AN   ROINN   OIDEACHAIS

INTERMEDIATE   CERTIFICATE   EXAMINATION,   1988

68802

MATHEMATICS – HIGHER COURSE – PAPER I (300 marks)

THURSDAY, 9 JUNE – MORNING,   9.30 to 12.00

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. If $n = \dfrac{1}{35 \cdot 79}$, then

    (a) $0 \cdot 1 < n < 1$ (b) $0 \cdot 01 < n < 0 \cdot 1$

    (c) $0 \cdot 001 < n < 0 \cdot 01$ (d) $0 \cdot 0001 < n < 0 \cdot 001$

2. IR£2000 was invested for one year in a bank at 12% interest per annum.   The interest earned was taxed at the rate of 30%. The amount of interest received after tax was
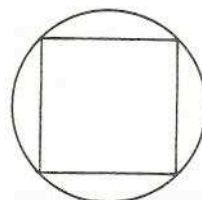
    (a) IR£600   (b) IR£240   (c) IR£168   (d) IR£72

3. $\dfrac{350}{0 \cdot 007} =$

    (a) 5×10 (b) 5×10^2 (c) 5×10^3 (d) 5×10^4

4. If the area of the square is 100, then the area of the circle is

    (a) 50π (b) 100π

    (c) $\pi \sqrt{50}$ (d) $\pi \sqrt{100}$

5. The length of a radius of a circle is increased by 10%. The percentage increase in the area of the circle is
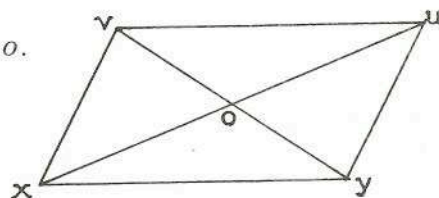
    (a) 10%   (b) 11%   (c) 20%   (d) 21%

6. $(p, q) \uparrow (q, r)$ and $(p, q) \uparrow (x, y)$ $\Rightarrow$

    (a) $\overrightarrow{pr} = \overrightarrow{xy}$ (b) $\overrightarrow{pr} = 2\overrightarrow{xy}$

    (c) $pryx$ is a parallelogram   (d) $(p, r) \uparrow (x, y)$

7. The diagonals of the parallelogram $xyuv$ intersect at o. The composition of translations $\overrightarrow{ov} \circ \overrightarrow{xo}$ equals

    (a) $\overrightarrow{yu}$ (b) $\overrightarrow{vx}$

    (c) $\overrightarrow{xy}$ (d) $\overrightarrow{uv}$

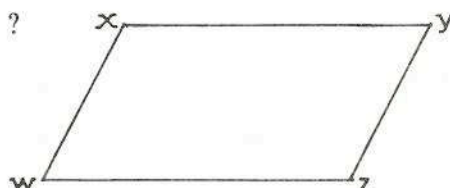8. K and M are lines and $K \cap M = \phi$. Then $S_M \circ S_K$ is

    (a) a central symmetry   (b) a translation
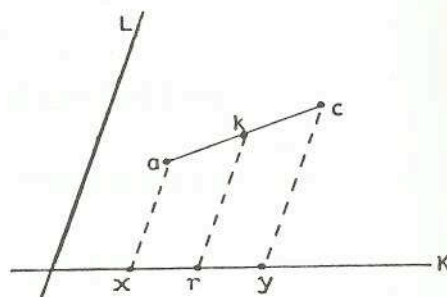
    (c) an axial symmetry   (d) I_π

9. How many axes of symmetry has the parallelogram $xwzy$?

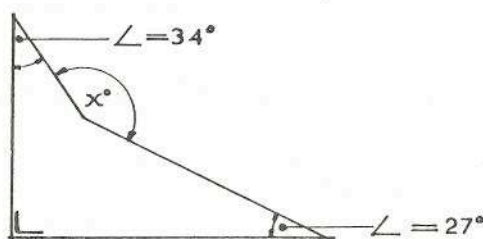   (a) 0   (b) 1

    (c) 2   (d) 4

OVER →

10. k is the mid-point of $[ac]$.
x, r, y are the images of a, k, c under the
projection on a line K where the projection
is taken parallel to L.
Which one of the following is not true ?

(a) $(a, k) \uparrow (k, c)$ (b) $(x, r) \uparrow (r, y)$

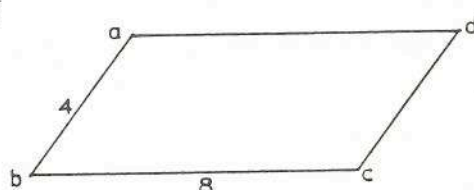(c) $(a, c) \uparrow (x, y)$ (d) r is the mid-point of $[xy]$

11. $x°$ is

(a) $209°$ (b) $153°$
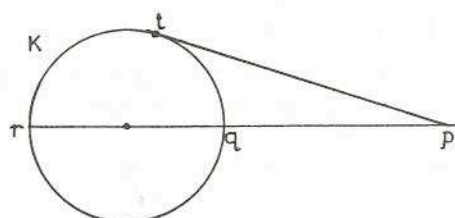
(c) $151°$ (d) $119°$

12. The area of the parallelogram $abcd$ is $16\sqrt{2}$
and $|\angle bcd| > 90°$.
Then $|\angle bcd| =$

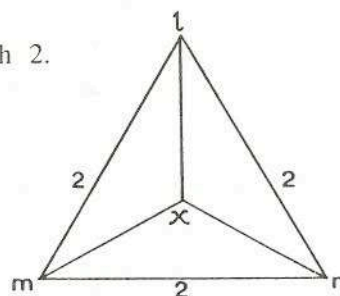(a) $120°$ (b) $135°$

(c) $150°$ (d) $160°$

13. $[rq]$ is a diameter of the circle K and
$|rq| = |qp|$.
The length of the tangent, $|pt| = 4\sqrt{2}$.
The radius of the circle has length

(a) 2   (b) 4

(c) $\sqrt{8}$ (d) 8

14. lmn is an equilateral triangle having sides of length 2.
The bisectors of the angles meet at x.
The radius of the incircle has length

(a) $\dfrac{1}{\sqrt{3}}$ (b) $\dfrac{1}{2}$

(c) 1   (d) $\sqrt{3}$

15. A tangent T touches a circle at $(0, 0)$.
If the centre of the circle is $(3, 1)$, the slope of the tangent T is

(a) $-\dfrac{1}{3}$ (b) $\dfrac{1}{3}$ (c) 3   (d) -3

16. $x - 2y + 1 = 0$ is the image of a line L under the central symmetry in $(0, 0)$.
The equation of L is

(a) $x + 2y + 1 = 0$ (b) $x - 2y - 1 = 0$

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

17. The equation of a line through $(2, -3)$ and perpendicular to the line $y = 5$ is

(a) $x = 2$ (b) $x = 5$ (c) $x = -3$ (d) $y = -3$

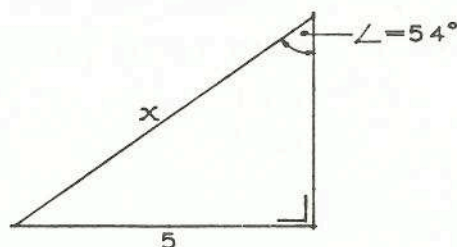18. The line $x + y = 4$ cuts the axes at p and q. $|pq| =$

(a) 4   (b) 8   (c) 16   (d) $\sqrt{32}$

19. $\text{Cos } 38° 42' =$

(a) $\sin 38° 42'$ (b) $\tan 51° 18'$ (c) $\cos 51° 18'$ (d) $\sin 51° 18'$

20. $x =$

(a) $5 \sin 54°$ (b) $5 \cos 54°$

(c) $\dfrac{5}{\sin 54°}$ (d) $\dfrac{5}{\cos 54°}$

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MATHEMATICS – HIGHER COURSE – PAPER I (300 marks)

THURSDAY, 9 JUNE – MORNING, 9.30 to 12.00

SECTION B (200 marks)
Attempt QUESTION 1 and THREE other questions (50 marks each)

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

1.   (a)   A sales person travelled 12 600 km in a month.   The bill for petrol was IR£546.   Petrol cost 65p per litre.   Calculate the average number of kilometres travelled per litre of petrol.

     (b)   A pencil consists of a cylinder and cone, as shown, each of diameter 0·6 cm.   The height of the cone is 10% of the total height, h, of the pencil.

           If the volume of the pencil is 3·96 cm^3, calculate the height, h, of the pencil.   Take $\pi = \frac{22}{7}$.
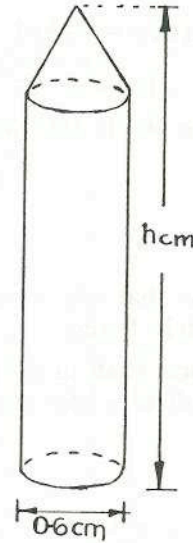
2.   (a) t is the image of h under S_A and k is the image of t under S_B where $A \perp B$.
           Prove that the three points h, o, k are collinear.
           Hence or otherwise, prove that the composition of two axial symmetries in perpendicular axes is a central symmetry.
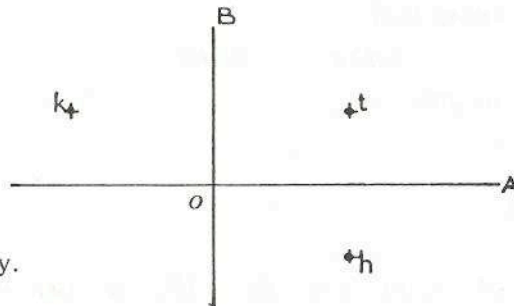

     (b) abc is an equilateral triangle.   The bisectors of the interior angles meet at k.

           Find the image of $\triangle akp$ under the rotation

           $$S_{ar} \circ S_{bp}$$
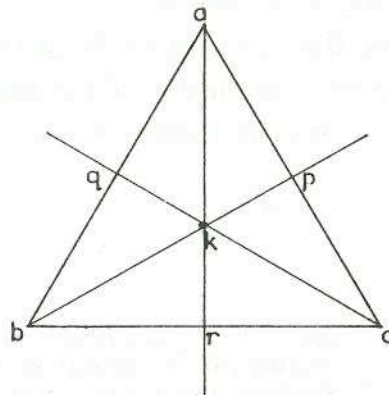
3.   If two sides of a triangle are equal in length, prove that the measures of the angles opposite these sides are also equal.

     $pqrs$ is a parallelogram. x is the image of r under the axial symmetry in the line qs.
     Prove that
           $\triangle qys$
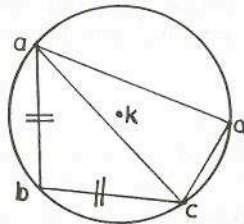   is an isosceles triangle.

OVER →.
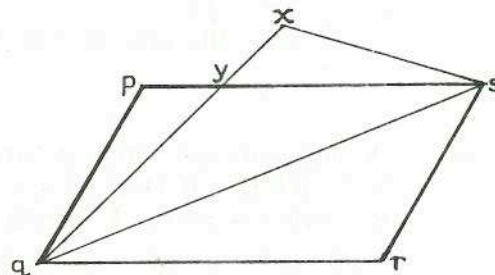
4. Assuming that the measure of the angle at the centre of a circle is twice the measure of an angle at the circle standing on the same arc, prove that the angles at the circle standing on the same arc are equal in measure.

If $|pq| = |xy|$, prove that
$$|\angle prq| = |\angle xzy|,$$
where o is the centre of the circle.
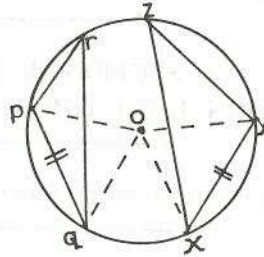
If $|ab| = |bc|$, prove that
$$|\angle adc| = |\angle bkc|$$
where k is the centre of the circle.

5. Prove that the areas of two triangles of equal height are proportional to the lengths of their bases.

Deduce that in a triangle a line joining a vertex to the mid-point of the opposite side divides the triangle into two parts of equal area.

abc is a triangle whose base $[bc]$ is bisected at x. If y is any point in the line ax, show that
$$\triangle aby = \triangle acy$$
in area.
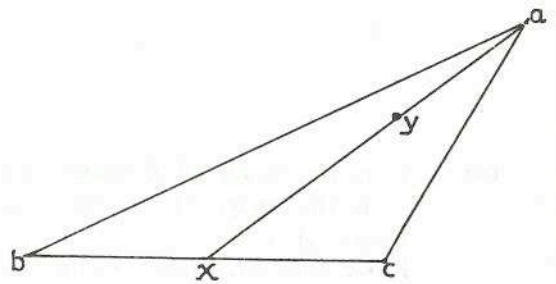
6. $a(-3, 1)$ and $b(1, 3\frac{1}{2})$ are two points. Find the slope of ab.

Find the equation of the image of ab under the translation which maps $a(-3, 1)$ to $c(0, 2)$.

Show that the area of the parallelogram $acdb$ is $3 \cdot 5$.

Find the coordinates of the point k on the Y-axis such that
area of $\triangle abk$ = area of parallelogram $acdb$.

7. (a) $pqrs$ is a playground in the form of a square on horizontal ground. $[pk]$ is a flagpole erected vertically at p where $|pk| = 8 \cdot 5$ m and $|\angle krp| = 9°39'$.

Calculate

(i) $|pr|$
(ii) the area of the playground.
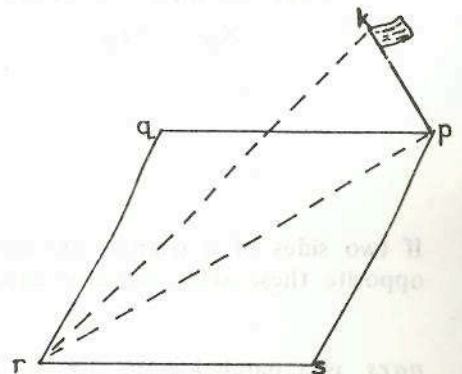
(b) A ship sails out from p and travels to q, a distance of 25 km in the direction N 37°09′ E. It then changes course and travels in the direction E 47°44′ S until it reaches a point k which is directly east of p.

Find $|pk|$ to the nearest km.