JUNIOR CERTIFICATE EXAMINATION, 1994

# MATHEMATICS - HIGHER LEVEL - PAPER 2 (300 marks)

FRIDAY, 11 JUNE – MORNING, 9·30 to 12·00

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.**

1. *(i)* Express 25 ml as a percentage of one litre.

    (ii) $k (2 + \sqrt{3}) (2 - \sqrt{3}) = 1$. Find the value of k.

    (iii) $\dfrac{8\pi}{3}$ cm³ is the volume of a cone.
    The cone's height and radius length are equal.
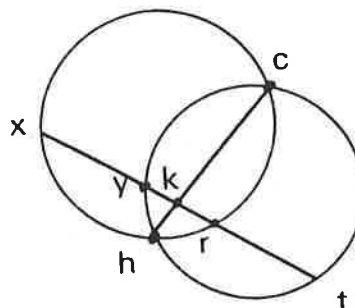   Calculate the length of the radius.

    (iv) In the triangle pqr, $xy \parallel qr$ and $xt \parallel pr$.

    $| xt | = | tq | = 5$ cm and $| xy | = 11$ cm.
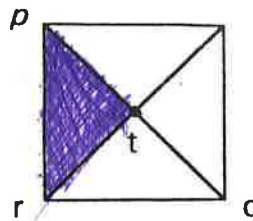   Find $| pr |$.
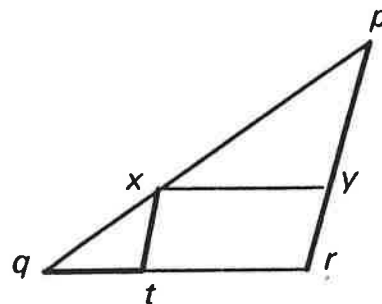
    (v) The diagram shows a tangent pt.
    A line drawn from p cuts the circle at q and r.
    If $| pr | = 9$ and $| qr | = 5$, find $| pt |$.
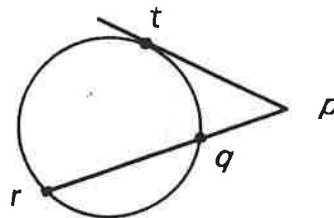
    (vi) The line xt cuts the chord ch, a chord of
    both circles, at k.
    Say why $| xk | . | kr | = | tk | . | ky |$.

(vii) The diagonals of a square meet at *t*.
Say what composition of *two* transformations
maps the triangle *prt* on to the triangle *qtr*.

(viii) The distance between two points $(2t, 0)$ and $(0, -t)$ is $\sqrt{20}$.
Find two values of *t*.

(ix) What is the equation of the line joining the points $(5, -2)$ and $(0, -7)$.

(x) What is the value of A for which
$$\sin A = \sin 2A = \frac{\sqrt{3}}{2} \quad \text{when} \quad 0° < A < 90° \text{ ?}$$

$y = \frac{x}{t^2} + 2$

2. *(a)* If $t = \sqrt{\dfrac{x}{y-2}}$ express *y* in terms of *t* and *x*.
Write the value of *y* if $x = 25$ and $t = 5$.

$t^2 = \frac{x}{y-2}$

$t^2(y-2) = x$

$t^2 y - 2t^2 = x$

$y = \frac{x}{t^2} + 2$

(b) A worker's income before deductions is IR£13 700.
Tax at 32% is paid on the first IR£7000.
Find the amount of this tax.

The rest of the income, less the tax-free allowance, is taxed at 48%.
The total tax bill is IR£2552.
Calculate the tax-free allowance.

3. *(a)* Prove that vertically opposite angles are equal in measure.

(b) Prove that any point on the bisector of an angle
is equidistant from the arms of the angle.

(c) The diagram shows a circle and two perpendicular diameters.
Perpendicular lines are drawn to each diameter from
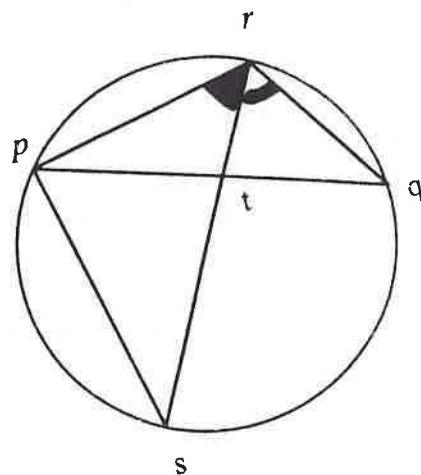points *v* and *w* on the circle.
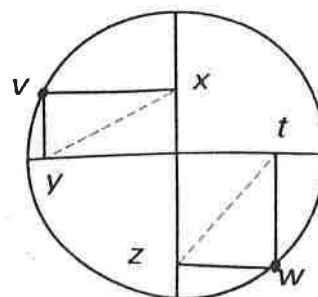
Prove $|\,xy\,| = |\,tz\,| = |\,\text{radius}\,|$.

4.   **(a)**   Prove that if the angles of two triangles are, respectively, equal in measure, then the lengths of the corresponding sides are proportional.

(b)   Two chords pq, rs of a circle meet in t, such that $|\angle srp| = |\angle qrt|$.

Explain why the triangles srp and qrt are equiangular.

Complete the ratio $\dfrac{|pr|}{|rs|} = \dfrac{|rt|}{|??|}$.
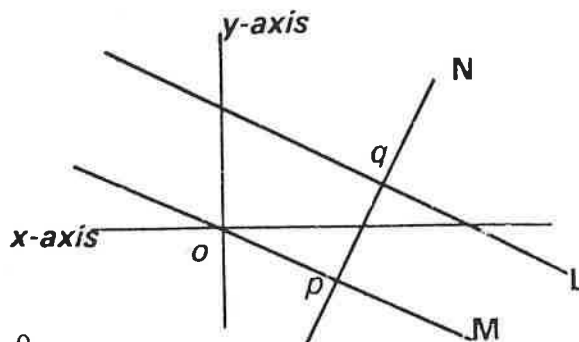
Prove $|pr| \cdot |rq| = |rt|^2 + |pt| \cdot |tq|$.

5.   The equation of the line L is
$x + 2y - 5 = 0$.

Find the slope of L and the coordinates of the point q (3, ?) on L.

Show that the equation of M, the image of L under the translation $(0, 0) \rightarrow (-1, -2)$

is $x + 2y = 0$.

Find the equation of the line N, through (3, 1) perpendicular to L.

If $N \cap M = \{p\}$, $N \cap L = \{q\}$ and o is the origin, verify
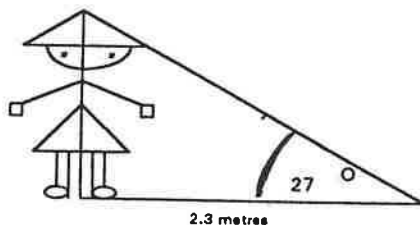
$$|op|^2 + |pq|^2 = |oq|^2.$$

6. *(a)*

θ	60°	90°	120°
sin θ	$\dfrac{\sqrt{3}}{2}$		$\dfrac{\sqrt{3}}{2}$
cos θ		0	
tan θ			$-\sqrt{3}$

Copy the table into your answerbook and fill in the missing values, where possible.

(b) A girl standing on level ground casts a shadow 2.3 metres long.

The angle of elevation of the sun is 27°.

2.3 metres

Calculate the girl's height to the nearest centimetre.

(c) A hare escaping from a dog ran in a triangular pattern.

The diagram shows the path of the escape.

Calculate, to the nearest metre, the distance run by the hare.

[You may round off values of sine to one decimal place i.e. sin 31° can be taken to be 0.5]

111°   31°

80 METRES

START