AN ROINN OIDEACHAIS

INTERMEDIATE CERTIFICATE EXAMINATION, 1991

MATHEMATICS – SYLLABUS A – PAPER 2 (300 marks)

FRIDAY, 7 JUNE – MORNING, 9.30 to 12.00

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

Marks may be lost if all your work is not clearly shown.

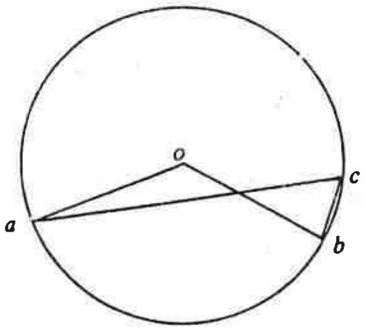
Mathematical tables may be obtained from the superintendent.

(i) If $x = 110\%$, express 90% in terms of x.

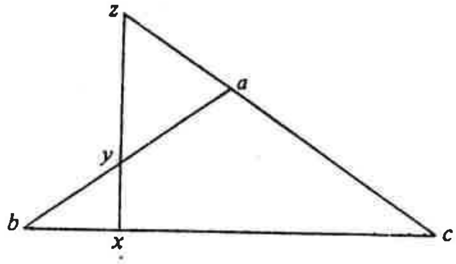
(ii) Simplify $\left(\frac{9}{16}\right)^{-\frac{3}{2}}$ and write your answer in the form $\frac{a}{b}$, $a, b \in \mathbf{R}$.

(iii) The areas of two circles are πr^2 and $(1{\cdot}21)\pi r^2$.
Find, in terms of r, the difference in the lengths of the radii of the circles.

(iv) The centre of the circle is o.
If $|\angle aob| = 130°$ and
$|\angle cao| = 15°$,
Calculate $|\angle obc|$.



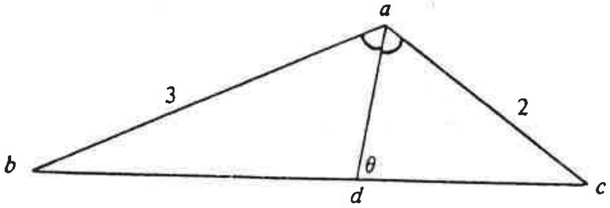
(v) From x, a point in $[bc]$ of the isosceles Δabc, where $|ab| = |ac|$, a line is drawn at right angles to bc, cutting ab in y and ca produced in z.
Prove Δayz is isosceles.



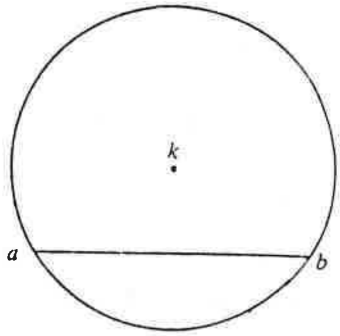
(vi) If ad is the bisector of $\angle cab$ in the triangle abc and $|ab| = 3$, $|ac| = 2$, use the Sine rule to prove

$$\frac{|bd|}{|dc|} = \frac{3}{2}.$$

Note: $\sin(180° - \theta) = \sin\theta$.



(vii) k is the centre of the circle. If $|ab| = 12$ cm and the distance from k to ab is 5 cm, calculate the length of a diameter of the circle.



(viii) a is the point having coordinates $(-2, 3)$. Find the image of a under $S_a \circ S_X$, where X represents the X axis.

(ix) M is the line $3x - 2y = 6$. Find the image of M under the translation $t : (0, 0) \rightarrow (4, 2)$.

(x) If $0 \leqslant A \leqslant 360°$, find the value of A for which $\sin A = 1$.

2. (a) If

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f},$$

express v in terms of u and f.
Calculate v when $f = 15$ and $u = 40$.

(b) (i) Find the compound interest on IR£1200 for two years at 9% per annum.

(ii) A person borrows IR£1200 at 9% per annum compound interest for two years. At the end of the first year a repayment of one half of what is then owed is made.

Calculate, to the nearest IR£, how much is owed at the end of the second year.

3. p is the midpoint of $[ab]$ in Δabc. Through p a line is drawn parallel to bc cutting ac in q.

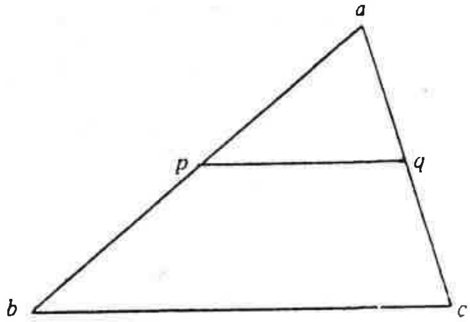
(i) Prove that p and q are equidistant from the line bc.

(ii) If bq and pc intersect in x, prove that the

area Δpbx = area Δqxc.

(iii) Hence, or otherwise, prove that

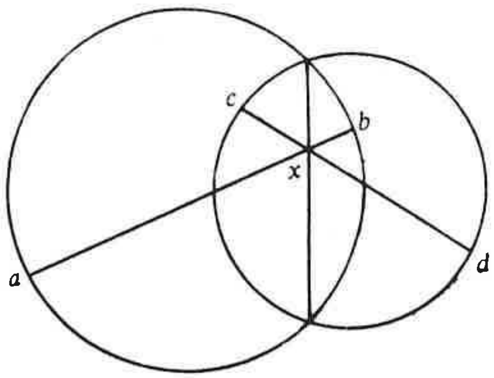
area Δbxc = area quadrilateral $apxq$.



4. If $[pr]$ and $[qs]$ are two chords of a circle intersecting in k, prove that $|pk| \cdot |kr| = |qk| \cdot |ks|$.

Through any point x in the common chord of the circles as shown, two chords $[ab]$ and $[cd]$ are drawn. Prove

$$|ax| \cdot |xb| = |cx| \cdot |xd|.$$



5. $a(-4, 8)$, $b(0, 4)$ and $c(-6, -2)$ are the vertices of a triangle.

Find the coordinates of d the midpoint of $[ab]$.

Verify that $ab \perp bc$.

Find the equation of the line M which passes through d parallel to bc.

The image of c under the axial symmetry in M is w. Find the coordinates of w.

Calculate the area of $abcw$.

(a) Without using the Tables, construct an angle B such that $\cos B = 0{\cdot}8$.

Construct the bisector of your angle B and investigate from your diagram if

$$\cos \tfrac{1}{2} B = \tfrac{1}{2} \cos B.$$

(b) A mast, $[pq]$, is erected to support a television aerial. The mast is upheld by two cables.

The angle of elevation of cable $[pc]$ to the top of the mast is 35° and of cable $[pd]$ is $50^\circ\ 12'$, where $|cd| = 10$ m.

Calculate the height of the mast, $[pq]$, to the nearest metre.