AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA

JUNIOR CERTIFICATE EXAMINATION, 1999

MATHEMATICS - HIGHER LEVEL

FRIDAY, 11 JUNE - MORNING, 9.30 to 12.00

PAPER 2 (300 marks)

Attempt **QUESTION 1** (100 marks) and **FOUR** other questions (50 marks each).

Marks may be lost if necessary work is not clearly shown.
Mathematics Tables may be obtained from the Superintendent.

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1. **(i)** A tank contains 125 litres of petrol. 50 litres are removed.
What percentage of the petrol remains in the tank?

(ii) Two squares have sides of length 4 cm and 10 cm, respectively.
Find, in its simplest form, the ratio of their areas.

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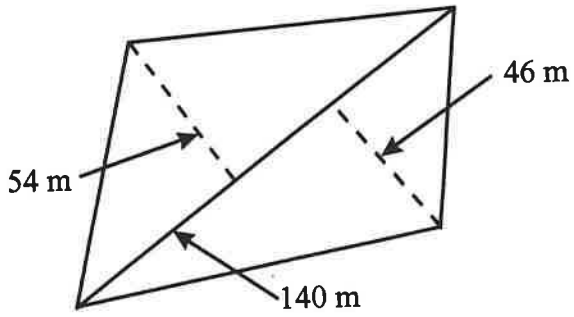
(iii) A fence joining two opposite corners of a four-sided field is 140 m in length.

The perpendicular distances from the other two corners to the fence are 54 m and 46 m.

Calculate the area of the field in m^2.



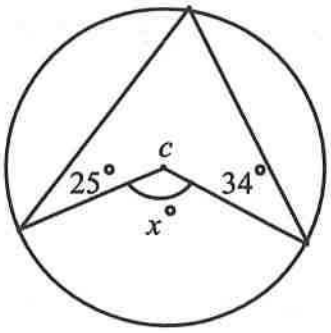
(iv) The length of the radius of the large circle in the diagram is 8 cm.

The length of the radius of the small circle is 1 cm.

Find the area of the shaded region, taking $\pi = \frac{22}{7}$.

(v) The centre of the circle is c.

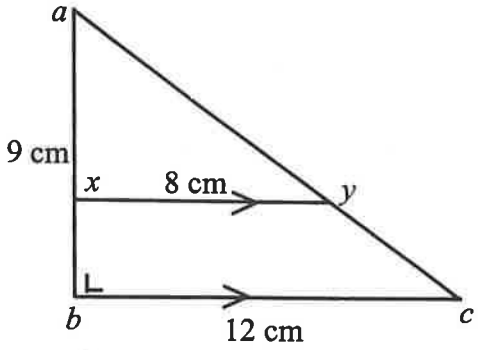
Find the value of x.



(vi) In the triangle abc, $|\angle abc| = 90°$, $|ab| = 9$ cm and $|bc| = 12$ cm.

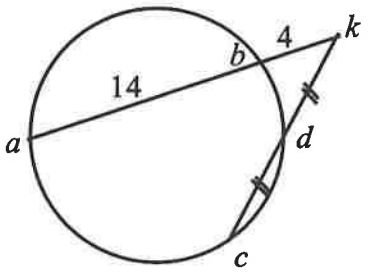
xy is parallel to bc and $|xy| = 8$ cm.

Calculate $|ay|$.



(vii) In the diagram $|ab| = 14$, $|bk| = 4$ and $|kd| = |dc|$.

Calculate $|kd|$.



(viii) Find the equation of the line containing the point (5, 1) and which is parallel to the line containing (0, 0) and (2, 4).

(ix) The image of the point $(-1, 4)$ under the axial symmetry in the line $x = 2$ is (h, k).

Find (h, k).

(x) If $4\tan 2A = 1$, find the measure of angle A as accurately as the Tables allow.

2. (a) $y = ax + a^3$ and $x = 3 - 2a^2$.

(i) Express y in terms of a.

(ii) Evaluate y when $a = 2$.

(b) A person's annual gross income is IR£18 000.

Tax free allowances amount to IR£5300. Tax is paid at 25% on the first IR£9000 of taxable income and at 45% on the remainder of taxable income.

(i) Calculate the tax paid.

The person's tax can be calculated by a simpler method under which the tax free allowance is increased and tax is paid at 45% on all of the taxable income. The person pays the same amount of tax.

Calculate

(ii) the person's taxable income when the simpler method is used

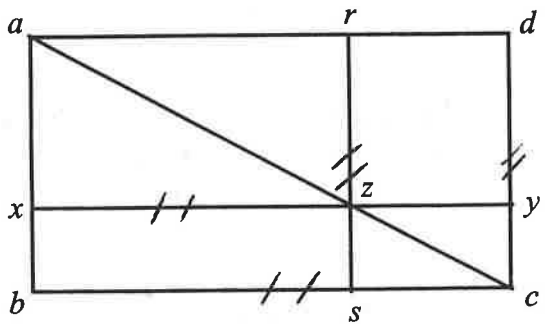
(iii) the amount by which the tax free allowance is increased.

3. (a) Prove that a line which is drawn parallel to one side of a triangle divides the other two sides in the same ratio.

(b) $abcd$ is a rectangle.

xy and rs intersect at z, a point on ac.

$xy \parallel bc$ and $rs \parallel dc$.



(i) Prove that $|ax| : |xb| = |ar| : |rd|$.

(ii) Prove that the rectangles $xbsz$ and $rzyd$ are equal in area.

4. Prove that any point on the perpendicular bisector of a given line segment is equidistant from the endpoints of the line segment.

Construct a triangle xyz in which $|xy| = 10$ cm, $|yz| = 8$ cm and $|xz| = 6$ cm.

Construct the circumcircle of the triangle, showing all your construction lines clearly.

Explain why the centre of the circumcircle is the midpoint of $[xy]$.

5. $a(1, -2)$, $b(-2, 3)$ and $c(3, 6)$ are three points.

(i) Find the coordinates of p, the midpoint of $[ac]$.

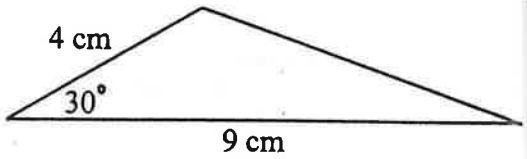
(ii) Show that $bp \perp ac$.

(iii) Show that $|ab| = |bc|$.

(iv) If $abcd$ is a parallelogram, find the coordinates of d.

(v) Find the area of $abcd$.

6. **(a)** Calculate the area of the triangle in the diagram.

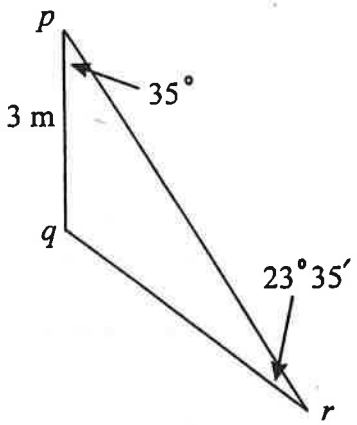


(b) A ladder which is 6 m long leans against a vertical wall. The foot of the ladder is on level ground at a distance of 1 m from the bottom of the wall.

Find, as accurately as the Tables allow, the measure of the angle which the ladder makes with the ground.

(c) In the triangle pqr, $|pq| = 3$ m,

$|\angle prq| = 23° 35'$ and $|\angle qpr| = 35°$.



(i) Find $|qr|$, correct to one place of decimals.

(ii) t is a point on the line pq such that $|\angle qrt| = 68° 17'$.

Find $|qt|$, correct to one place of decimals.