



Coimisiún na Scrúduithe Stáit State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2009

MATHEMATICS – ORDINARY LEVEL

PAPER 2 (300 marks)

MONDAY, 8 JUNE – MORNING, 9:30 to 12:00

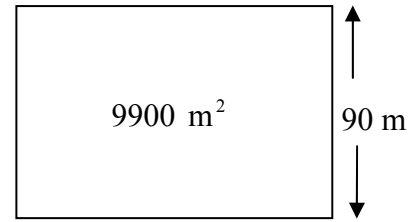
Attempt **FIVE** questions from **Section A** and **ONE** question from **Section B**.
Each question carries 50 marks.

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

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

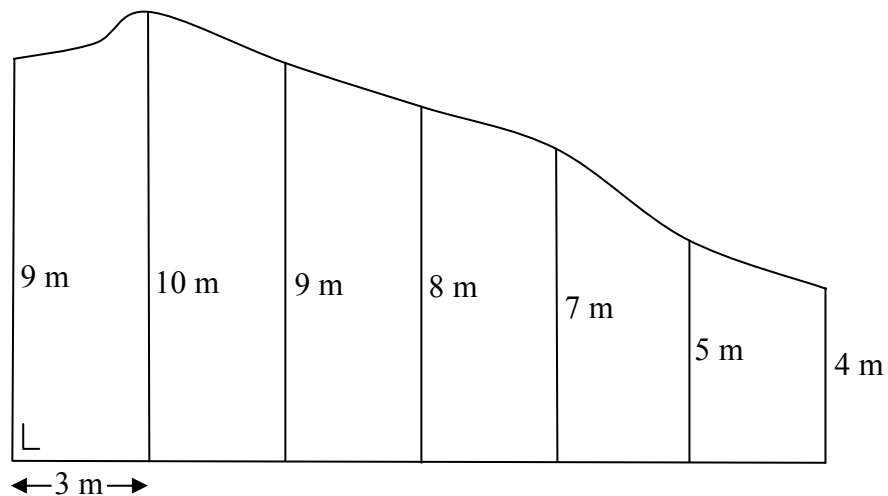
SECTION A
Attempt FIVE questions from this section.

1. (a) The area of a rectangular playing pitch is 9900 m^2 .
 The width of the playing pitch is 90 m.



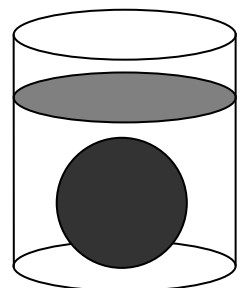
- (i) Find the length of the playing pitch.
 (ii) Find the perimeter of the playing pitch.

- (b) The sketch shows the garden of a house. At equal intervals of 3 m along one side, perpendicular measurements are made to the boundary, as shown on the sketch.



- (i) Use Simpson's rule to estimate the area of the garden.
 (ii) The owner of the house digs an ornamental pond in the garden. The surface area of the pond is 7 m^2 .
 What percentage of the area of the garden is taken up by the pond?
 Give your answer correct to the nearest percent.

- (c) (i) The volume of a sphere is $36\pi \text{ cm}^3$.
 Find the radius of the sphere.
 (ii) When the sphere is fully immersed in a cylinder of water,
 the level of the water rises by 2.25 cm.
 Find the radius of the cylinder.



2. (a) $a(-2, 1)$ and $b(4, 5)$ are two points.
- (i) Plot the points a and b on a co-ordinate diagram.
 - (ii) Find the slope of ab .
 - (iii) Find the equation of ab .
- K is the line $3x + 2y - 9 = 0$.
- (iv) Show that K passes through the midpoint of $[ab]$.
 - (v) Show that K is perpendicular to ab .
- (b) $p(3, 0)$ is a point.
- t and s are two distinct points on the y -axis and $|pt| = |ps| = 5$.
- (i) Find the co-ordinates of t and the co-ordinates of s .
 - (ii) Find the area of the triangle tsp .
 - (iii) $ptus$ is a parallelogram in which $[ts]$ is a diagonal.
Find the co-ordinates of the point u .

3. (a) The circle C has equation $x^2 + y^2 = 25$.
- (i) Write down the radius of C .
 - (ii) Verify that the point $(4, -3)$ is on C .
 - (iii) The line T is a tangent to C at the point $(4, -3)$. Find the equation of T .
 - (iv) On a co-ordinate diagram, draw the circle C and the tangent T .
 - (v) L is a tangent to C and L is parallel to the x -axis.
Find the two possible equations of L .

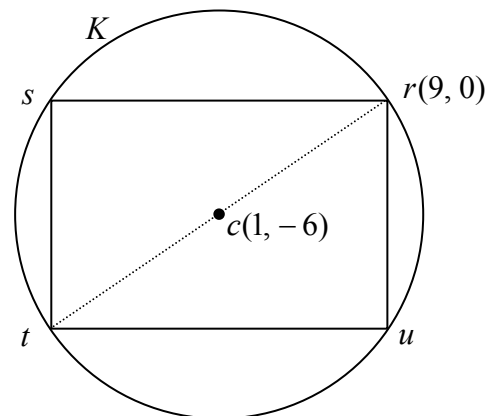
- (b) The point $c(1, -6)$ is the centre of the circle K , as shown.

The point $r(9, 0)$ is on the circle.

- (i) Find the radius of the circle.
- (ii) Write down the equation of the circle.

The vertices of the rectangle $rstu$ are on the circle and sr is horizontal.

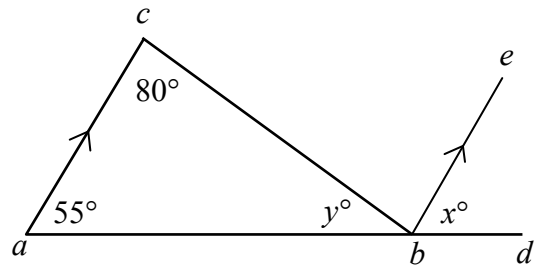
- (iii) Find the co-ordinates of t , the co-ordinates of s and the co-ordinates of u .



4. (a) In the diagram, ac is parallel to be ,
 $|\angle bca| = 80^\circ$ and $|\angle cab| = 55^\circ$.

(i) Find x .

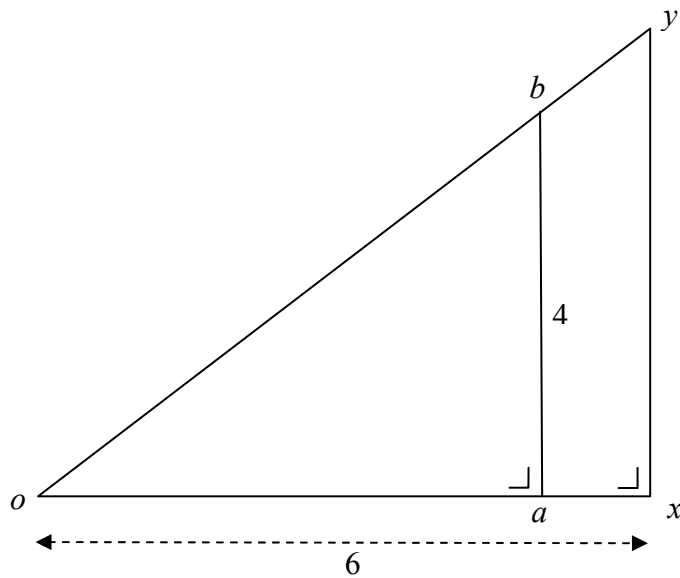
(ii) Find y .



- (b) Prove that the sum of the lengths of any two sides of a triangle is greater than that of the third side.

- (c) The right-angled triangle oxy is the image of the triangle oab under the enlargement of centre o and scale factor 1.2 .

$|ab| = 4$ and $|ox| = 6$.



(i) Find $|xy|$.

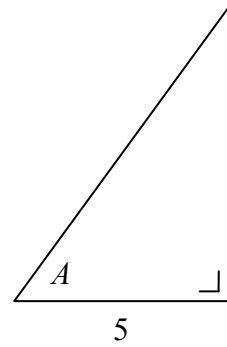
(ii) Find $|oa|$.

(iii) Find the area of the triangle oab .

(iv) Find the area of the figure $axyb$.

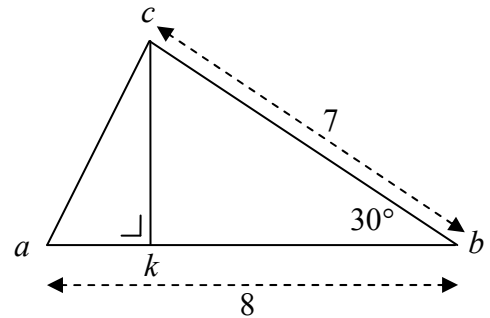
5. (a) The length, 5, of a side of the right-angled triangle is shown and A is the angle indicated, where $\tan A = \frac{7}{5}$.

- (i) Copy the diagram into your answer book and on it mark the side of length 7.
- (ii) Find the length of the third side.

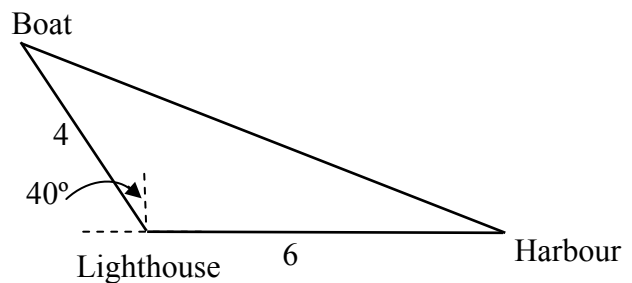


- (b) In the triangle abc ,
 $|ab| = 8$ cm, $|bc| = 7$ cm
 and $|\angle abc| = 30^\circ$.

- (i) Find the area of the triangle abc .
- (ii) Given that $ck \perp ab$, find $|ck|$.
- (iii) Given that $|ac| = 4$ cm, find $|\angle kca|$ correct to the nearest degree.



- (c) A harbour is 6 km due East of a lighthouse.
 A boat is 4 km from the lighthouse.
 The bearing of the boat from the lighthouse is $N 40^\circ W$.



- (i) How far is the boat from the harbour?
 Give your answer correct to one decimal place.
- (ii) Find the bearing of the boat from the harbour.
 Give your answer correct to the nearest degree.

6. (a) (i) Evaluate $\binom{7}{2}$.

(ii) Evaluate $\binom{7}{2} + \binom{7}{5}$.

- (b) There are 210 boys and 240 girls in a school. The school has a junior cycle and a senior cycle. The number of boys and the number of girls in each cycle is shown in the table.

	Boys	Girls
Junior cycle	120	130
Senior cycle	90	110

- (i) A student is picked at random.
What is the probability that the student is a boy?
- (ii) A student is picked at random.
What is the probability that the student is in the senior cycle?
- (iii) A junior cycle student is picked at random.
What is the probability that the student is a girl?
- (iv) A boy is picked at random.
What is the probability that he is in the senior cycle?
- (c) Three boys and two girls are seated in a row as a group.
In how many different ways can the group be seated if
- (i) there are no restrictions on the order of seating
- (ii) there must be a boy at the beginning of the row
- (iii) there must be a boy at the beginning of the row and a boy at the end of the row
- (iv) the two girls must be seated beside each other?

7. (a) Find the median of the numbers

3, 9, 2, 1, 13, 5, 8.

- (b) A car-park opens at 07:30. The number of cars entering the car-park during 15 minute intervals on a particular morning is recorded in the following table:

Time	07:30 - 07:45	07:45 - 08:00	08:00 - 08:15	08:15 - 08:30	08:30 - 08:45	08:45 - 09:00
Number of cars	20	40	100	165	105	50

[Note: 07:30 - 07:45 means 07:30 or later, but not including 07:45 etc.]

- (i) How many cars entered the car-park from 07:45 to 08:30?
- (ii) What was the maximum number of cars that could have entered the car park by 08:20?
- (iii) Copy and complete the following cumulative frequency table:

Time	Before 07:45	Before 08:00	Before 08:15	Before 08:30	Before 08:45	Before 09:00
Number of cars						

- (iv) Draw the cumulative frequency curve (ogive).

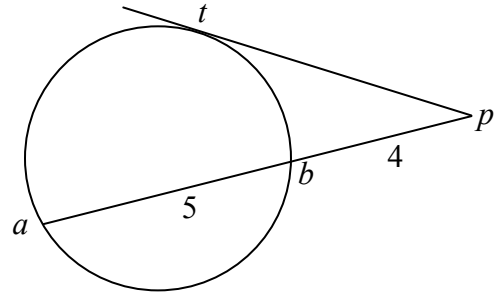
Use your curve to estimate

- (v) the median time
- (vi) the number of cars that had entered the car-park by 08:10
- (vii) the time by which 75% of the cars had entered the car-park.

SECTION B
Attempt ONE question from this section.

8. (a) pt is a tangent to the circle at t .
 pa intersects the circle at b .
 $|ab| = 5$ and $|bp| = 4$.

- (i) Find $|pa|$.
(ii) Find $|pt|$.

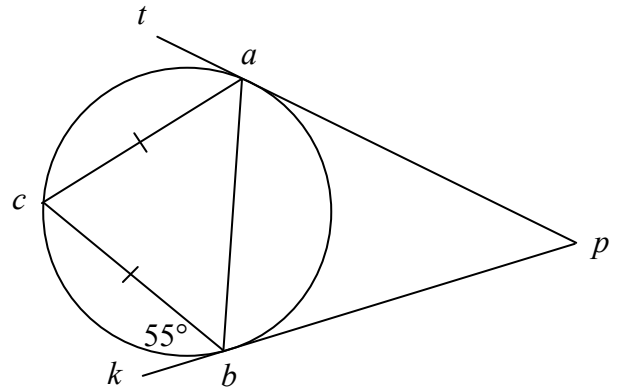


- (b) Prove that an angle between a tangent ak and a chord $[ab]$ of a circle has degree-measure equal to that of any angle in the alternate segment.

- (c) pt and pk are tangents to the circle at a and b , respectively.

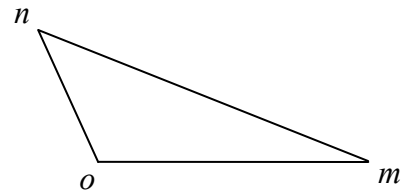
c is a point on the circle such that
 $|ca| = |cb|$ and $|\angle kbc| = 55^\circ$.

- (i) Find $|\angle bac|$.
(ii) Find $|\angle cba|$.
(iii) Find $|\angle acb|$.
(iv) Find $|\angle bpa|$.



9. (a) The diagram shows the triangle omn , where o is the origin. Copy the diagram into your answerbook and on it show

- (i) the point r such that $\vec{r} = -\vec{n}$
(ii) the point s such that $\vec{s} = \vec{m} + \vec{n}$.



- (b) Let $\vec{a} = 7\vec{i} + \vec{j}$ and $\vec{b} = 5\vec{i} - 5\vec{j}$.

- (i) Express $\vec{a} + \vec{b}$ in terms of $\vec{i}$ and $\vec{j}$.
(ii) Express $\vec{a}\vec{b}$ in terms of $\vec{i}$ and $\vec{j}$.
(iii) Hence, or otherwise, calculate $(\vec{a} + \vec{b}) \cdot \vec{a}\vec{b}$, the dot product of $\vec{a} + \vec{b}$ and $\vec{a}\vec{b}$.
(iv) Is $(\vec{a} + \vec{b}) \perp \vec{a}\vec{b}$? Give a reason for your answer.

- (c) Let $\vec{p} = 2\vec{i} + 5\vec{j}$ and $\vec{q} = \vec{i} - \vec{j}$.

- (i) Find the scalars k and t such that $k\vec{p} + t\vec{q} = 14\vec{j}$.
(ii) Show that $|\vec{p} + \vec{q}| < |k\vec{p} + t\vec{q}|$.

10. (a) €6000 is invested at 5% per annum compound interest.
Find the value of the investment at the end of 10 years, correct to the nearest euro.

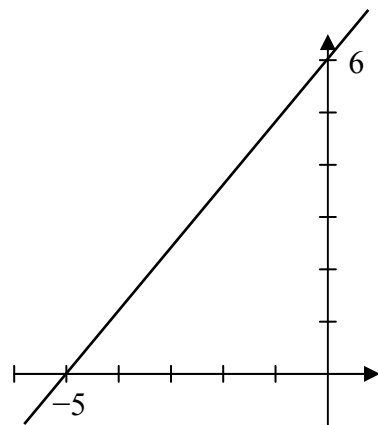
- (b) (i) Expand $(1+x)^5$ fully.
(ii) Simplify $(1+x)^5 - (1-x)^5$.
(iii) Hence, find the value of $(1+\sqrt{2})^5 - (1-\sqrt{2})^5$.
Give your answer in the form $k\sqrt{2}$, where $k \in \mathbf{N}$.

- (c) The first two terms of a geometric series are $6 + \frac{18}{4} + \dots$
(i) Find S_{20} , the sum of the first 20 terms of the series, correct to one decimal place.
(ii) Find S_{∞} , the sum to infinity of the series.
(iii) Find $S_{\infty} - S_{20}$.

11. (a) The diagram shows the line $6x - 5y + 30 = 0$.

- (i) Copy the diagram into your answer book
and on it show the set of points which satisfy
the inequality $6x - 5y + 30 \leq 0$.

- (ii) Using the same diagram, illustrate the inequality $y \geq 2$.



- (b) A person is setting up a new taxi firm. The firm will use medium-sized cars and large cars.

Each medium-sized car costs €20 000 and each large car costs €30 000.

The person has at most €300 000 to purchase the cars.

At any given time there are at most 13 drivers available to operate the taxis.

- (i) Taking x as the number of medium-sized cars and y as the number of large cars, write down two inequalities in x and y and illustrate these inequalities on graph paper.
(ii) The estimate of the monthly profit on a medium-sized car is €800 and on a large car is €900. How many of each type of car should the person buy to maximise profit?
(iii) On your graph, show the region where the monthly profit is at most €7200.

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