



Coimisiún na Scrúduithe Stáit State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2005

MATHEMATICS – HIGHER LEVEL


PAPER 2 (300 marks)

MONDAY, 13 JUNE – MORNING, 9:30 to 12:00

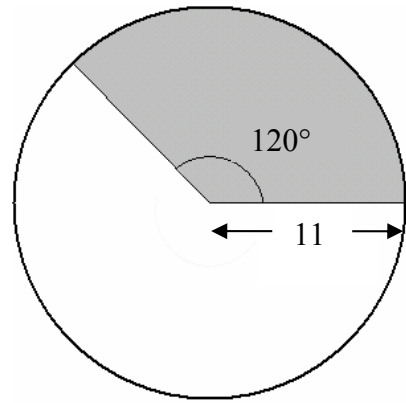
Attempt **ALL** questions.

Each question carries 50 marks.

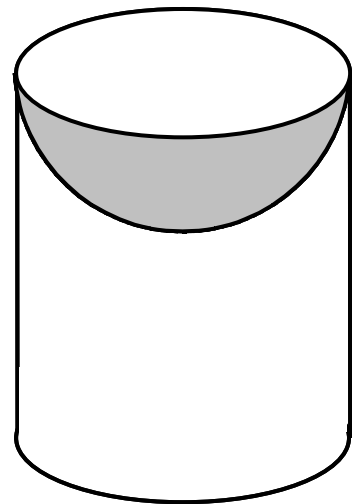
Graph paper may be obtained from the superintendent.

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

- 1. (a)**
- (i)** ✎ Find, correct to the nearest cm^2 ,
the area of a disc of radius 11 cm.
- (ii)** ✎ Find, correct to the nearest cm^2 ,
the area of the shaded region in
the diagram.



- (b)**
- (i)** A solid metal cylinder has height 20 cm
and diameter 14 cm.
- ✎ Find its curved surface area in
terms of π .
- (ii)** A hemisphere with diameter 14 cm is
removed from the top of this cylinder, as
shown.



- ✎ Find the total surface area of the
remaining solid in terms of π .

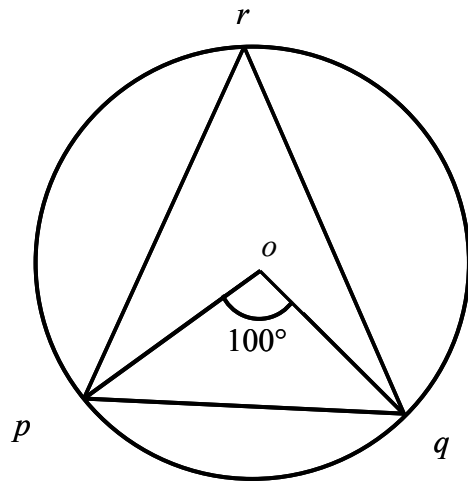
- (c)**
- (i)** A cone has radius x and height $3x$.
- ✎ Find its volume in term of π and x .
- (ii)** A second cone has twice the radius and half the height of the first cone.
- ✎ Find the ratio of the volume of the second cone to the
volume of the first.

- 2. (a)** $a(1, 4)$ and $b(-2, -1)$ are two points.
- (i) ✍ Find the slope of ab .
 - (ii) Find the equation of ab .
- (b)** L is the line $3x - 4y + 7 = 0$ and contains the point $p(-1, h)$.
 M is the line $4x + 3y - 24 = 0$ and contains the point $q(k, 0)$.
- (i) ✍ Find the values of h and k .
 - (ii) L and M intersect at the point r .
✍ Find the coordinates of r .
 - (iii) Show p, q, r, L and M on a coordinate diagram on graph paper.
 - (iv) ✍ Prove that $\angle prq$ is a right angle.
- (c)** ✍ Prove that a line through the centre of a circle perpendicular to a chord bisects the chord.

3. (a) o is the centre of the circle, as shown.

(i) Find $|\angle prq|$.

(ii)  Find $|\angle opq|$.



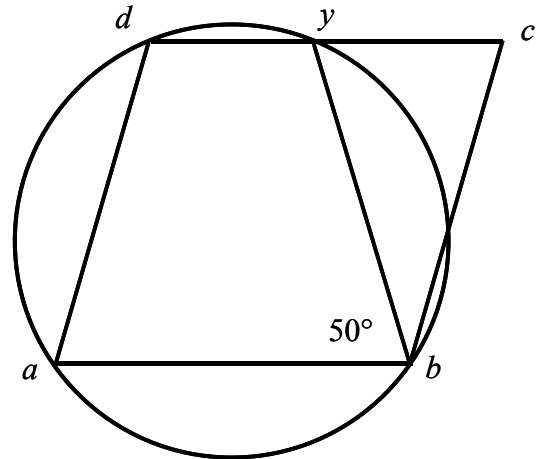
(b) Prove that the measure of the angle at the centre of a circle is twice the measure of the angle at the circumference, standing on the same arc.

(c) $abcd$ is a parallelogram and a, b, y and d are points on the circle.


$|\angle aby| = 50^\circ$.

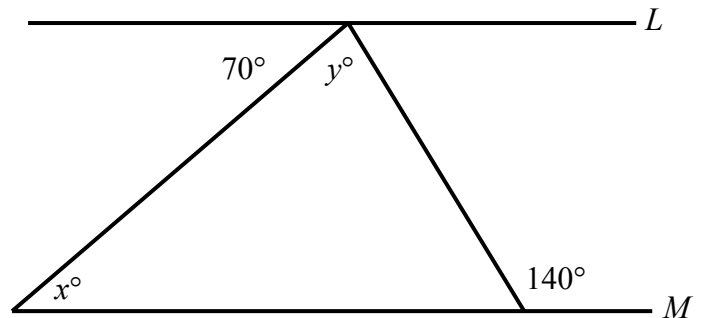
(i)  Find $|\angle ady|$.


(ii)  Prove $|by| = |bc|$.



4. (a) The line L is parallel to the line M .

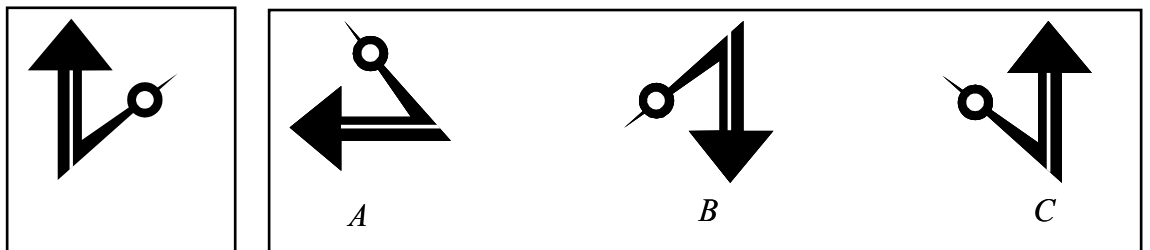
 Calculate the value of x and the value of y , in the diagram.



- (b) (i)  Show how to divide a line segment into three equal parts.

All construction lines must be clearly shown.



- (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.

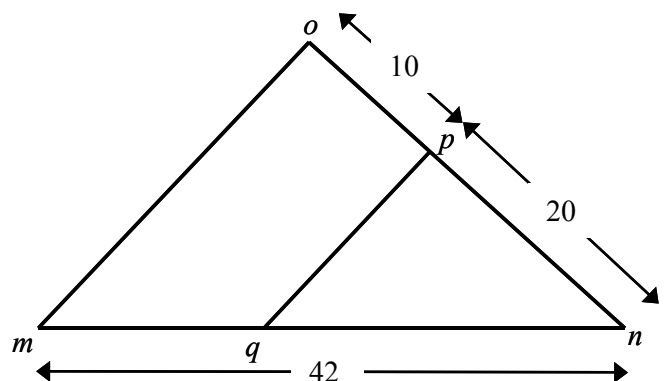



- (c) $[om]$ is parallel to $[pq]$.

$|op| = 10$ cm, $|pn| = 20$ cm

and $|mn| = 42$ cm.

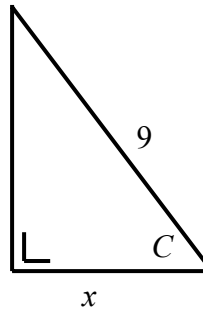
- (i)  Find $|qm|$.
- (ii)  If $|qm| = |pq|$, find $|om|$.



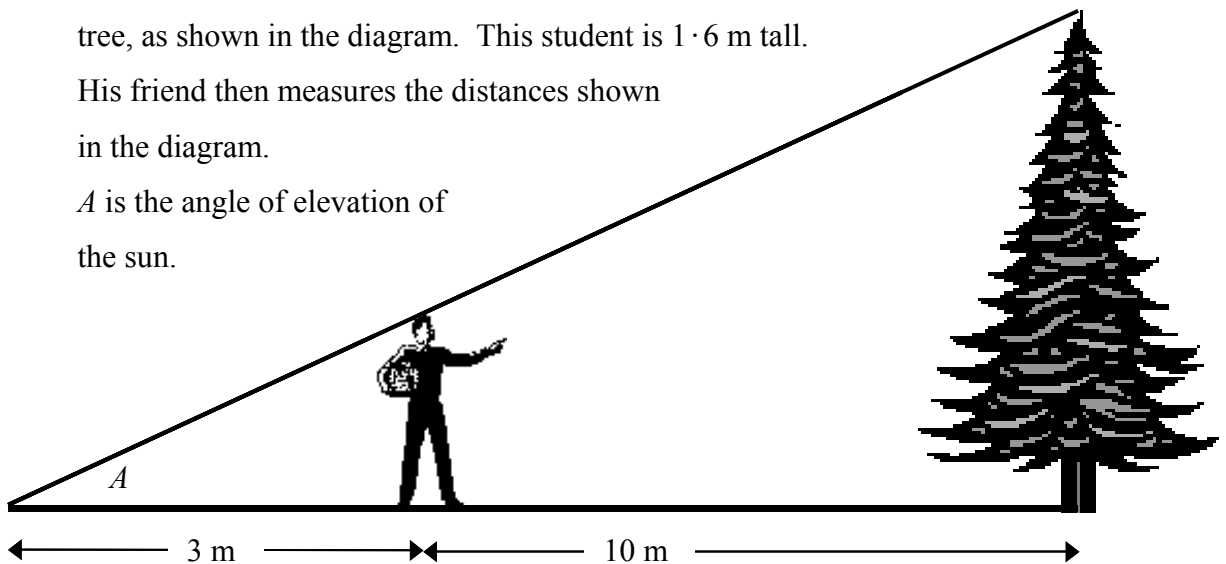
- (iii)  Find $\frac{\text{area } \Delta pqn}{\text{area } \Delta omn}$ as a fraction in its simplest form.

[Hint: area of $\Delta = \frac{1}{2} ab \sin C$].

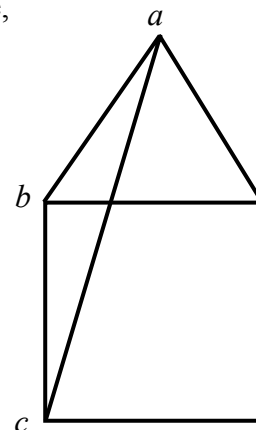
5. (a) ✎ Given that $\cos C = \frac{2}{3}$,
find the value of x .



- (b) Some students wish to estimate the height of a tree standing on level ground. One of them stands so that the end of his shadow coincides with the end of the shadow of the tree, as shown in the diagram. This student is 1.6 m tall. His friend then measures the distances shown in the diagram. A is the angle of elevation of the sun.



- (i) ✎ Find A , correct to the nearest degree.
- (ii) ✎ Find the height of the tree correct to one decimal place.
- (c) The diagram shows an equilateral triangle and a square, each of side 6. a is joined to c .



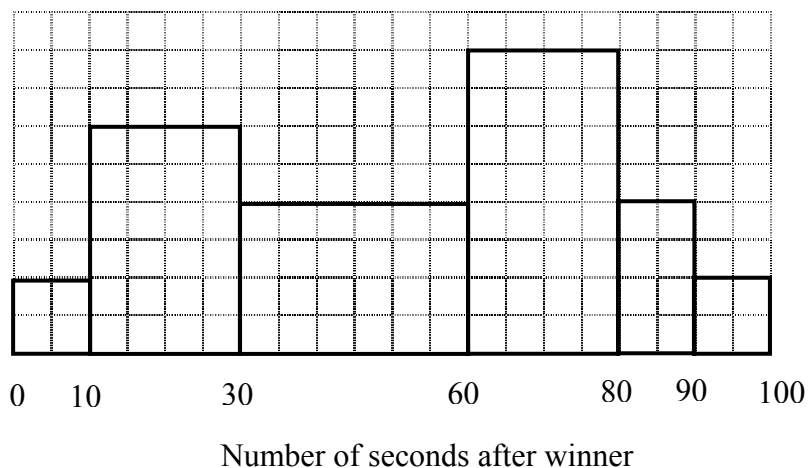
- (i) ✎ Find $|\angle abc|$ and $|\angle bac|$.
- (ii) ✎ Find $|ac|$, correct to one decimal place.

6. (a) ✎ 6 is the mean of the numbers 3, 1, 9, x , 5.

Find the value of x .

- (b) The times taken by a number of athletes to finish a race after the winner crossed the finish line were recorded.

The results are shown in the following histogram.



- (i) Given that there are 6 athletes in the 10 – 30 time interval, complete the following frequency table.

Number of seconds after winner	0 – 10	10 – 30	30 – 60	60 – 80	80 – 90	90 – 100
Number of athletes		6				

[Note: 10 – 30 means 10 or more but less than 30, etc.]

- (ii) ✎ Taking mid-interval values, calculate the mean time taken to finish the race after the winner, correct to the nearest second.

- (c) The number of people voting in a polling station on election day was recorded every two hours. The following are the results.

Time	8:00 – 10:00	10:00 – 12:00	12:00 – 14:00	14:00 – 16:00	16:00 – 18:00	18:00 – 20:00	20:00 – 22:00
Number of people	200	300	250	350	800	550	350

[Note: 10:00 – 12:00 means 10:00 or later but before 12:00, etc.]

- (i) Draw up a cumulative frequency table.
- (ii) On graph paper construct the ogive.
- (iii) ✎ Use your graph to estimate the number of people who cast their vote between 17:00 and 19:00.

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