MATHEMATICS – HIGHER COURSE – PAPER I (300 marks)

MONDAY, 11 JUNE – MORNING 9.30 to 12

Examination Number

SECTION A (100 marks)

Attempt all questions.   You should not spend more than 50 minutes on this section.
Answer each question by writing one of (a), (b), (c), (d) in the box under each question number.
If you wish to change an answer, cross out your first choice and write your new answer near the box.
Mathematics tables may be obtained from the Superintendent.

THIS PAPER MUST BE ENCLOSED IN YOUR ANSWER BOOK

1. $0.0984 \div 0.008$ is

   (a) 0.0123   (b) 0.07892   (c) 12.3   (d) 1.23

2. The volume in litres of a hollow cube of side 1 metre is

   (a) 1   (b) 10   (c) 100   (d) 1000

3. $1 \text{ km} \div 1\frac{1}{3}$ in metres is

   (a) 750   (b) 1000   (c) $333\frac{1}{3}$ (d) $1333\frac{1}{3}$

4. $12\frac{1}{2}\%$ of pupils in a class of 48 obtained grade C or higher in a test.   The number of pupils obtaining grade C or lower, therefore, could be

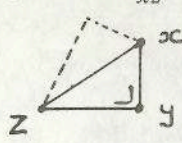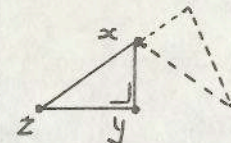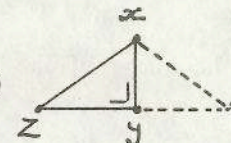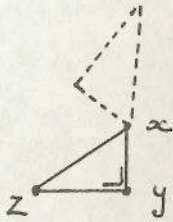   (a) 6   (b) 40   (c) 41   (d) 48

5. £A invested for 1 year at $x\%$ per annum earned £$12x$ simple interest. A is

   (a) 120   (b) 1200   (c) 100   (d) 12

6. P, Q, T are three lines, such that $P \perp Q \parallel T$.   Which one of the following is false ?

   (a)   Dir $P \perp$ Dir Q (b)   Dir $Q =$ Dir T

   (c)   Dir $P \perp$ Dir T (d)   Dir $P =$ Dir T

7. xyz is a triangle such that $|\angle xyz| = 90°$.   Which sketch represents $\triangle xyz$ and its image under $S_{xz} \circ S_{xy}$.

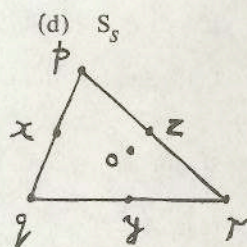   (a)   (b)   (c)   (d)

8. $pqrs$ is a parallelogram. $S_p \circ S_q \circ S_r$ is equal to

   (a) S_p (b) S_q (c) S_r (d) S_s

9. The perpendicular bisectors of the three sides of a triangle (not equilateral) meet at o.   Then

   (a) a circle, centre o, having the three sides as tangents, can be drawn
   (b) $|ox| = |oy| = |oz|$
   (c) $|op| = |oq| = |or|$
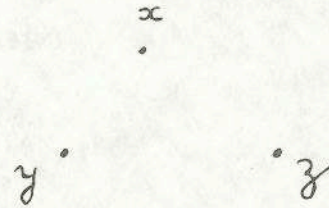   (d) $|px| = |pz| = |ry|$

10. x, y, z are three points as in diagram. Then $\overrightarrow{yx} \circ \overrightarrow{zx} \circ \overrightarrow{yz}$ is

(a) $2\overrightarrow{yx}$ (b) $3\overrightarrow{yx}$

(c) I_π (d) $\overrightarrow{xy}$

11. $[pr]$ and $[qs]$ are diameters of a circle, (see diagram). Then
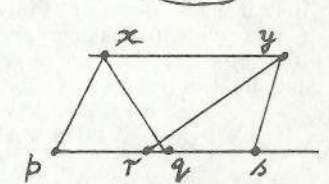
(a) $|\angle psq| = 90°$.   (b) $|\angle qpr| = |\angle prs|$.

(c) the image of qp under S_{qs} is rs.   (d) $|\angle prq| = 90°$.
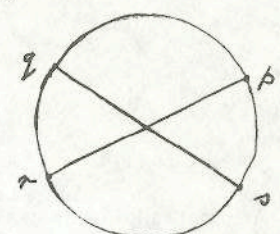
12. In the diagram, $xy \parallel ps$ and $|pq| = |rs|$. Then area $\triangle pqx$: Then area $\triangle pqx$: area $\triangle rsy$ as
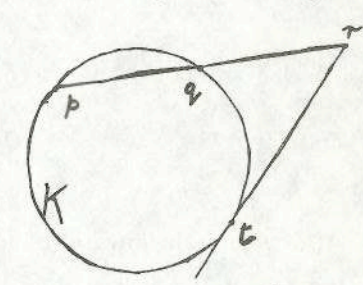
(a) $|px| : |ry|$ (b) $|xq| : |ys|$

(c) $|rq| : |ps|$ (d) $|pr| : |qs|$

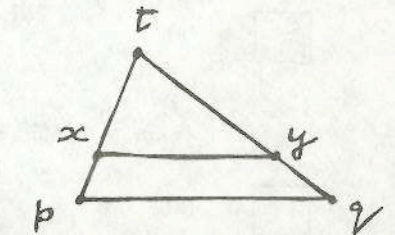13. K is a circle. $|pq| = |qr|$. rt is a tangent to K. $|rt| = \sqrt{18}$. $|rq|$ is

(a) 3   (b) 9

(c) $\sqrt{18}$ (d) 18

14. In $\triangle tpq$, $xy \parallel pq$. Then $|tx| : |xp| = |ty| : |yq|$ is one of the following. Which one ?
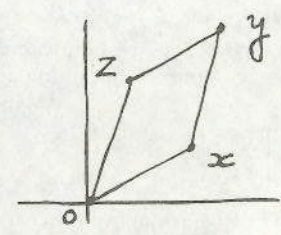
(a) $5 : 4 = 7 : 6$ (b) $\frac{1}{3} : \frac{1}{5} = 5 : 3$

(c) $\frac{3}{2} : \frac{2}{3} = \frac{5}{4} : \frac{4}{5}$ (d) $4 : 3 = 14 : 13$

15. In the parallelogram $oxyz$ the coordinates of z, y are $(2, 5)$ $(6, 8)$, respectively. The coordinates of the midpoint of $[xz]$ are
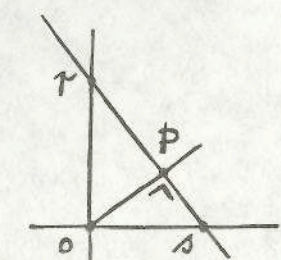
(a) $(4, 6\frac{1}{2})$ (b) $(1\frac{1}{2}, 2)$

(c) $(2, 1\frac{1}{2})$ (d) $(3, 4)$

16. The equation of rs is $3x + 2y - 6 = 0$ (see diagram). The equation of op is

(a) $2x + 3y - 6 = 0$.   (b) $2x - 3y = 0$.

(c) $3y + 2y = 0$.   (d) $2x - 3y - 6 = 0$.

17. The coordinates of o, p are $(0, 0)$, $(3, 0)$, respectively. The area of $\triangle opq$ is $\frac{15}{2}$. Then the coordinates of q can be

(a) $(-2, 5)$ (b) $(4, \frac{5}{2})$ (c) $(2, -\frac{5}{2})$ (d) $(0, \frac{5}{4})$

18. The equation of the image of the line $x - y = 0$ under the translation $(0, 0) \rightarrow (-1, 0)$ is

(a) $x + y = 0$.   (b) $x - y + 1 = 0$.   (c) $x + y + 1 = 0$.   (d) $x - y - 1 = 0$.

19. If $\cos \theta > 0.2419$, then $\sin \theta$ is

(a) greater than 0.9703 (b) less than 0.9703 (c) greater than $76°$ (d) less than $76°$

20. If $\sin 2\theta = 2 \sin \theta \cos \theta$, then $\sin 120°$ is

(a) $\frac{\sqrt{3}}{4}$ (b) $\frac{4}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) $\frac{\sqrt{3}}{2}$

AN   ROINN   OIDEACHAIS   M.43

INTERMEDIATE   CERTIFICATE   EXAMINATION,   1979

MATHEMATICS – HIGHER COURSE – PAPER I (300 marks)

MONDAY, 11 JUNE – MORNING, 9.30 to 12

SECTION B (200 marks)

Attempt **QUESTION 1** and **THREE** other questions

1. (a) The rent on a shop over 7 years was £25 per week for each of 52 weeks each year.
        The rent for the same shop is increased so as to yield a total rent of £16 380 spread
        evenly over the next 7 years.
        Calculate the percentage increase in the rent.

    (b) A Building Society offers an interest rate of 13·8% per annum compound interest.   The
        annual interest is taxed by the Government so that the real interest rate is only 9%.
        How much tax is paid on £1000 lodged with a Building Society for two years ?

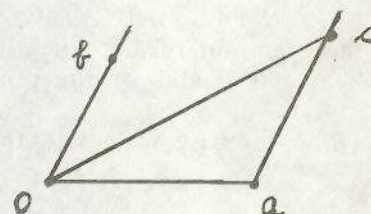   (50 marks)

2. (i) Prove that the measure of the angle at the centre of a circle is twice the measure of
        an angle at the circle standing on the same arc.

    (ii) Prove that the sum of the opposite angles of a cyclic quadrilateral add up to 180°.

    (iii) $pqrs$ is a quadrilateral.

        $|pq| = |pr| = |ps|$ and $|\angle qps| = 136°$.
        Calculate $|\angle qrs|$. Explain how your answer is obtained.
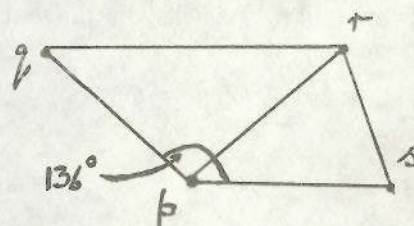
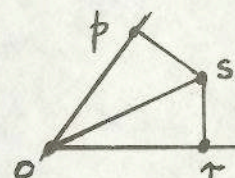   (40 marks)
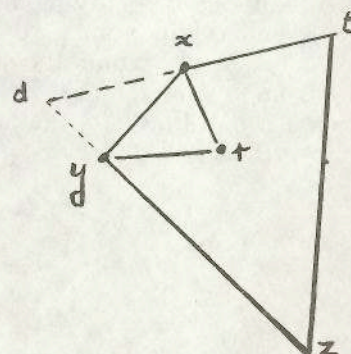
3. (a) In the diagram, $|oa| = |ac|$ and $ac \parallel ob$.
        Prove oc bisects $\angle aob$.

    (b) os is the bisector of $\angle por$ and $sp \perp op$ and $sr \perp or$
        (see diagram).   Prove $|sp| = |sr|$.

    (c) $xyzt$ is a quadrilateral and xr, ry are the bisectors
        of $\angle txy$, $\angle xyz$, respectively.
        If tx and zy meet in d, prove rd is the bisector
        of $\angle tdz$.

                                                                        (40 marks)

                                                                        OVER   →
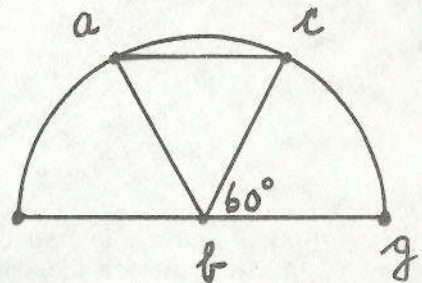
4. (i) Prove that the composition of two translations is a translation.

   (ii) The diagram D shows an equilateral triangle abc in a semicircle of centre b and $|\angle cbg| = 60°$. Copy the diagram and construct its image, F, under the composition of translations

   $$\vec{bc} \quad \text{o} \quad \vec{ab} \; .$$

   (iii) F is also the image of D under

   $$S_x \quad \text{o} \quad S_b \; .$$

   Show the point x in your diagram and give a reason for your answer.

(50 marks)

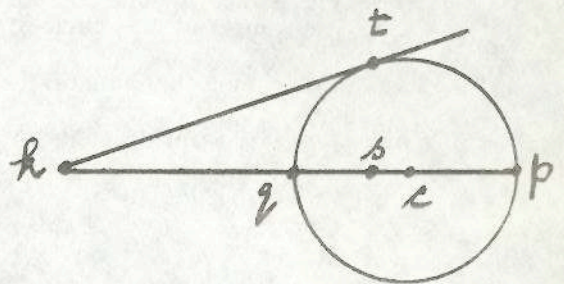5. If $[ab]$ and $[cd]$ are two chords of a circle which intersect outside the circle at k, prove

   $$|ka| \, . \, |kb| = |kc| \, . \, |kd| \; .$$

   Deduce that if kt is a tangent to the circle at t, then

   $$|ka| \, . \, |kb| = |kt|^2 \; .$$

   kt is a tangent to a circle of centre c, as in the diagram, and q is the midpoint of $[kp]$. s is the point such that $|qs| : |sc| = 2 : 1$.
   Prove that kt is also a tangent to the circle through t, s and c.

   [Hint: Let $|kq| = 2x$]

(50 marks)

6. If $a \, (-2, -2)$ and $b \, (4, 6)$ are two points, find the slope and the equation of ab.
   Find the equation of the line through the point $(2, 0)$ which is the perpendicular to ab and find the coordinates of the point where this line intersects ab.

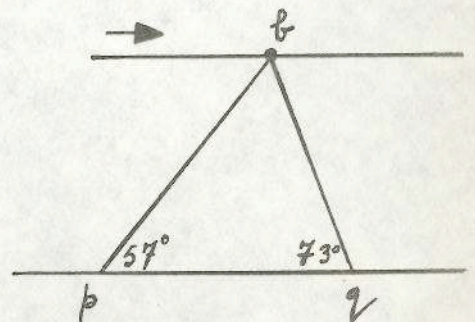   Hence, or otherwise, calculate the distance of $(2, 0)$ from the line ab.

(50 marks)

7. (a) Construct an angle A such that

   $$7 \sin A = 5$$

   [Use of Tables not allowed.]

   (b) A balloon, b, is flying due East at a speed of 30 km per hour. p and q are points 10 km apart directly under the path of b. At 12 noon the angles of elevation of b as measured from p and q are 57° and 73° (see diagram). At what time, to the nearest minute, will b be directly overhead at q ?

(50 marks)