inside the cylinder.

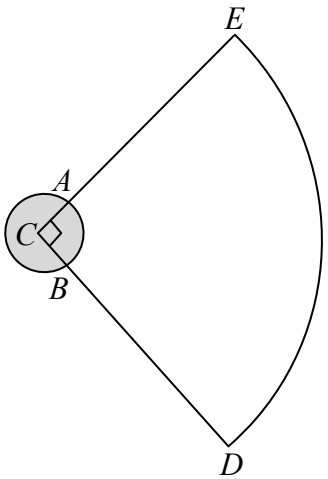


(i) ✍ Calculate the volume of the cylinder.
Give your answer in terms of π.

(ii) ✍ Calculate the volume of the cone.
Give your answer in terms of π.

(iii) ✍ What fraction of the cylinder remains after the cone is removed?

(c) The diagram, not to scale, represents a shot-put zone in an athletics stadium.
The area of *CDE* is a quarter of the area of a disc of centre *C* and of radius 100 m.



(i) ✍ Calculate the area of *CDE*, correct to two decimal places.

The shot-put zone consists of a throwing zone and a landing zone.
The throwing zone (shaded) is a disc of centre *C* and of radius 1 m.

(ii) ✍ Calculate the area of the throwing zone, correct to two decimal places.

The landing zone is the unshaded area *ABDE*, which is part of *CDE*.

(iii) ✍ Calculate the total area of the shot-put zone, correct to two decimal places.

2. **(a)** $X(-3, 1)$ and $Y(4, -2)$ are two points.

✍ Find the length of the line segment $[XY]$.

Give your answer in surd form.

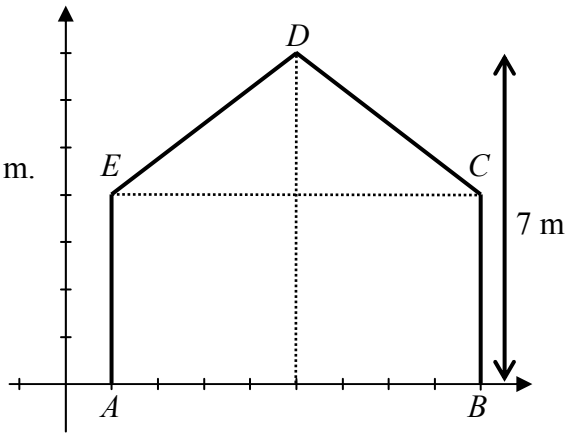
(b) The diagram shows the gable end of a house.

The total height is 7 m.

The height to roof level is 4 m, i.e. $|AE| = 4$ m.

A is the point (1, 0).

B is the point (9, 0).



(i) Write down the coordinates of the points C, D and E.

(ii) ✍ Find the slope of the rafter $[ED]$.

(iii) ✍ Find the area of the gable.

(c) The line k passes through the point $P(3, 2)$.

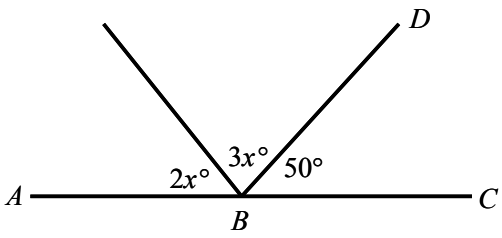
k is perpendicular to the line l: $2x + 3y = -1$.

(i) ✍ Find the equation of k.

(ii) ✍ Find the coordinates of the image of P by an axial symmetry in l.

3. **(a)** In the diagram, $|\angle DBC| = 50°$.

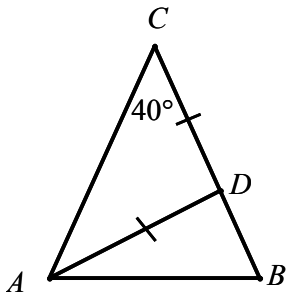
✍ Find the value of x.



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

(ii) The triangle ABC is isosceles with $|AC| = |BC|$.
The triangle ADC is also isosceles with $|AD| = |CD|$.
$|\angle ACB| = 40°$.

✍ Find $|\angle DAB|$ and $|\angle ADB|$.

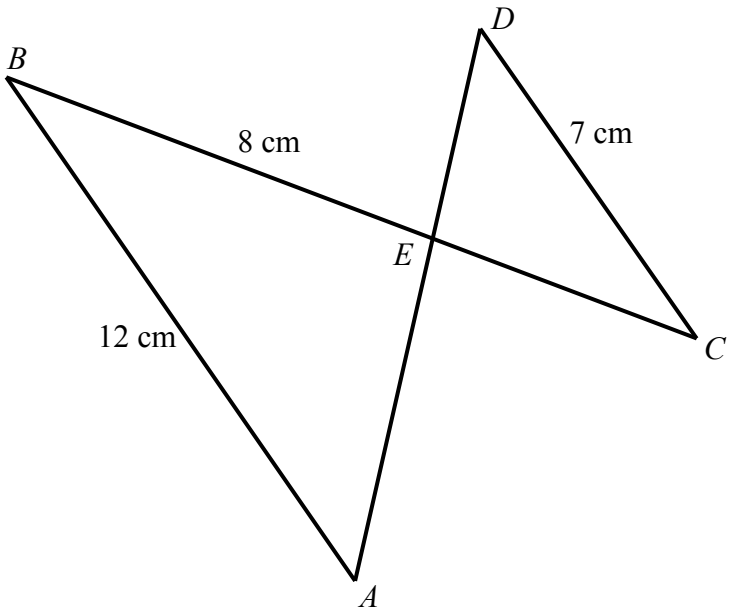


(c) AB is parallel to CD. BC and AD intersect at the point E.

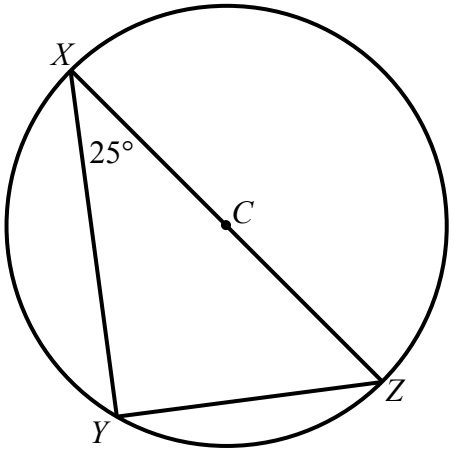
(i) ✍ Prove that the triangles ABE and CDE are equiangular.

$|AB| = 12$ cm, $|BE| = 8$ cm and $|CD| = 7$ cm.

(ii) ✍ Find $|EC|$ correct to one decimal place.



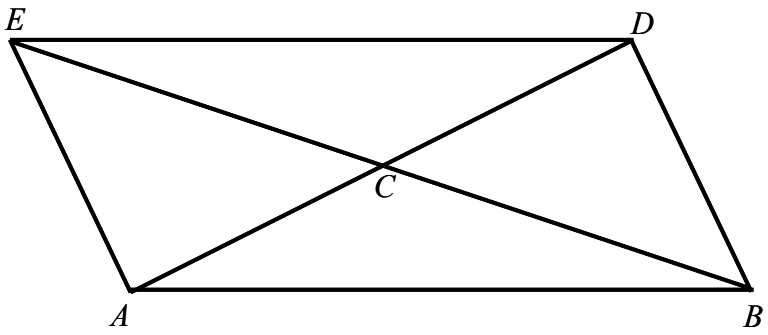
4. **(a)** X, Y and Z are points on a circle with centre C.
$|\angle YXZ| = 25°$.



✍ Find $|\angle XZY|$.

(b) ✍ Prove that the measure of the angle at the centre of the circle is twice the measure of the angle at the circumference, standing on the same arc.

(c) The quadrilateral $ABDE$ has diagonals $[AD]$ and $[BE]$ intersecting at C.
C is the midpoint of both $[AD]$ and $[BE]$.



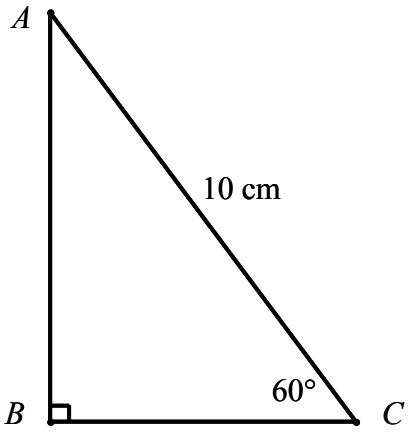
(i) ✍ Prove that $\triangle ECD$ is congruent to $\triangle ACB$.

(ii) ✍ Hence, prove that $ABDE$ is a parallelogram.

5. **(a)** ABC is a right angled triangle.

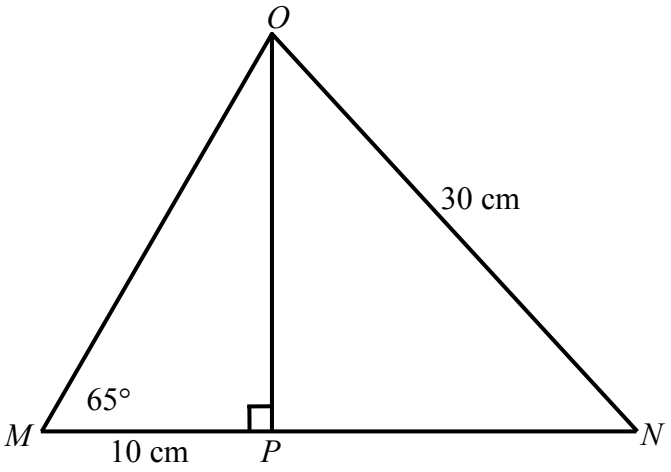
$|\angle ACB| = 60°$ and $|AC| = 10$ cm.

✍ Calculate the length of $[AB]$, correct to two decimal places.



(b) In the diagram MNO is a triangle with $[OP]$ perpendicular to $[MN]$.
$|MP| = 10$ cm, $|ON| = 30$ cm
and $|\angle PMO| = 65°$.
Calculate

(i) ✍ $|OP|$, correct to one decimal place

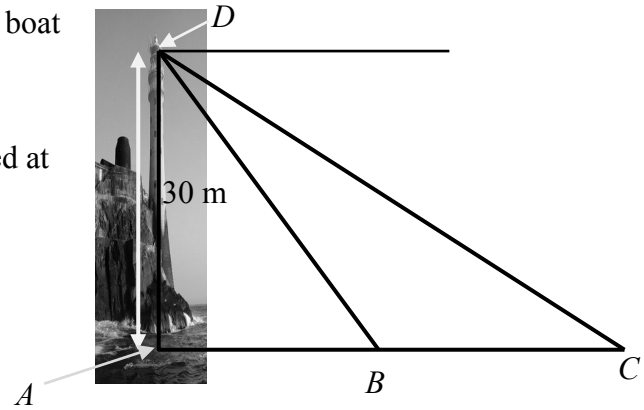


(ii) ✍ $|\angle MON|$, correct to one decimal place.

(c) A boat sails due east from the base A of a 30 m high lighthouse, $[AD]$.
At the point B the angle of depression of the boat from the top of the lighthouse is 68°.
Ten seconds later the boat is at the point C and the angle of depression is now 33°.

(i) ✍ Find $|BC|$, the distance the boat has travelled in this time.

(ii) ✍ Calculate the average speed at which the boat is sailing between B and C.
Give your answer in metres per second, correct to one decimal place.



6. **(a)** The mean of 7, 2, x, 15 and 5 is 9.

✍ Find the value of x.

(b) The results obtained by 200 students in an examination are recorded in the following grouped frequency distribution.

Mark	0 – 20	20 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 100
Number of students	20	36	36	52	30	14	12

[Note: 20 – 40 means 20 or more but less than 40, etc.]

(i) ✍ Draw a cumulative frequency table.

(ii) ✍ Use your cumulative frequency table to construct the ogive.

(iii) ✍ If 50% of the students passed, use your ogive to estimate the pass mark.

(c) 130 people were surveyed as they were leaving a shop to see how much they had just spent in the shop. The results are recorded in the following table.

Amount spent (€)	0 – 20	20 – 30	30 – 40	40 – 50	50 – 100
No. of people	60	10	5	25	30

[Note: 20 – 30 means 20 or more but less than 30, etc.]

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

(ii) ✍ Taking mid-interval values, calculate the mean amount of money spent in the shop. Give your answer correct to the nearest euro.

(iii) ✍ What is the maximum number of people who could have spent less than the mean?

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