Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2009

MATHEMATICS – HIGHER LEVEL

PAPER 2 (300 marks)

MONDAY, 8 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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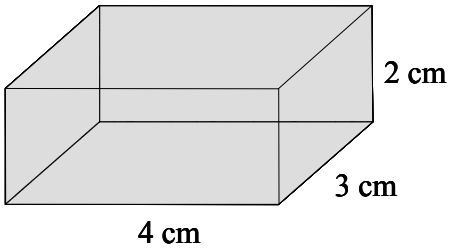
1. **(a)** ✍ Find the total surface area of a solid hemisphere of diameter 14 cm.

Give your answer correct to the nearest whole number.

(b) A jeweller buys a rectangular block of gold of length 4 cm, width 3 cm and height 2 cm. 1 cm^3 of gold costs €400.



(i) ✍ Calculate the cost of the block of gold.

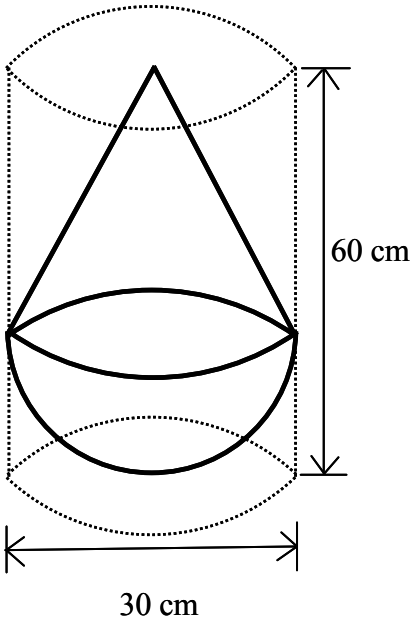
The jeweller needs 250 mm^3 of gold to make a gold ring.

(ii) ✍ How many rings can be made from the block?

Each ring is sold for €120.

(iii) ✍ Calculate the amount of profit the jeweller makes on each ring.

(c) A float in the shape of a cone on top of a hemisphere is made from solid rubber. The diameter of the hemisphere is 30 cm and the height of the float is 60 cm.



(i) ✍ Find the volume of the float in terms of π.

The float is cut from a solid rubber cylinder of diameter 30 cm and height 60 cm.

(ii) ✍ Express the volume of rubber used in the float as a percentage of the volume of the cylinder.

Give your answer correct to the nearest whole number.

2. **(a)** a (-2, -1) and b (5, -4) are the end points of the diameter of a circle.

✍ Find the coordinates of the centre of the circle.

(b) ✍ Prove that the opposite sides and opposite angles of a parallelogram are respectively equal in measure.

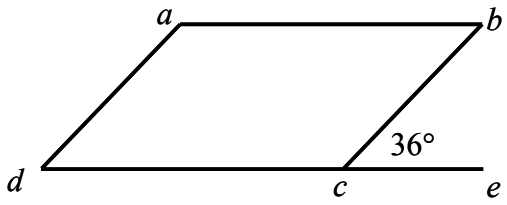
(c) **(i)** ✍ Verify that the points (3, 0) and (0, -2) are on the line L: $2x - 3y = 6$.

(ii) ✍ Find the equation of the line K through (3, 0) which is perpendicular to L.

(iii) ✍ Show the lines L and K on a coordinate diagram on graph paper.

(iv) ✍ Find the area of the triangle formed by the lines L and K and the y axis.

3. **(a)** *abcd* is a parallelogram with [*dc*] produced to *e* and $|\angle bce| = 36°$, as shown.



Find **(i)** $|\angle abc|$,

(ii) ✍ $|\angle bad|$.

(b) **(i)** ✍ Show how to construct the circumcircle of a triangle.

All construction lines must be clearly shown.

(ii) Each of the three figures labelled *A*, *B* and *C* shown below is the image of the figure *X* under a transformation. For each of *A*, *B* and *C*, state what the transformation is (translation, central symmetry, axial symmetry or rotation) and in the case of a rotation, state the angle.

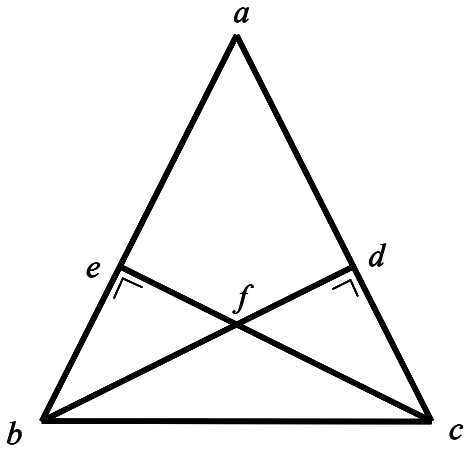
X *A* *B* *C*

(c) The triangle *abc* is an isosceles triangle, with $|ab| = |ac|$ and $|\angle bec| = |\angle cdb| = 90°$.

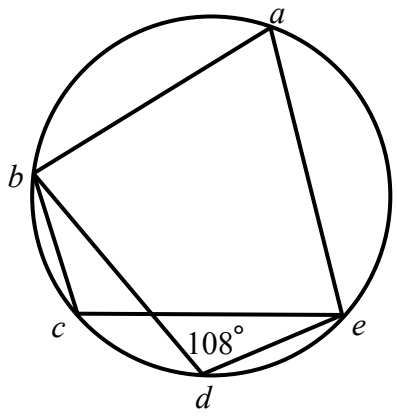
The lines *ec* and *bd* intersect at *f*.

(i) ✍ Prove $|\angle dbc| = |\angle ecb|$.

(ii) ✍ Prove $|ef| = |fd|$.



4. **(a)** a, b, c, d and e are points on a circle and $|\angle bde| = 108°$.



Find **(i)** ✍ $|\angle bae|$,

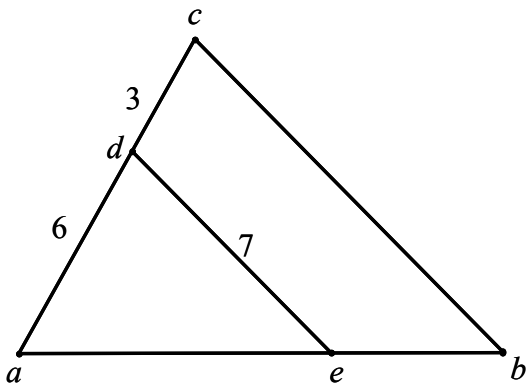
(ii) ✍ $|\angle bce|$,

giving a reason for your answer in each case.

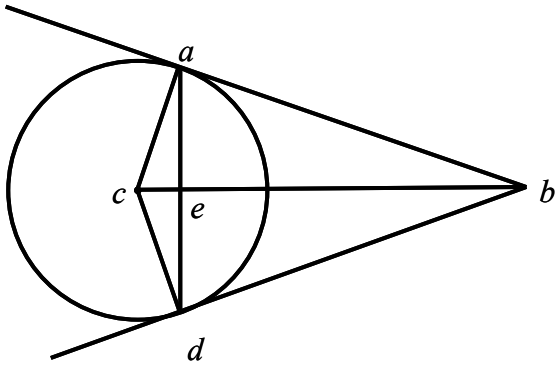
(b) **(i)** ✍ Prove that if two triangles are equiangular, the lengths of corresponding sides are in proportion.

(ii) In the triangle abc, de is parallel to cb.
$|ad| = 6$, $|dc| = 3$ and $|de| = 7$.

✍ Find $|cb|$.



(c) ba and bd are tangents to the circle of centre c.
$[bc]$ intersects the chord $[ad]$ at the point e.



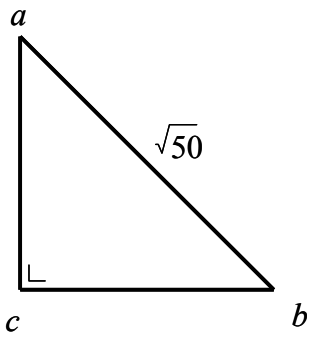
(i) ✍ Prove that $\Delta\, abc$ is congruent to $\Delta\, dbc$.

(ii) ✍ Hence, prove that $[bc]$ bisects the chord $[ad]$.

5. **(a)** abc is an isosceles triangle with $|ac| = |bc|$,

$|ab| = \sqrt{50}$ and $|\angle acb| = 90°$.

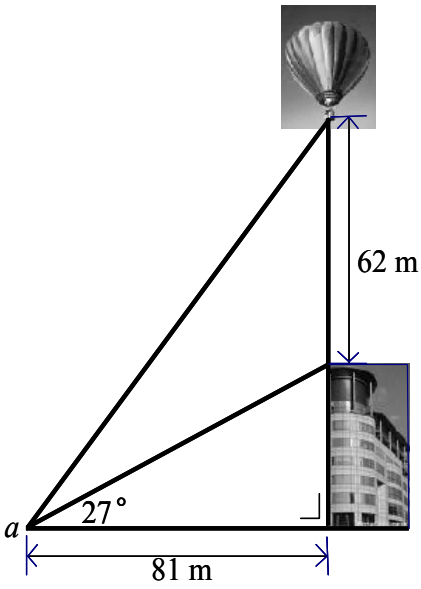
✍ Find $|bc|$.



(b) The angle of elevation of the top of a building, as viewed from a point a, 81 m from the base of the building, is 27°.

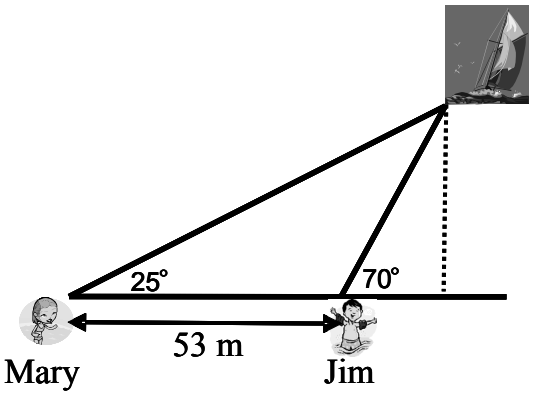
(i) ✍ Find the height of the building correct to the nearest metre.

The bottom of a balloon is 62 m above the top of the building, as shown.



(ii) ✍ Find the angle of elevation of the bottom of the balloon as viewed from the point a. Give your answer correct to the nearest degree.

(c) Mary and Jim are standing 53 m apart on a straight shoreline.
They observe a boat at sea making angles of 25° and 70° respectively with the shore, as shown.



(i) ✍ Find the distance Jim is from the boat correct to the nearest metre.

(ii) ✍ Calculate the shortest distance from the boat to the shoreline.

6. **(a)** 8 is the mean of the five numbers 13, 6, 5, x and 7.

✍ Find the value of x.

(b) The weights, in kg, of 125 Junior Certificate students are given in the following frequency table.

Weight in kg	40 – 50	50 – 55	55 – 60	60 – 70	70 – 75
Number of students	16	22	27	52	8

[Note: 40 – 50 means 40 or more but less than 50, etc.]

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

(ii) ✍ Using mid interval values, calculate the mean weight of the Junior Certificate students.

(c) The salaries of the employees in a manufacturing firm were recorded. The following were the results.

Salary (in 1000's €)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of employees	7	12	20	29	7

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

(i) Construct the cumulative frequency table.

(ii) On graph paper construct the ogive.

(iii) ✍ Use your graph to estimate the median salary.

(iv) ✍ Estimate from your graph the percentage of employees whose salaries are between €70 000 and €90 000.

Give your answer correct to the nearest whole number.

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