



**Coimisiún na Scrúduithe Stáit  
State Examinations Commission**

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**LEAVING CERTIFICATE EXAMINATION, 2010**

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**MATHEMATICS – ORDINARY LEVEL**

**PAPER 2 ( 300 marks )**

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**MONDAY, 14 JUNE – MORNING, 9:30 to 12:00**

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Attempt **FIVE** questions from **Section A** and **ONE** question from **Section B**.  
Each question carries 50 marks.

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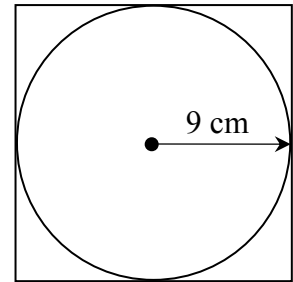
**WARNING: Marks will be lost if all necessary work is not clearly shown.**

**Answers should include the appropriate units of measurement,  
where relevant.**

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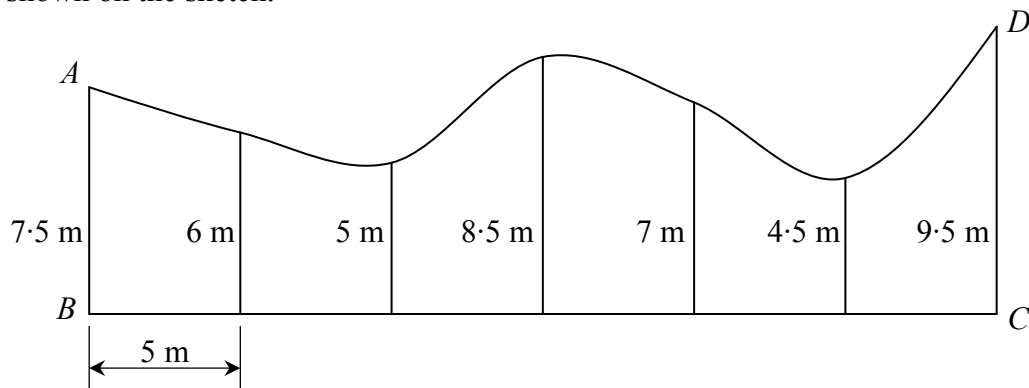
**SECTION A**  
**Attempt FIVE questions from this section.**

1. (a) A circle is inscribed in a square as shown.  
The radius of the circle is 9 cm.



- (i) Find the perimeter of the square.  
(ii) Calculate the area of the square.

- (b) The diagram shows a sketch of a field  $ABCD$  that has one uneven edge. At equal intervals of 5 m along  $[BC]$ , perpendicular measurements are made to the uneven edge, as shown on the sketch.



- (i) Use Simpson's rule to estimate the area of the field.  
(ii) The actual area of the field is  $200 \text{ m}^2$ .  
Find the percentage error in the estimate.

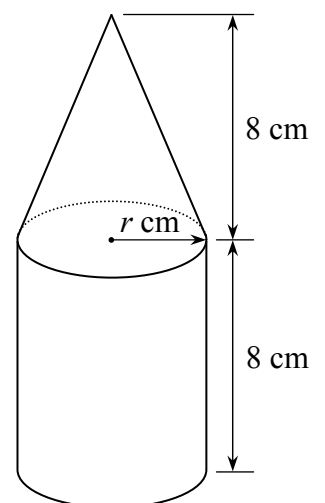
- (c) The diameter of a solid metal sphere is 9 cm.

- (i) Find the volume of the sphere in terms of  $\pi$ .

The sphere is melted down. All of the metal is used to make a solid shape which consists of a cone on top of a cylinder, as shown in the diagram.

The cone and the cylinder both have height 8 cm.  
The cylinder and the base of the cone both have radius  $r$  cm.

- (ii) Calculate  $r$ , correct to one decimal place.



2. (a) Find the area of the triangle with vertices  $(0, 0)$ ,  $(8, -6)$  and  $(-1, 5)$ .

(b)  $l$  is the line  $3x - 4y - 15 = 0$ .

(i) Verify that  $(1, -3)$  is a point on  $l$ .

(ii)  $l$  intersects the  $x$ -axis at  $P$ . Find the co-ordinates of  $P$ .

The line  $k$  passes through the point  $(1, -3)$  and is perpendicular to  $l$ .

(iii) Show the lines  $l$  and  $k$  on a co-ordinate diagram.

(iv) Find the equation of  $k$ .

(c)  $A(2, -1)$  and  $B(-4, 7)$  are two points.

(i) Find  $|AB|$ .

(ii) Find  $C$ , the image of  $B$  under the translation  $(2, -1) \rightarrow (-7, 11)$ .

(iii) Show that  $|AB| : |AC| = 2 : 5$ .

3. (a) A circle with centre  $(0, 0)$  passes through the point  $(5, -12)$ .

(i) Find the radius of the circle.

(ii) Write down the equation of the circle.

(b) The circle  $c$  has equation  $x^2 + y^2 = 17$ .

$l$  is the line  $x - 4y - 17 = 0$ .

The line  $l$  is a tangent to  $c$  at the point  $T$ .

(i) Find the co-ordinates of  $T$ .

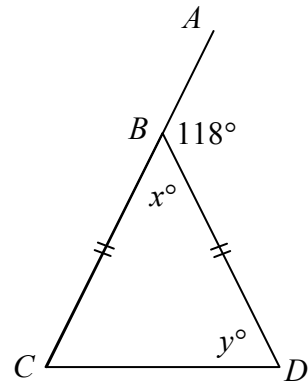
(ii) The point  $T$  is one end-point of a diameter of  $c$ .  
Find the co-ordinates of the other end-point.

(c) A circle has equation  $x^2 + (y - 7)^2 = 100$ .

(i) Write down the co-ordinates of the centre of the circle and the radius of the circle.

(ii) The point  $(6, h)$  is on the circle. Find the two possible values of  $h$ .

4. (a) In the diagram,  
 $|BC| = |BD|$  and  $|\angle ABD| = 118^\circ$ .



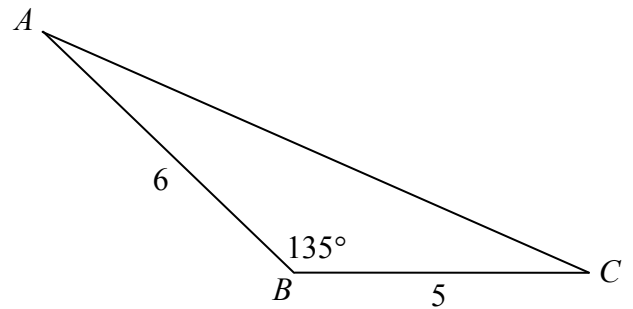
- (i) Find  $x$ .  
(ii) Find  $y$ .

- (b) Prove that if three parallel lines make intercepts of equal length on a transversal, then they will also make intercepts of equal length on any other transversal.

- (c) (i) Draw a square  $OABC$  with side 4 cm and label the vertices.  
(ii) Draw the image of the square under the enlargement with centre  $O$  and scale factor 2.5.  
(iii) Calculate the ratio  
area of image square : area of original square.  
(iv) Another square,  $OPQR$ , is the image of the square  $OABC$  under a different enlargement with centre  $O$ .  
The area of  $OPQR$  is  $324 \text{ cm}^2$ .  
Calculate the scale factor of this enlargement.

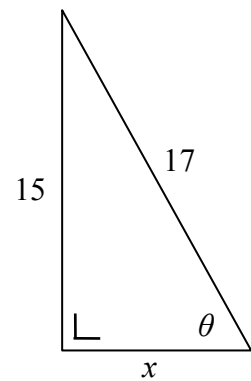
5. (a) In the triangle  $ABC$ ,  
 $|AB| = 6$  cm,  $|BC| = 5$  cm  
 and  $|\angle ABC| = 135^\circ$ .

Calculate the area of the triangle,  
 correct to the nearest square centimetre.



- (b) Consider the right-angled triangle shown in the diagram.

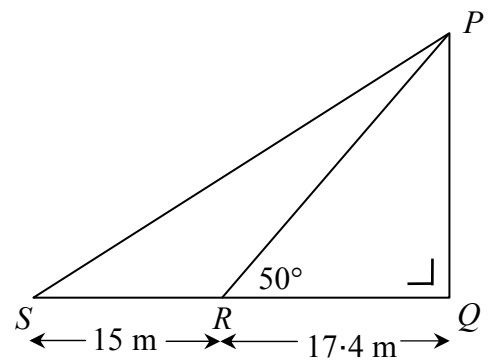
- (i) Find the value of  $x$ .  
 (ii) Write down, as a fraction, the value of  $\sin \theta$ .  
 (iii) Write down, as a fraction, the value of  $\cos \theta$ .  
 (iv) Find the value of  $\sin 2\theta$ .



- (c) A vertical mast  $[PQ]$  is supported by two straight cables  $[PS]$  and  $[PR]$ , as shown.

The cables are joined to level ground at  $S$  and  $R$  where  $|SR| = 15$  m,  $|RQ| = 17.4$  m  
 and  $|\angle PRQ| = 50^\circ$ .

- (i) Find  $|PR|$ , correct to the nearest metre.  
 (ii) Find  $|PS|$ , correct to the nearest metre.



- 6. (a) (i)** In how many different ways can a committee of four people be selected from ten people?
- (ii)** If one particular person must be on the committee, in how many different ways can the committee be selected?

- (b)** Tickets for a raffle are placed in a box.  
The box contains 15 blue tickets and 10 red tickets.  
Tickets are drawn at random from the box and they are not replaced.

What is the probability that

- (i)** the first ticket drawn is red
- (ii)** the first ticket drawn and the second ticket drawn are both red
- (iii)** the first ticket drawn is red and the second ticket drawn is blue
- (iv)** the first two tickets drawn are different in colour?
- (c)** A code consists of a four-digit number which is formed from the digits 3 to 9 inclusive. No digit can occur more than once in the code.
- (i)** Write down the smallest possible four-digit code.
- (ii)** How many different codes are possible?
- (iii)** How many of the four-digit codes are greater than 6000?
- (iv)** How many of the four-digit codes are divisible by 2?

7. (a) The following table gives the distribution of donations, in euro, made by 20 people to an appeal fund:

Amount of donation, €	5 - 15	15 - 25	25 - 35	35 - 65
Number of people	2	4	8	6

[Note: 5 - 15 means 5 or over but less than 15 etc.]

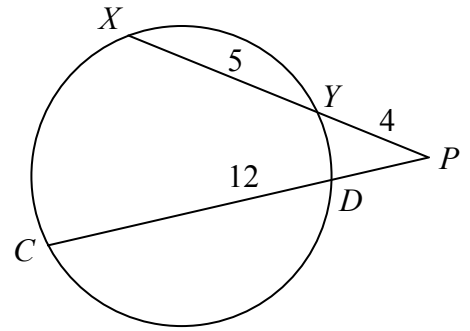
- (i) Draw a histogram to represent the data.
  - (ii) Taking mid-interval values, calculate the mean amount donated.
  - (iii) Taking mid-interval values, calculate the standard deviation, correct to one decimal place.
- (b) The cumulative frequency table below refers to the scores, in an aptitude test, of 400 candidates who applied for places on a particular course:

Score	$\leq 20$	$\leq 40$	$\leq 60$	$\leq 80$	$\leq 100$
Cumulative frequency	40	150	300	380	400

- (i) Draw the cumulative frequency curve.
- (ii) Use your curve to estimate the median score.
- (iii) Candidates who scored above 65 in the test were called for interview. Use your curve to estimate the number of candidates who were called for interview.

**SECTION B**  
**Attempt ONE question from this section.**

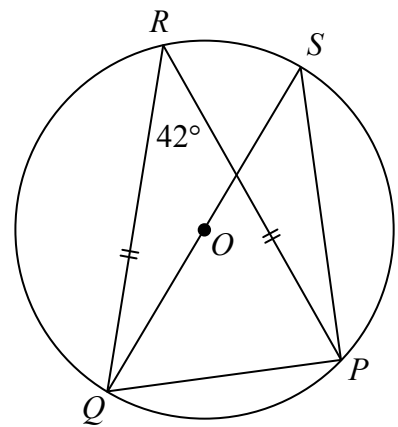
8. (a)  $[XY]$  and  $[CD]$  are chords of a circle which, when produced, intersect at a point  $P$  outside the circle.  
 $|XY| = 5$ ,  $|YP| = 4$  and  $|CP| = 12$ .



- (i) Find  $|XP|$ .  
(ii) Find  $|PD|$ .

- (b) Prove that a line is a tangent to a circle at a point  $T$  of the circle if and only if it passes through  $T$  and is perpendicular to the line through  $T$  and the centre.

- (c) In the diagram,  $O$  is the centre of the circle and  $|\angle PRQ| = 42^\circ$ .  
 $[QS]$  is a diameter and  $|RQ| = |PR|$ .

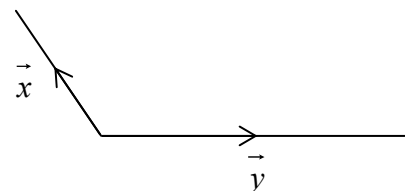


- (i) Find  $|\angle PSQ|$ .  
(ii) Find  $|\angle SQP|$ .  
(iii) Find  $|\angle QPR|$ .  
(iv) Find  $|\angle RQS|$ .

9. (a) Let  $\vec{p} = 7\vec{i} + 9\vec{j}$  and  $\vec{q} = -2\vec{i} + 3\vec{j}$ .  
(i) Express  $\vec{p} + \vec{q}$  in terms of  $\vec{i}$  and  $\vec{j}$ .  
(ii) Hence, calculate  $|\vec{p} + \vec{q}|$ .

- (b) The diagram shows the vectors  $\vec{x}$  and  $\vec{y}$ .  
Draw separate diagrams to show each of the following vectors:

- (i)  $\vec{y} - \vec{x}$   
(ii)  $2\vec{x} + \vec{y}$   
(iii)  $\frac{1}{2}\vec{x} - \vec{y}$ .



- (c) Let  $\vec{r} = 12\vec{i} - 9\vec{j}$  and  $\vec{s} = 9\vec{i} + 12\vec{j}$ .  
(i) Show that  $\vec{r} \perp \vec{s}$ .  
(ii) If  $\vec{OR} + 3\vec{RU} = \vec{OS}$ , express  $\vec{u}$  in terms of  $\vec{i}$  and  $\vec{j}$ .



10. (a) Expand  $(1 - x)^6$  fully.

(b) The starting salary for a job is €24 000 per annum. At the end of each year of employment the annual salary increases by 3%.

(i) What will the annual salary be after the first increase?

(ii) What will the annual salary be after the fourth increase?  
Give your answer correct to the nearest euro.

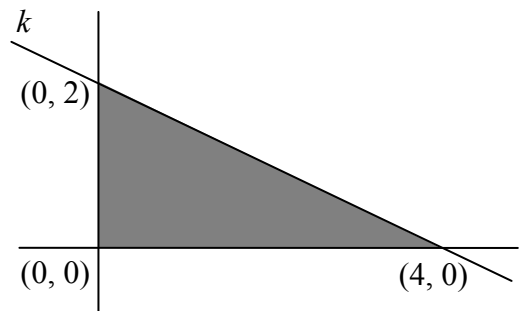
(c) (i) The first term of a geometric series is 5. The sum to infinity of the series is 10. Find the common ratio.

(ii) Write the recurring decimal  $0.1333\dots$  as an infinite geometric series and hence in the form  $\frac{a}{b}$ , where  $a, b \in \mathbb{N}$ .

11. (a) The line  $k$  passes through the points  $(0, 2)$  and  $(4, 0)$ .

(i) Find the equation of  $k$ .

(ii) Write down the three inequalities which define the shaded region in the diagram.



(b) A contractor has the task of loading containers onto a truck. There are two types of container: heavy containers which weigh 160 kg each and light containers which weigh 40 kg each. The truck can carry, at most, a total weight of 2080 kg.

The time taken to load a heavy container is 3 minutes. The time taken to load a light container is 2 minutes. The total time spent loading a truck cannot be greater than 54 minutes.

(i) Taking  $x$  as the number of heavy containers and  $y$  as the number of light containers, write down two inequalities in  $x$  and  $y$  and illustrate these on graph paper.

(ii) The contractor charges €48 to load each heavy container and €36 to load each light container. How many of each should be loaded in order to maximise income?

(iii) On your graph, show the region where the income is at most €576.

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