1. (i) One litre of water is added to four litres of milk in a container. Calculate the percentage of water in the container.

(ii) \( \text{IR£105} \) was shared among three people in the ratio \( 1 : 2 : \frac{1}{2} \). Calculate the smallest share.

(iii) The volume of cone A is 72 cm\(^3\). Another cone B has the same height as cone A but the length of the radius of its base is twice that of cone A. Calculate the volume of cone B.

(iv) The centre of the circle is \( o \), \( |ab| = 6 \) and \( |bo| = 5 \).

Find \( |bc| \).

(v) In the triangle \( rst \), \( xy \) is parallel to \( st \).

If \( |xs| = 5 \), \( |yr| = 6 \) and \( |rs| = 12 \), find \( |rt| \).
(vi) In the diagram \( qu \perp qp \) and \( \angle quv = \angle kpz = 75^\circ \).

Prove that \( vw \perp kw \).

(vii) The circles \( H \) and \( K \) have diameters [ab] and [ac], respectively.

Explain why eb is parallel to dc.

(viii) \( xyzw \) is a square. Construct the image of the square under \( S_x \circ S_w \).

(ix) Calculate the area of the triangle formed by the x-axis, the y-axis and the line \( 3x - y = 6 \).

(x) If \( 100 \cos 2A = 81 \), use the Tables to find the measure of the angle A.

2. (a) An antique dealer bought three chairs at an auction. He sold them later for IR£301.60, making a profit of 16% on their total cost. Calculate the total cost of the chairs.

The first chair cost IR£72 and it was sold at a profit of 15%. Calculate its selling price.

The second chair cost IR£98 and it was sold for IR£91.

Find the percentage profit made on the sale of the third chair.

(b) If \( y = \sqrt{x - 4} + 2 \), express \( x \) in terms of \( y \).

Then, find the value of \( x \) when \( y = 2 + \sqrt{2} \).
3. Prove that any point on the bisector of an angle is equidistant from the arms of the angle.

Construct a triangle with sides of length 10 cm, 9 cm and 7 cm.

Construct the incircle of the triangle. Show all your construction lines clearly.

If \( r \) cm is the length of the radius of the circle, prove that the area of the triangle is \( 13r \) cm\(^2\).

4. (i) \( a, b, c, d \) are points of the circle in the diagram. The lines \( ab \) and \( cd \) intersect at \( k \), as shown.

Prove that

\[ l a k l \cdot l k b l = l c k l \cdot l k d l. \]

(ii) From the point \( k \) a tangent is drawn to touch the circle at \( t \). Deduce that

\[ l k a l \cdot l k b l = l k t l^2. \]

(iii) Two circles intersect at \( n \) and \( t \).
The line \( pr \) is a tangent to the circles at \( p \) and at \( r \).

Prove that \( m \) is the midpoint of \([pr]\).

5. \( a(-4, 0) \) and \( b(2, 8) \) are two points and \( o \) is the origin.

(i) Find the slope of \( ab \).

(ii) Find the co-ordinates of \( d \), the midpoint of \([ab]\).

(iii) Calculate \( l o d l \) and show that \( o \) is twice as far from \( b \) as it is from \( d \).

(iv) Find the equation of the line \( P \) which passes through \( d \) and which is perpendicular to \( ab \).

(v) If \( 4y + 3x = k \) is the image of the line \( P \) under the translation \((0,0) \rightarrow (6, -6)\), find the value of \( k \).
6. (a) In the diagram, \( b = 3 \), \( c = 4 \) and \( A = 90^\circ \).

Calculate \( l \), the sum of the lengths of the three sides of the triangle. \( \triangle \)

Hence, find the value of \( k \) if

\[ k \tan B = l. \]

(b) A circle with centre \( o \) contains the point \( p \).

\[ |\angle PQP| = 36^\circ 52', |\angle OPQ| = 90^\circ \]

and \( |OQ| = 5 \).

Calculate \( |OP| \), the length of the radius of the circle.

\( r \) is another point on the circle and \( \angleROP \) is obtuse, as shown.

If the area of triangle \( ROP \) is 2.8 square units, find \( |\angle ROP| \).

(e) \( x, y \) and \( z \) are three points on level ground.

From \( x \) the direction of \( y \) is North 45° East.

From \( x \) the direction of \( z \) is North 22.5° West.

\( z \) is due West of \( y \).

\[ |xy| = 5 \text{ m}. \]

Copy the diagram into your answerbook and mark in \( z \).

Calculate \( |xz| \), correct to the nearest metre.