

INTERMEDIATE CERTIFICATE EXAMINATION 1976

MATHEMATICS - HIGHER COURSE - PAPER I (300 marks)

THURSDAY, 10 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 either (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. The lowest common denominator for the addition $\frac{1}{7} + \frac{3}{14} + \frac{12}{35}$ is

- (a) 98 (b) 245 (c) 490 (d) 70

2. A speed of 1000 m/s is increased by 10% every second. In three seconds the speed in m/s is

- (a) 1300 (b) 1110 (c) 1221 (d) 1331

3. y is $\frac{2}{3}$ of a half a number. What fraction of the number is y ?

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

4. A profit of 20% is made when an article is sold for £30. The cost price is

- (a) £25 (b) £24 (c) £36 (d) £10

5. Two taps P and Q open together can fill a tank in 2 minutes. P on its own can fill the tank in 4 minutes. Q on its own can fill the tank in

- (a) 3 minutes (b) 4 minutes (c) 2 minutes (d) greater than 4 minutes

6. Parallel projection preserves

- (a) length (b) size of angle (c) equipollence (d) length and equipollence

7. $x \in \Pi$. Then S_x , the central symmetry in x , is a set of

- (a) line segments (b) points (c) equipollent couples (d) couples

8. $p \in \Pi$, $q \in \Pi$. Then $S_p \circ S_q$ is

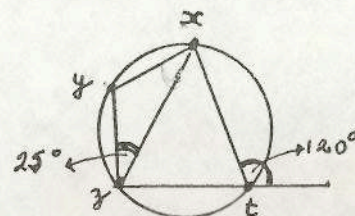
- (a) \vec{pq} (b) $2\vec{qp}$ (c) $2\vec{pq}$ (d) \vec{qp}

9. L and M are two parallel lines. $x \in L$ and $y \in M$ and $L \perp xy$. Then $S_M \circ S_L$ is

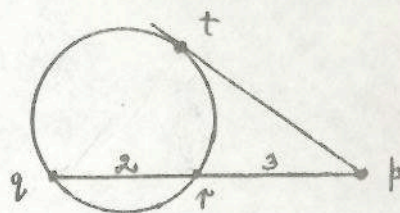
- (a) S_{xy} (b) $S_x \circ S_y$ (c) $2 \vec{xy}$ (d) $S_L \circ S_M$

10. In the diagram $|\angle yxz|$ is

- (a) 25° (b) 35° (c) 45° (d) cannot be found

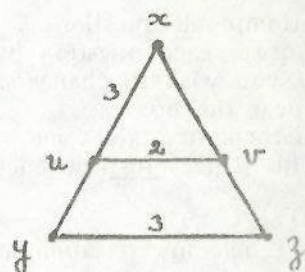


11. In the diagram pt is a tangent and $|qr| = 2$, $|rp| = 3$.
Then $|pt|$ is



- (a) $\sqrt{6}$ (b) $\sqrt{18}$ (c) $\sqrt{15}$ (d) $\sqrt{13}$

12. In the diagram $uv \parallel yz$. $|uv| = 2$, $|yz| = 3 = |xu|$.

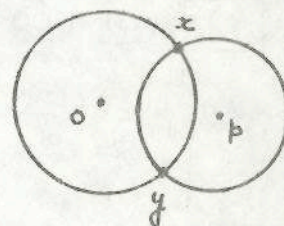


- Then $|uy|$ is
(a) $4\frac{1}{2}$ (b) 2 (c) $1\frac{1}{2}$ (d) $\frac{2}{3}$

13. In a Δlmn , $|lm|^2 = |ln|^2 - |mn|^2$, then

- (a) $|lm| > |ln|$ (b) $|\angle mnl| = 90^\circ$
(c) $|lm| = |ln| - |mn|$ (d) $|\angle mln| + |\angle mnl| = 90^\circ$

14. The circles in diagram have radii of unequal length and their centres are at o and p . Then



- (a) op bisects $[xy]$ at right angles (b) $|ox| = |px|$
(c) S_{xy} maps the circles onto themselves (d) xy bisects $[op]$

15. The set $\{(-3,3), (3,3)\}$ is the image of $\{(3,-3), (3,3)\}$ by the

- (a) identity 1_{Π} (b) axial symmetry in the line $x = 0$.
(c) central symmetry in the origin (d) axial symmetry in the line $x = y$.

16. A line through the origin perpendicular to $3x - 2y = 0$ is

- (a) $2x + 3y + 5 = 0$ (b) $3x + 2y = 0$
(c) $2x - 3y = 0$ (d) $2x + 3y = 0$

17. The slope of the line through the two points $(-1,3)$ and $(4,-7)$ is

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

18. If $\cos A < 0.8100$ when $0^\circ \leq A \leq 90^\circ$, then $\sin A$ must be greater than

- (a) 0.5866 (b) 0.8100 (c) 0.5864 (d) 0.5872

19. In a Δpqr , $|\angle pqr| = 55^\circ$ and $|\angle prq| = 90^\circ$. Then $|qr|$ is

- (a) $\cos 55^\circ$ (b) $|pq| \cos 55^\circ$ (c) $|pq|^2 - |pr|^2$ (d) $\sin 55^\circ$

20. If $\tan A = \frac{12}{5}$, then $\sin A$ is

- (a) $\frac{5}{12}$ (b) $\frac{12}{13}$ (c) $\frac{13}{5}$ (d) $\frac{5}{13}$

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SECTION B (200 marks)

Attempt QUESTION 1 and THREE other questions

1. Find, correct to the nearest penny, the compound interest on £1500 for three years at 12% per annum.

Calculate, to the nearest integer, the rate of simple interest that would give this same yield on £1500 after 3 years.

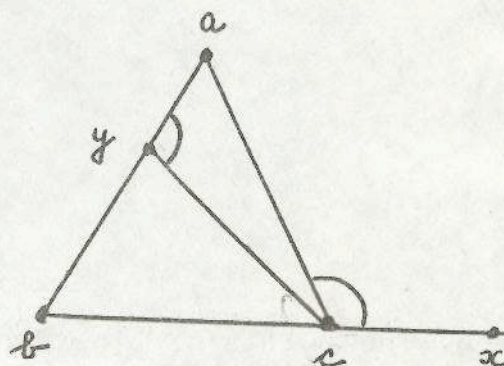
(40 marks)

2. Prove that the measure of the exterior angle of a triangle equals the sum of the measures of the interior opposite angles.

In the diagram $|\angle acx| = |\angle ayc|$. Prove

(i) $|\angle yac| = |\angle ycb|$,

(ii) $|\angle cy| = |\angle cb|$ given that $|\angle ab| = |\angle ac|$.



(40 marks)

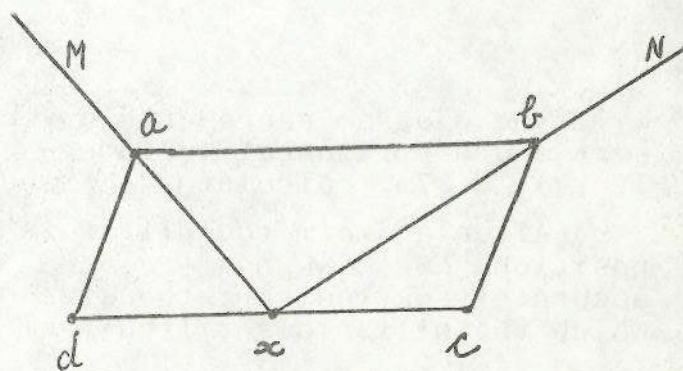
3. Prove that the composition of two axial symmetries in perpendicular axes is a central symmetry.

$abcd$ is a parallelogram in which $|ab| = 2|ad|$ and the bisectors of the angles dab and abc meet at x on the side $[dc]$. Prove

(i) $|\angle axb| = 90^\circ$,

(ii) x is the midpoint of $[dc]$,

(iii) $[dc]$ is its own image under $S_M \circ S_N$.



(40 marks)

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4. Prove that the angle at the centre of a circle has a measure which is double that of an angle at the circle standing on the same arc.

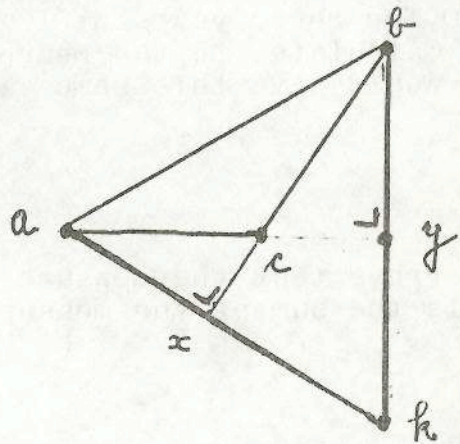
Deduce that all angles at the circle standing on the same arc have the same measure.

In a Δabc the point m is the midpoint of $[ab]$ and the circumcircle of the triangle cuts cm , produced, at x . If $bx \parallel ca$, prove that m is the circumcentre of the triangle.

(40 marks)

5. If the angles of one triangle are equal in measure to the angles in another, prove that the lengths of their corresponding sides are proportional.

k is the orthocentre of the Δabc .
Prove that $|ya| \cdot |yc| = |yk| \cdot |yb|$.



(50 marks)

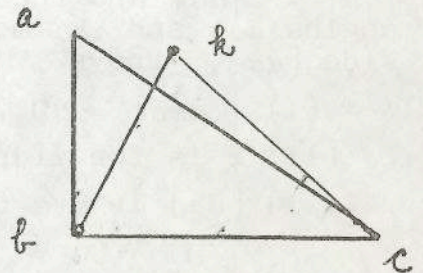
6. The points a, b, c have coordinates $(-1, 5), (-3, -1), (4, -1)$, respectively.

- Show that $(-2, 2)$ are the coordinates of m , the midpoint of $[ab]$.
- If g is the point $(0, 1)$, show that $|mg| : |gc| = 1 : 2$.
- Is m on the line cg ? Give your reason.
- Is $ab \perp cg$? Give your reason.

(50 marks)

7. The diagram represents a vertical pillar $[ba]$ and a horizontal surface bc and $\angle acb = 30^\circ$. If $|ac| = 27\text{m}$, calculate $|ab|$ and $|bc|$.

After a storm the pillar is tilted into the position $[bk]$ and now $\angle kcb = 35^\circ 6'$. Find, as accurately as you can, the size of the angle by which the pillar has tilted from the vertical.



(60 marks)