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AN ROINN OIDEACHAIS M.43(a)

INTERMEDIATE CERTIFICATE EXAMINATION, 1984

MATHEMATICS - HIGHER COURSE - PAPER I (300 marks)

FRIDAY, 8 JUNE - MORNING, 9.45 to 12.15

SECTION A (100 marks)

Examination Number

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. $5\frac{1}{2} \div 2\frac{1}{2} =$

(a) $2\frac{1}{5}$ (b) $2\frac{1}{2}$ (c) $2\frac{3}{4}$ (d) $13\frac{3}{4}$

2. 60% of 7% is

(a) 0·42% (b) 4·2% (c) 42% (d) 420%

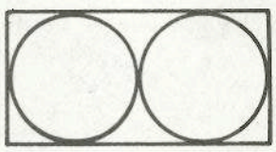
3. 45 km per hour in metres per second is

(a) 12·5 (b) 66 (c) 75 (d) 750

4. The volume in cm^3 of a hemisphere of radius $\frac{3}{2}$ cm is

(a) $\frac{16\pi}{27}$ (b) $\frac{32\pi}{27}$ (c) $\frac{9\pi}{4}$ (d) $\frac{9\pi}{2}$

5. The fraction of the area of the rectangle taken up by the areas of the two circles is

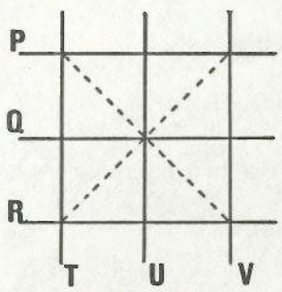


(a) $\frac{\pi}{8}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi^2}{8}$ (d) $\frac{3\pi}{2}$

6. If $(p, q) \uparrow (r, s)$, which one of the following is false ?

(a) $(p, q) \in \vec{rs}$ (b) $\vec{sr} = \vec{qp}$ (c) $\vec{ps} \neq \vec{qr}$ (d) $\vec{pr} \neq \vec{qs}$

7. The lines P, R, T, V form a square.
Which one of the following compositions of axial symmetries maps the square on itself ?

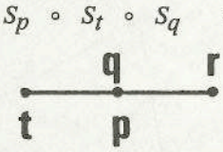


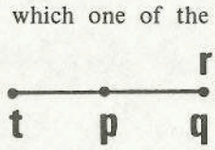
(a) $S_Q \circ S_V$ (b) $S_Q \circ S_U$
(c) $S_Q \circ S_T$ (d) $S_Q \circ S_P$

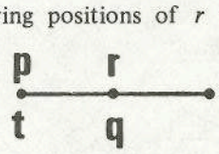
8. The composition of two central symmetries is

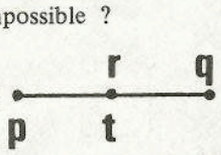
(a) a translation (b) a central symmetry (c) an axial symmetry (d) a projection

9. If $S_p \circ S_t \circ S_q = S_r$, which one of the following positions of r is impossible ?

(a) 

(b) 

(c) 

(d) 

10. The diagonals of a square meet at k so that S_k, the central symmetry in k, maps the square onto itself. The domain of S_k is

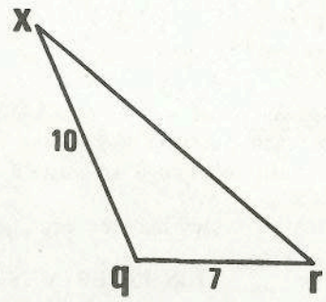
(a) the square itself (b) the square and its diagonals (c) the plane (d) all the couples having k as centre

OVER →

11. The point of concurrency of the perpendicular bisectors of the sides of any triangle is called the

(a) centroid (b) incentre (c) circumcentre (d) orthocentre

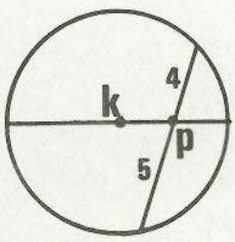
12. q and r are fixed points and the locus of x is the circle of centre q and of radius 10. The length $|xr|$ cannot be



(a) 1 (b) 3

(c) $\sqrt{149}$ (d) 17

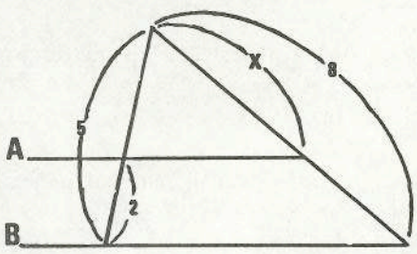
13. k is the centre of the circle of radius 7. If $|kp| = x$, then x is



(a) $\sqrt{19}$ (b) $\sqrt{29}$

(c) $\sqrt{33}$ (d) $\sqrt{41}$

14. If $A \parallel B$, then $5 : 2 =$



(a) $(8 - x) : 8$ (b) $(8 + x) : 8$

(c) $8 : (x - 8)$ (d) $8 : (8 - x)$

15. Which one of the following lines is perpendicular to $2x - 5y + 7 = 0$?

(a) $2x + 5y + 7 = 0$ (b) $5x - 2y - 7 = 0$

(c) $2x - 5y - 7 = 0$ (d) $5x + 2y + 7 = 0$

16. The image of the line $2y = 5 - 3x$ under the axial symmetry in the y-axis is

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

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

17. $p(-1, -5)$, $q(-2, 1)$, $r(2, 5)$, and s form the parallelogram $pqrs$. The coordinates of s are

(a) (3, 0) (b) (3, −1) (c) (4, 0) (d) (4, 1)

18. The two lines $2y = x + 1$ and $3y - 2(x + 1) = 0$ meet on the x-axis where x is

(a) 0 (b) $\frac{1}{2}$ (c) $\frac{2}{3}$ (d) −1

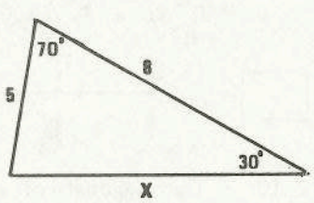
19. If $\cos A = 0{\cdot}8841$ and $0 \leqslant A \leqslant 90°$, then A is

(a) 27°52′ (b) 62°8′ (c) 27°56′ (d) 27°4′

20. x =

(a) $\dfrac{8 \sin 80°}{\sin 30°}$ (b) $\dfrac{5 \sin 70°}{\sin 80°}$

(c) $\dfrac{8 \sin 70°}{\sin 30°}$ (d) $\dfrac{5 \sin 70°}{\sin 30°}$



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MATHEMATICS - HIGHER COURSE - PAPER I (300 marks)

FRIDAY, 8 JUNE - MORNING, 9.45 to 12.15

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

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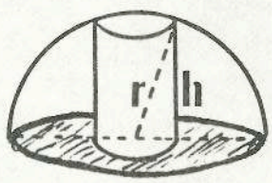
1. (a) Two cars P and Q were bought for IR£2950 and IR£3550, respectively. Car P was sold at a profit of 14% while car Q was sold at a loss of 12%. Calculate the overall percentage profit or loss.

(b) A solid cylinder of height h is cut from a solid hemisphere of radius r. If the radius of the hemisphere is three times the radius of the base of the cylinder, find how many times is the volume of the hemisphere greater than the volume of the cylinder. Give your answer correct to the nearest integer.



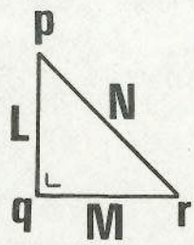
2. abc is an isosceles triangle in which $|ab| = |ac|$. Prove that $|\angle abc| = |\angle acb|$.

d is a point in $[bc]$ such that $ad \perp bc$. Prove that d is equidistant from ab and ac.

Taking the axial symmetry in the bisector of $\angle bad$, or otherwise, show, with proof, how to construct a point q in ab such that the distance of q from ad is the same as the distance of d from ab.

3. Prove that the composition of two axial symmetries in perpendicular axes is a central symmetry.

The lines L, M, N form an isosceles right angled triangle pqr.



Construct the image of Δpqr under the composition of axial symmetries

$$S_N \circ S_M \circ S_L$$

and prove that the image of q is the distance $|pr|$ from q.

4. Prove that the image of a circle under the axial symmetry in a line through its centre is the same circle.

From a point k outside a circle of centre c two tangents kt_1 and kt_2 are drawn to touch the circle at t_1 and t_2. Say why c is on the bisector of the $\angle t_1 k t_2$ and hence, or otherwise, prove that t_2 is the image of t_1 under the axial symmetry in kc.

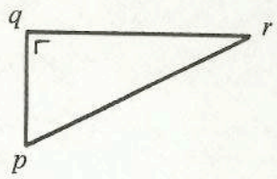
OVER →

5. In a triangle abc,
$|\angle bac| = 90°$, $ad \perp bc$ and d is a point in $[bc]$.

Prove $|\angle dab| = |\angle dca|$
and hence deduce that the triangles abd and abc are similar.

Prove that $|bd| \,.\, |bc| = |ba|^2$ and deduce the Theorem of Pythagoras.

If $|\angle pqr| = 90°$, as in the diagram, show how to construct a rectangle $prxy$ which is equal in area to the square on $[pq]$.



6. $a(3, 4)$, $b(-2, 1)$, $c(5, -1)$ are three points.

(i) Find the slope of ab.

(ii) Find the equation of the line through c which is parallel to ab.

(iii) Show that $\frac{40}{3}$ is the area of the triangle enclosed between the line in (ii) and the two axes.

(iv) Find the coordinates of a point p on the y-axis for which the area of Δapb is equal to the area in (iii).

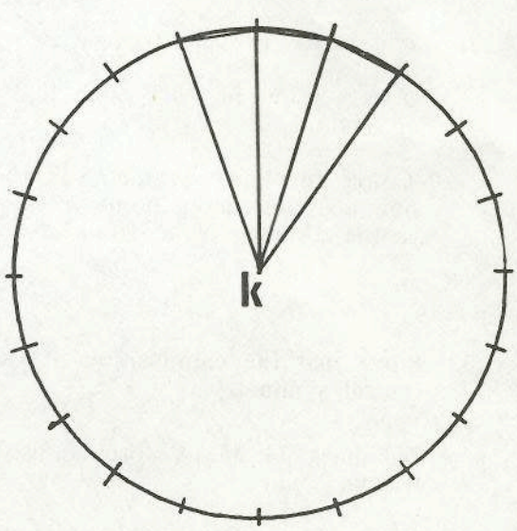
(v) Let ab cut the y-axis at h and let q be the image of p under the central symmetry in h. Prove that $\frac{40}{3}$ is also the area of the Δaqb.

7. (a) Prove that the area of a triangle is

$$\tfrac{1}{2}\, a \,.\, b \,.\, \sin C$$

where a, b, C have their usual meanings.

(b) 20 identical triangles are drawn in a circle of centre k. Some of these triangles are shown in the diagram. Calculate the percentage of the area of the circle occupied by the 20 triangles, giving your answer correct to the nearest integer and taking $\pi = 3{\cdot}14$.



(c) The Δpqr indicates the course sailed by boats in a race.

Calculate, to the nearest integer, the length of the course beginning and ending at p.