



Coimisiún na Scrúduithe Stáit State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2010

MATHEMATICS – HIGHER LEVEL

PAPER 2 (300 marks)

MONDAY, 14 JUNE – MORNING, 9.30 to 12.00


Attempt **ALL** questions.

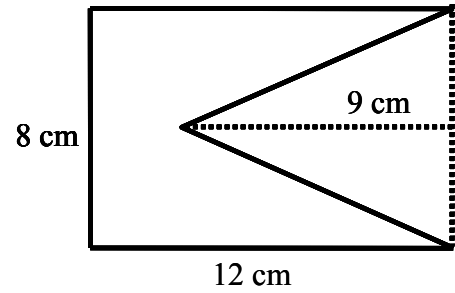
Each question carries 50 marks.

Graph paper may be obtained from the Superintendent.


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

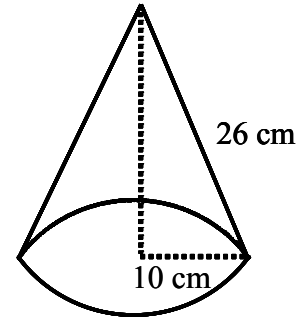
1. (a) The diagram shows a rectangular piece of cardboard with a triangular section cut out.

 Calculate the area of the cardboard.





- (b) A cone has a slant height of 26 cm and a radius of 10 cm.

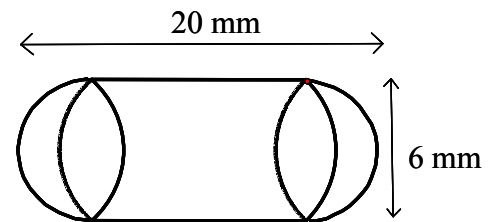
- (i)  Find the curved surface area of the cone, in terms of π .




The curved surface area of the cone is doubled, while the slant height remains the same.

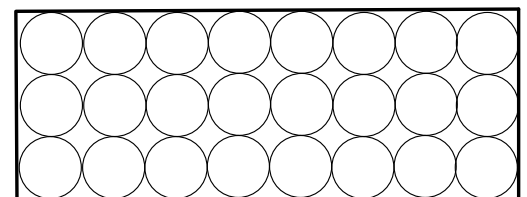
- (ii)  Find the radius and hence the vertical height of this cone, correct to the nearest cm.
- (iii)  Show that the volume of this cone is more than double the volume of the cone part (i).


- (c) A vitamin capsule is in the shape of a cylinder with hemispherical ends. The length of the capsule is 20 mm and the diameter is 6 mm.



- (i)  Calculate the volume of the capsule, giving your answer correct to the nearest mm^3 .

A course of these vitamins consists of 24 capsules. The capsules are stacked in three rows of eight in a box as shown in the diagram.



- (ii)  How much of the internal volume of the box is not occupied by the capsules.

2. (a) $M(-1, 2)$ is the midpoint of $[PQ]$ and P is the point $(-2, -4)$.

~~✍~~ Find the co-ordinates of Q .

(b) l is the line $2x - y + 6 = 0$.

(i) ~~✍~~ Find the slope of l .

(ii) ~~✍~~ Find the equation of the line m through $(5, 1)$ perpendicular to the line l .

(iii) ~~✍~~ T is the point of intersection between l and m .
Find the coordinates of T .

(c) A is the point $(1, -3)$, B is the point $(-2, 1)$, C is the point $(4, -2)$.

$D(2, -1)$ is a point on the line BC .

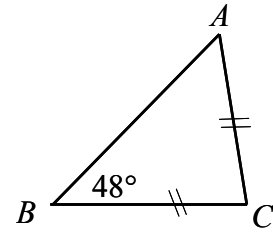
(i) ~~✍~~ Show that AD is perpendicular to BC .



(ii) ~~✍~~ Find $|BC|$.

(iii) ~~✍~~ Given that $|AD| = \sqrt{5}$, find the area of the triangle ABC .

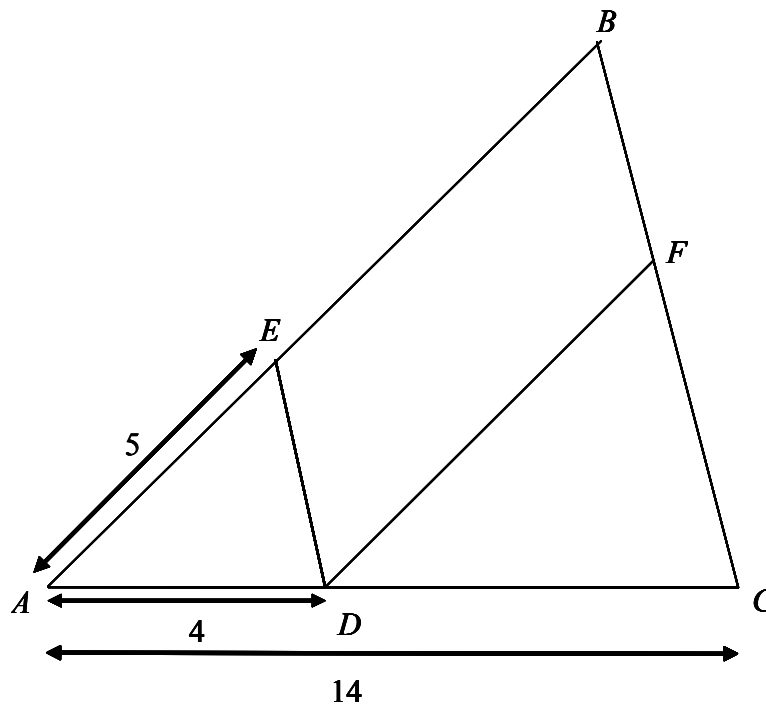
3. (a) The triangle ABC shown in the diagram is isosceles, with $|AC| = |BC|$ and $|\angle ABC| = 48^\circ$.

 Find $|\angle ACB|$.



- (b) (i)  Show how to construct the triangle XYZ , with sides $|XY| = 10$ cm, $|XZ| = 8$ cm and $|YZ| = 5$ cm.
- (ii)  Prove that an exterior angle of a triangle equals the sum of the two interior opposite angles in measure.


(c)



In the triangle ABC , $[DE]$ is parallel to $[CB]$, $|AD| = 4$ cm, $|AC| = 14$ cm and $|AE| = 5$ cm.

(i)  Find $|EB|$.

$[DF]$ is parallel to $[AB]$.

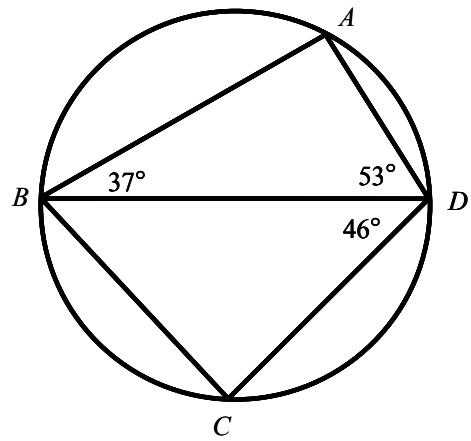
(ii)  Find $\frac{\text{area } \Delta ADE}{\text{area } \Delta DCF}$ as a fraction in its simplest form.

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

4. (a) A, B, C and D are points on the circle as shown.

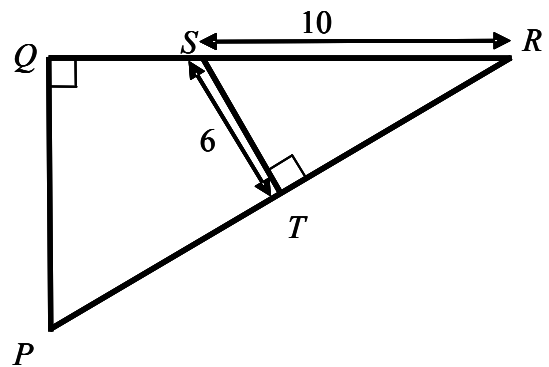
$$|\angle ABD| = 37^\circ \text{ and } |\angle ADB| = 53^\circ.$$

- (i) ✎ Explain why $[BD]$ is a diameter of the circle.
- (ii) ✎ Given that $|\angle BDC| = 46^\circ$, find $|\angle CBD|$.



- (b) ✎ Prove that in a right-angled triangle, the square of the length of the side opposite to the right angle is equal to the sum of the squares of the lengths of the other two sides.

- (c) PQR is a right angled triangle.
 T is the midpoint of $[PR]$.
 A line is drawn from T to meet $[QR]$ at S , such that $|\angle RTS|$ is a right angle.
 $|ST| = 6$ and $|SR| = 10$.

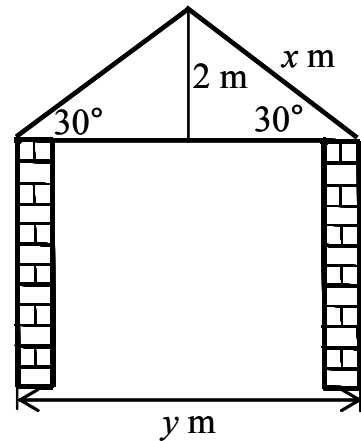


- (i) ✎ Find $|RT|$.
- (ii) ✎ Prove that $|\angle QPR| = |\angle TSR|$.
- (iii) ✎ Find $|PQ|$.

5. (a) ✎ Without using a calculator construct the angle A such that

$$6 \tan A = 8, \quad 0^\circ \leq A < 90^\circ.$$

- (b) A builder wants to construct a roof with a pitch of 30° . The height of the apex above the ceiling level is 2 m, as shown in the diagram.



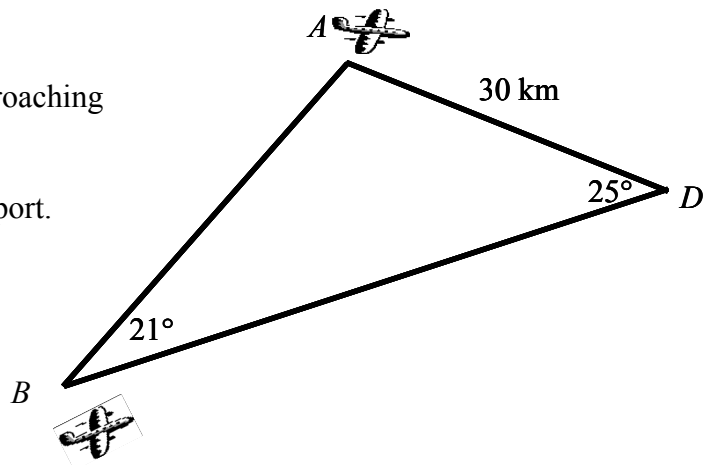
- (i) ✎ Calculate x , the length of the rafter.
- (ii) ✎ Calculate y , the length of the ceiling joist, correct to two decimal places.

- (c) Two planes, A and B , are approaching Dublin airport (D).

Plane A is 30 km from the airport.

$$|\angle ABD| = 21^\circ \text{ and}$$

$$|\angle ADB| = 25^\circ.$$




- (i) ✎ Find the distance plane B is from the airport, giving your answer correct to the nearest km.

Both planes travel at an average speed of 400 km/h on their approach to the airport.

- (ii) ✎ Calculate the time interval, in minutes, between the two planes landing.

6. (a) In Galway last year, there were 4320 small cars, 3780 medium cars and 1620 large cars sold.

 Illustrate this information on a pie chart.

- (b) The braking distance in metres, i.e. the distance travelled from when the brake is applied to when a car stops, is recorded for 50 drivers.


The cumulative frequency table below shows the results obtained.

Braking distance (m)	< 10	< 20	< 28	< 34	< 40
Number of Drivers	2	30	40	46	50

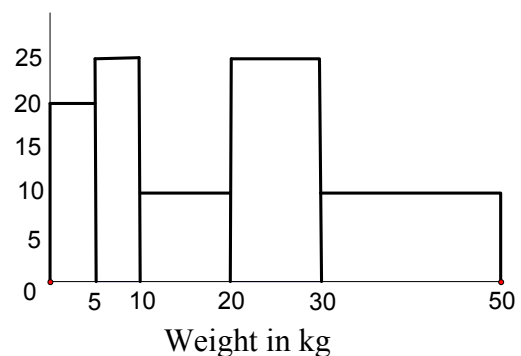
- (i) Copy and complete the following frequency table.

Braking distance (m)	0 – 10	10 – 20	20 – 28	28 – 34	34 – 40
Number of Drivers					

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

- (ii)  Taking mid-interval values, calculate the mean breaking distance, giving your answer correct to the nearest metre.

- (c) An airline recorded the weight of each passenger's baggage on a particular flight. The results are shown in the histogram.




- (i) Copy and complete the following frequency table in your answer book.

Weight in kg	0 – 5	5 – 10	10 – 20	20 – 30	30 – 50
No. of passengers	20				

[Note: 5 – 10 means 5 or more but less than 10, etc.]

- (ii) How many passengers were on the plane?
 (iii) The airline charged an excess baggage fee of €8 for every kg over 25 kg. The airline collected €2880 from passengers in the 30 – 50 kg group.

 What was the average excess baggage fee paid per passenger in the 30 – 50 kg group?

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