

AN ROINN OIDEACHAIS M.43(a)
 INTERMEDIATE CERTIFICATE EXAMINATION, 1985

MATHEMATICS - HIGHER COURSE - PAPER I (300 marks)

THURSDAY, 13 JUNE - MORNING, 9.30 to 12.00

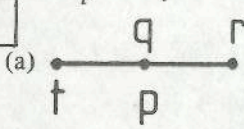
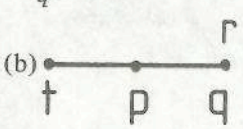
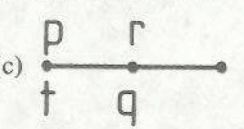
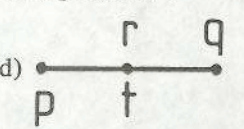
SECTION A (100 marks)

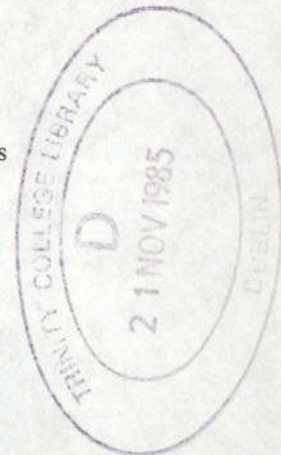
Examination Number

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. 120% of 120 is
 (a) 100 (b) 120 (c) 140 (d) 144
2. $(1.2 \times 10^2) + (2.8 \times 10^3) =$
 (a) 2.92×10^3 (b) 2.92×10^4 (c) 4×10^5 (d) 4×10^6
3. In the case of a rectangle you are given length : breadth = 5 : 2. If the length is 70 cm, the breadth in cm is
 (a) 20 (b) 28 (c) 35 (d) 50
4. A side of a square is $\sqrt{2}$ units in length. A circle is drawn through the vertices of the square. The radius of the circle is of length:
 (a) π (b) $\sqrt{2}$ (c) $\frac{\sqrt{2}}{2}$ (d) 1
5. The simple interest on IR£x at y% per annum for 5 years is
 (a) $5xy$ (b) $\frac{5x}{y}$ (c) $\frac{x}{20y}$ (d) $\frac{xy}{20}$
6. The diagonals of a parallelogram pqrs intersect at x. Then
 (a) (p, q) \uparrow (r, s) (b) (p, s) \uparrow (q, r) (c) (s, x) \uparrow (q, x) (d) (p, x) \uparrow (r, x)
7. The rectangle is NOT mapped onto itself under
 (a) $S_P \circ S_P$ (b) $S_Q \circ S_Q$
 (c) $S_Q \circ S_P$ (d) $S_R \circ S_P$
8. Which of the following transformations is NOT a function?
 (a) inverse of a translation (b) inverse of an axial symmetry
 (c) inverse of a central symmetry (d) inverse of a projection
9. If $S_P \circ S_t = S_r \circ S_q$, which of the following positions of r is impossible?
 (a)  (b)  (c)  (d) 
10. A translation CANNOT be
 (a) the identity transformation (b) the composition of two axial symmetries
 (c) a central symmetry (d) the composition of two central symmetries.



11. The relation "is perpendicular to" is defined on the set of all lines. This relation is

- (a) reflexive (b) symmetric (c) transitive (d) a function

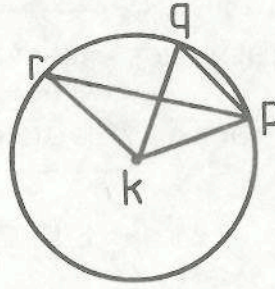
12. The centre of the circle is k .

$$|\angle qkr| = 70^\circ$$

$$|\angle qkp| = 50^\circ$$

Then $|\angle qpr| =$

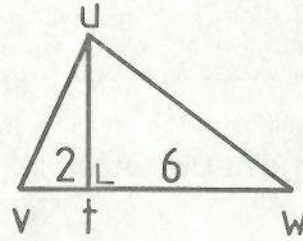
- (a) 25° (b) 35°
(c) 50° (d) 70°



13. $|\angle yuw| = 90^\circ$, $|vt| = 2$, $|tw| = 6$.

$|yu| =$

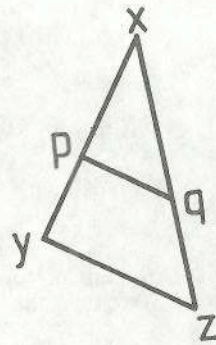
- (a) $\sqrt{8}$ (b) $\sqrt{12}$
(c) 4 (d) 16



14. $pq \parallel yz$ and $|pq| : |yz| = \frac{4}{5} : \frac{5}{4}$.

Then $|xp| : |py| =$

- (a) 5 : 4 (b) 16 : 9
(c) 9 : 16 (d) 4 : 5



15. $p(-3, 2)$, $q(1, 0)$ and $r(-3, -1)$ are three points. The area of Δpqr is

- (a) 3 (b) 4 (c) 6 (d) 16

16. K is the line $y = 2x$. $f(K)$ is the image of K under the axial symmetry in the x -axis. The equation of $f(K)$ is

- (a) $y = \frac{1}{2}x$ (b) $2x - y = 0$ (c) $x = 0$ (d) $2x + y = 0$

17. The slope of the line $2x - 4y + 5 = 0$ is

- (a) 2 (b) -2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

18. $u(-2, 1)$ and $v(-1, -2)$ are two points. The image of $(1, 3)$ under $S_v \circ S_u$ is

- (a) $(3, -3)$ (b) $(3, -1)$ (c) $(1, -2)$ (d) $(-5, -1)$.

19. If $\cos A = 0.33$ and $0 < A < 90^\circ$, then A is

- (a) $70^\circ 40'$ (b) $19^\circ 20'$ (c) $19^\circ 16'$ (d) $70^\circ 44'$

20. If $\sin 2A = 2\sin A \cos A$, then $\sin 120^\circ$ is

- (a) $\frac{\sqrt{3}}{8}$ (b) $\frac{\sqrt{3}}{4}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\sqrt{3}$

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SECTION B (200 marks)

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

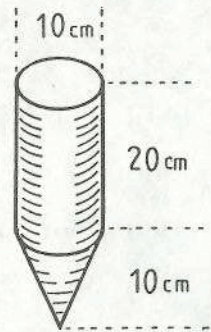
Marks may be lost if all your work is not clearly shown

1. (a) Calculate the compound interest on IR£2000 for three years at 15% per annum.

- (b) A vessel of height 30 cm consists of a cylinder and cone, as in diagram.

Find in terms of π the volume of the vessel.

If the volume of the vessel had to be $375\pi \text{ cm}^3$, the diameter remaining at 10 cm, find the ratio of the volume of the cylinder to the volume of the cone. (Assume the height of the vessel remains at 30 cm.)



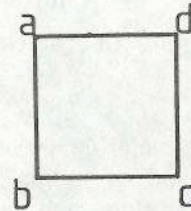
2. K is a circle having its centre at c and p is a point outside K . Show, with proof, how to construct the two tangents pt and ps , to K . If t and s are on K , prove

(i) $|ps| = |pt|$

(ii) $|\angle pst| = |\angle pct|$

and deduce that $|\angle pcs| = |\angle pct|$.Also prove that s is the image of t under the axial symmetry in the line pc .

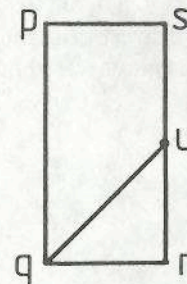
3. (a) Prove that the composition of two translations is a translation.
 $abcd$ is a square. Find the image of the square under the composition of translations $\vec{ca} \circ \vec{bc} \circ \vec{ab}$.



- (b) $pqrs$ is a rectangle in which $|pq| = 2|qr|$.

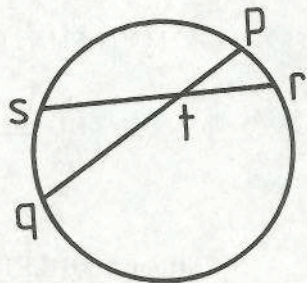
Prove that qu , the bisector of $\angle pqr$, is also the bisector of $[rs]$.The bisector of $\angle rqu$ meets rs at k .Taking the axial symmetry in qk , or otherwise, prove that

$|rk| < |ku|$.

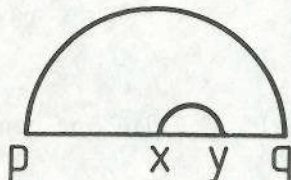


4. Construct three circles each of which contains two given points x and y . Construct with proof the circle through three non-collinear points p, q, r , and say why only one such circle is possible. A circle contains the four vertices of a quadrilateral. Prove that the opposite angles of the quadrilateral sum to 180° .

5. (a) Prove that the two triangles tps and tqr are similar and hence deduce that $|st| \cdot |tr| = |qt| \cdot |tp|$.
 If $|tp| = |tr|$, prove that the triangles spt and qrt are equal in area.



- (b) The diagram shows two semi-circles. k is a point such that each angle of the Δkxy measures 90° or less. Indicate clearly in the large semi-circle the region occupied by k .



6. (i) $a(-3, 4)$ and $b(5, -2)$ are two points. Calculate $|ab|$.
 (ii) Find the coordinates of the point c , the midpoint of $[ab]$.
 (iii) Find the equation of the line, K , through c which is perpendicular to ab .
 (iv) $p(x, 5)$ is a point in the 1st quadrant. Find in terms of x the area of the Δpab .
 (v) $q(x, y)$ is a point of K such that area of $\Delta qab = 50$. Find the coordinates of the two positions of q .

7. (a) The perimeter of an isosceles triangle pqr is 32 cm and its base $[qr]$ is 12 cm long. Find $\tan \angle pqr$.
 (b) $[uv]$ is a line segment one unit in length. Construct the point t in $[uv]$ such that $|ut| = \sin 50^\circ$.
 (Use of Tables not allowed.)



- (c) A marble travels in a circle of centre k and of radius 10 cm at a steady speed. During each second the angle at the centre of the circle increases by 37° . The marble begins at p . After 40 seconds the marble is at t . Calculate, to the nearest integer, the length of the line segment $[pt]$.

