



# Coimisiún na Scrúduithe Stáit State Examinations Commission

**JUNIOR CERTIFICATE EXAMINATION, 2007**

**MATHEMATICS – HIGHER LEVEL**

**PAPER 2 (300 marks)**

**MONDAY, 11 JUNE – MORNING, 9:30 to 12:00**

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Attempt **ALL** questions.

Each question carries 50 marks.

**Graph paper may be obtained from the superintendent.**

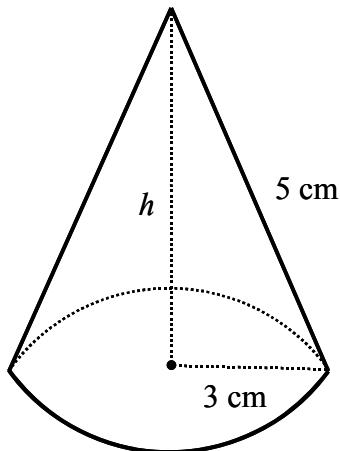
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The symbol  indicates that supporting work **must** be shown to obtain full marks.

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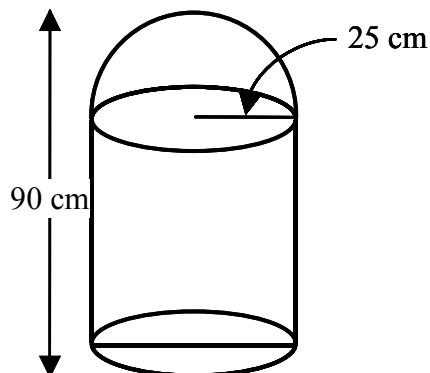
1. (a) A cone has a base radius of 3 cm and a slant height of 5 cm.

- (i) Find  $h$ , the perpendicular height of the cone.
- (ii) Find the volume of the cone in terms of  $\pi$ .

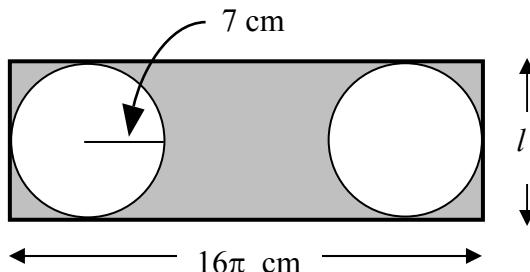


- (b) A hot water container is in the shape of a hemisphere on top of a cylinder as shown. The hemisphere has a radius of 25 cm and the container has a height of 90 cm.

- Find the internal volume of the container in litres, giving your answer correct to the nearest litre.



- (c) A rectangular piece of metal has a width of  $16\pi$  cm. Two circular pieces, each of radius 7 cm, are cut from the rectangular piece, as shown.



- (i) Find the length,  $l$ , of the rectangular piece of metal.
- (ii) Calculate the area of the metal not used (i.e. the shaded section), giving your answer in terms of  $\pi$ .
- (iii) Express the area of the metal not used as a percentage of the total area.

- 2.** (a)  $p(2, 4)$  and  $q(-1, 1)$  are two points.

$q$  is the midpoint of  $[pr]$ .



Find the co-ordinates of  $r$ .

- (b)  $(0, 6)$  and  $(4, -2)$  are two points on the line  $M$ .

(i) Find the slope of  $M$ .

(ii) Find the equation of the line  $N$  through  $(4, -2)$ , which is perpendicular to  $M$ .

Give your answer in the form  $ax + by + c = 0$ , where  $a, b$  and  $c \in \mathbf{Z}$ .

- (c)  $L$  is the line  $x - 2y + 2 = 0$  and  $K$  is the line  $x + 2y - 6 = 0$ .

(i) Find the coordinates of  $u$ , the point of intersection of  $L$  and  $K$ .

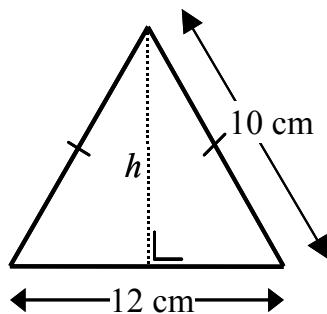
(ii)  $L$  cuts the  $y$ -axis at the point  $v$ . Find the coordinates of  $v$ .

(iii) Show that  $w(0, 3)$  is on the line  $K$ .

(iv) Show that  $|uw| = |uv|$ .

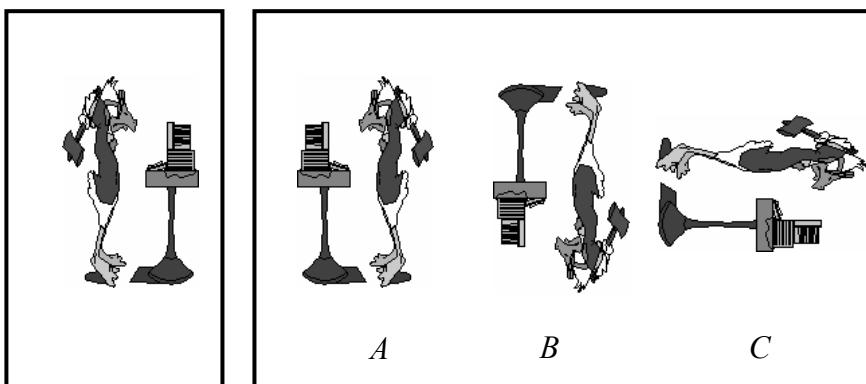
- 3. (a)** The isosceles triangle shown in the diagram, has a base of length 12 cm and the other two sides are each 10 cm in length.

- Find  $h$ , the perpendicular height of the triangle.



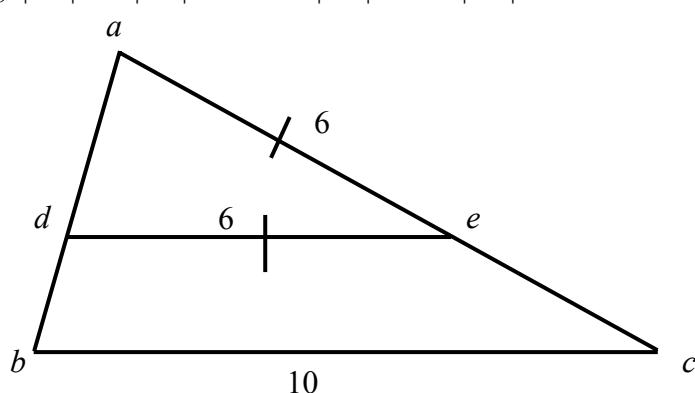
- (b) (i)** Prove that if two sides of a triangle are equal in measure, then the angles opposite these sides are equal in measure.

- (ii)** Each of the three figures labelled  $A$ ,  $B$  and  $C$  shown below in the box on the right is the image of the figure shown in the box on the left 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.



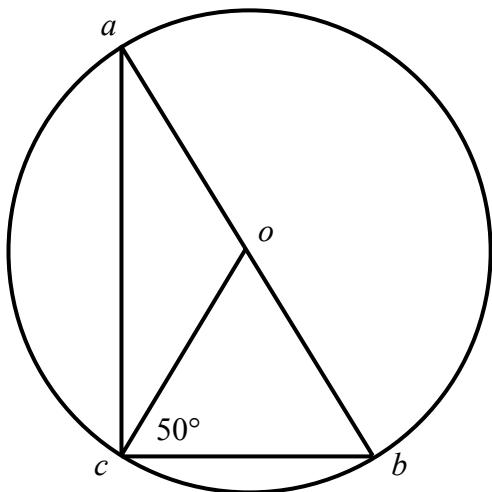
- (c)** In the triangle  $abc$ ,  $bc \parallel de$ ,  $|ae| = |de| = 6$  and  $|bd| = \frac{1}{2} |ce|$ .  
 $|bc| = 10$ .

- (i)** Find  $|ce|$ .  
**(ii)** Find  $|ad|$ .  
**(iii)** Find  $|ab|$ .



4. (a)  $[ab]$  is the diameter of a circle of centre  $o$ .  
 $|\angle ocb| = 50^\circ$ .

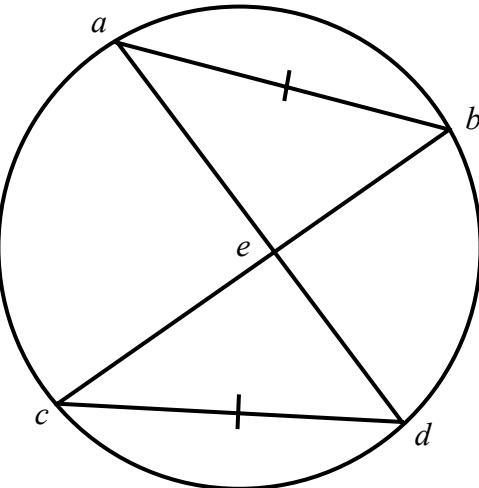
- (i) Find  $|\angle boc|$ .  
(ii) Find  $|\angle bac|$ .



- (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)  $[ab]$  and  $[cd]$  are chords of the circle as shown and  $|ab| = |cd|$ .  
The chords  $[ad]$  and  $[bc]$  intersect at the point  $e$ .

- (i) State why  $|\angle bad| = |\angle bcd|$ .  
(ii) Prove that the triangles  $bae$  and  $dce$  are congruent.  
(iii) Prove  $|ad| = |bc|$ .

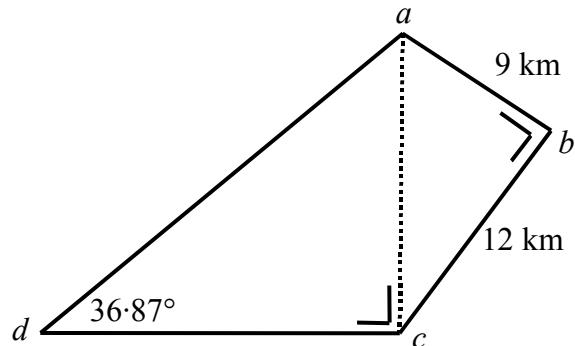


5. (a) If  $\sin A = -\frac{1}{2}$ , find the two values for the angle  $A$ , where  $0^\circ \leq A \leq 360^\circ$ .

- (b) In the diagram opposite,  $abcd$  represents the course in a triathlon.

Competitors must swim the 9 km from  $a$  to  $b$ , then run the 12 km from  $b$  to  $c$  and cycle from  $c$  to  $d$  and back to  $a$ .

$$|\angle adc| = 36.87^\circ.$$

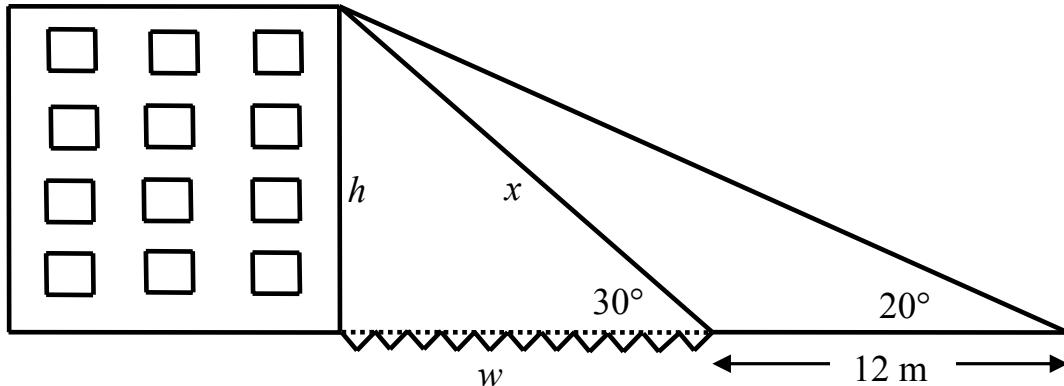


- (i) Find the distance from  $a$  to  $c$ .

- (ii) Find the distance from  $c$  to  $d$ , correct to the nearest km.

- (iii) Find the total length of the course.

(c)



The diagram shows an office block built on a river bank. From a point on the opposite river bank the angle of elevation of the top of the office block is  $30^\circ$ . From a point 12 m further back the angle of elevation is  $20^\circ$ .

- (i) Find  $x$ , correct to 2 decimal places.

- (ii) Find  $h$ , the height of the office block, correct to 2 decimal places.

- (iii) Find  $w$ , the width of the river, correct to 2 decimal places.

6. (a) In 4 games, a soccer player scored 1,  $x$ , 4 and 3 goals respectively.

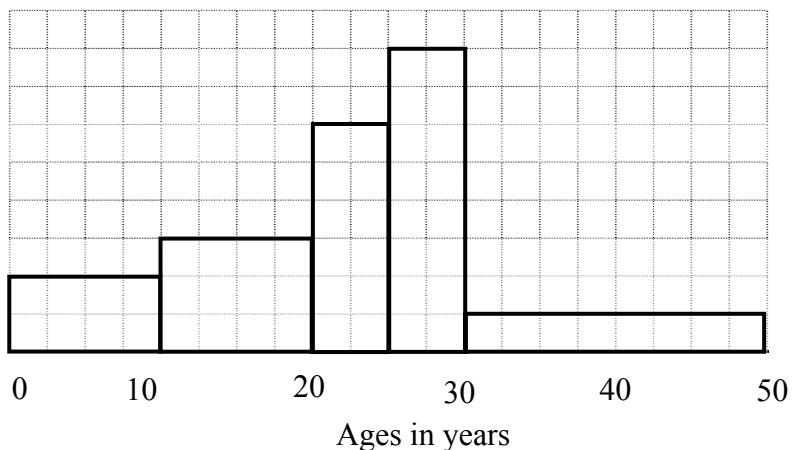
The mean number of goals scored by the player per game was 2.

Find the number of goals scored in the second game i.e. the value of  $x$ .

- (b) Over a period of one month, the owner of a factory recorded the number of days that each of his 50 employees was absent from work. The following table shows the results.

No. days absent	0	1	2	3	4	5
No. of employees	7	9	11	12	7	4

- (i) Find the mean number of days the employees were absent.
- (ii) Find the percentage of employees who were absent for more than the mean number of days.
- (iii) Write down the mode.
- (c) The distribution of the ages of people living in an apartment block is shown in the histogram below.



- (i) Given that there are 10 people in the 0 – 10 age group, copy and complete the frequency table below.

Ages in years	0 – 10	10 – 20	20 – 25	25 – 30	30 – 50
No. of people	10				

[Note: 10 – 20 means 10 years or more but less than 20 years old, etc.]

- (ii) Copy and complete the cumulative frequency table below.

Ages in years	< 10	< 20	< 25	< 30	< 50
No. of people					

- (iii) Construct an ogive and use it to estimate the median age.

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