

INTERMEDIATE CERTIFICATE EXAMINATION, 1989

MATHEMATICS – HIGHER COURSE – PAPER I (300 marks)

THURSDAY, 8 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.

Mathematical tables may be obtained from the Superintendent.

THIS PAPER MUST BE ENCLOSED IN YOUR ANSWER BOOK

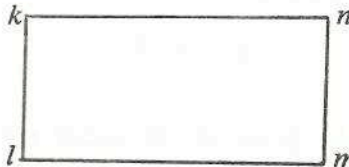
1. $(0.2)^3 =$
 (a) 0.8 (b) 0.08 (c) 0.008 (d) 0.0008

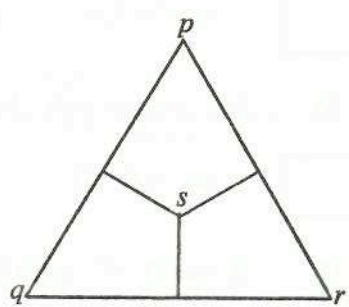
2. A cubic box has a side of length 5 cm. The volume of this box, in m^3 , is
 (a) 1.25×10^{-1} (b) 1.25×10^{-2} (c) 1.25×10^{-3} (d) 1.25×10^{-4}

3. An athlete's maximum speed in a sprint is 10 m/s. This maximum speed, in kilometres per hour, is
 (a) 360 (b) 36 (c) 3.6 (d) 0.36

4. A right circular cone has a radius of length 4 m and height 3 m. The curved surface area, in m^2 , is
 (a) 12π (b) 15π (c) 20π (d) 24π

5. To qualify for a swimming event in the Olympics, a swimmer must reduce her time for the event by 20%. Her speed must be increased by
 (a) 20% (b) 25% (c) 40% (d) 16%

6. $klmn$ is a rectangle. $S_n \circ S_k$ is 
 (a) $2\vec{kn}$ (b) \vec{nk}
 (c) $2\vec{nk}$ (d) \vec{kn}

7. s is the circumcentre of the equilateral triangle pqr . Which one of the following rotations about the point s does NOT map Δpqr onto itself?
 (a) 120° (b) 180°
 (c) 240° (d) 360°


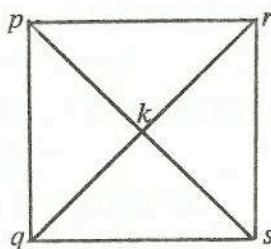
8. Which one of the following is a set of equipollent couples?
 (a) a translation (b) a central symmetry
 (c) an axial symmetry (d) a parallel projection

9. The relation "is a brother of" is defined on a set of boys in a school. This relation is

- (a) transitive
(b) reflexive
(c) an equivalence relation
(d) symmetric

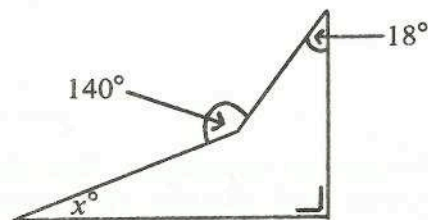
10. The diagonals of the square $pqsr$ intersect at k . The square $pqsr$ is NOT its own image under

- (a) S_k , the central symmetry in k
(b) the identity translation
(c) the axial symmetry in ps
(d) the projection on ps parallel to rq



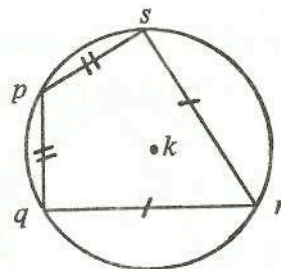
11. x° is

- (a) 18°
(b) 32°
(c) 36°
(d) 72°



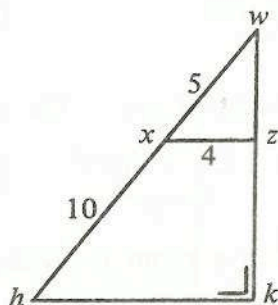
12. k is the centre of the circle and $|\angle qkr| = 66^\circ$. Then $|\angle qpr|$ is

- (a) 66°
(b) 44°
(c) 33°
(d) 22°



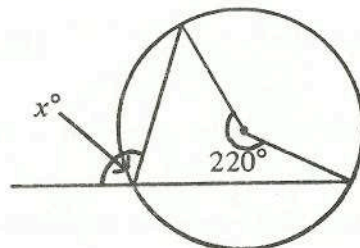
13. $xz \parallel hk$.
 $|zk| =$

- (a) 12
(b) 9
(c) 6
(d) 3



14. x° is

- (a) 70°
(b) 110°
(c) 140°
(d) 50°



15. The slope of a line parallel to the line $5x + 3y - 15 = 0$ is

- (a) $-\frac{5}{3}$
(b) $\frac{5}{3}$
(c) $-\frac{3}{5}$
(d) $\frac{3}{5}$

16. The vertices of triangle wuv are $w(0, 0)$, $u(-3, -4)$ and $v(3, -4)$. The area of Δwuv is

- (a) 7
(b) 12
(c) 14
(d) 24

17. The image of the point $(2, 3)$ under the central symmetry in the point $(-1, 0)$ is

- (a) $(-3, -3)$
(b) $(-2, 1.5)$
(c) $(-1, 3)$
(d) $(-4, -3)$

18. The points $p(6, 4)$, $q(-2, 1)$, $r(2, -1)$, $s(x, y)$ form the parallelogram $pqrs$. Then (x, y) is

- (a) $(10, 2)$
(b) $(4, 3)$
(c) $(10, 3)$
(d) $(10, 4)$

19. If $\cos Q < \sin 2Q$ and $0 \leq Q \leq 90^\circ$, then Q is

- (a) 0°
(b) 90°
(c) 30°
(d) 45°

20. If $4 \tan A - 5.08 = 0$ and $0 \leq A < 90^\circ$, then A is

- (a) $38^\circ 40'$
(b) $50^\circ 12'$
(c) $51^\circ 47'$
(d) $65^\circ 33'$

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MATHEMATICS – HIGHER COURSE – PAPER I (300 marks)

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SECTION B (200 marks)

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

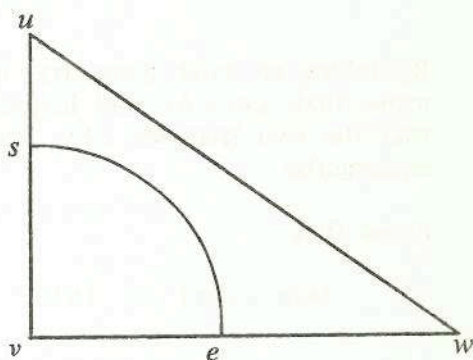
Marks may be lost if all your work is not clearly shown

1. (a) A person borrowed IR£3000 at 11% per annum compound interest. The person repays IR£1000 at the end of the first year. How much does the person owe after 2 years ?

- (b) A triangular piece of plywood uvw has sides of length $|uv| = 20$ cm, $|uw| = 29$ cm and $|\angle uvw| = 90^\circ$. A woodwork student cuts out a sector vse with centre v and radius of length 14 cm.

Calculate

- the area of the remaining piece, figure $usew$
- the perimeter of figure $usew$.

Take $\pi = 3\frac{1}{7}$.

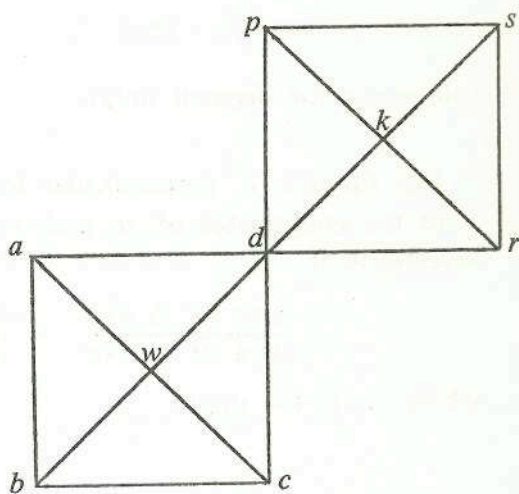
2. Prove that the composition of two central symmetries is a translation.

The square $pdrs$ is the image of the square $abcd$ under the central symmetry in the point d .

Using the letters of the diagram, name

- a composition of two central symmetries
- a composition of two translations
- a composition of two axial symmetries,

which in each case of (i), (ii) and (iii) maps the square $abcd$ onto the square $pdrs$.



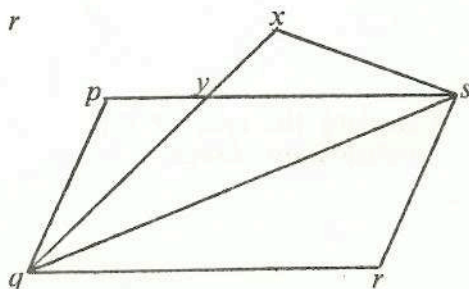
3. Prove that a diagonal of a parallelogram bisects the area of the parallelogram.

$pqrs$ is a parallelogram. x is the image of r under the axial symmetry in the line qs .

Prove that

$$\triangle qps = \triangle qxs$$

in area.

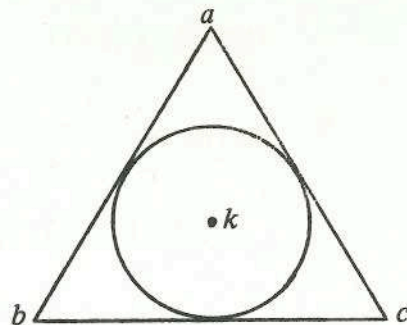
Hence, deduce that $px \parallel qs$.

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4. Prove that the bisectors of the interior angles of a triangle are concurrent.

abc is an equilateral triangle.
 k is the centre of the incircle of this triangle.

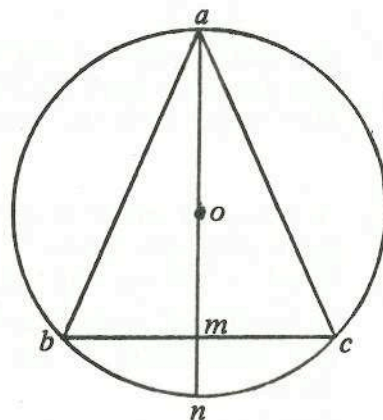
Use $\sin 30^\circ = \frac{1}{2}$, or otherwise, to prove that the circle bisects $|kb|$.



5. Prove that if the angles of two triangles are equal in measure, then the lengths of their corresponding sides are proportional.

abc is an isosceles triangle inscribed in a circle with centre o and $|ab| = |ac|$.
 The diameter an is drawn cutting bc at m .

By taking an axial symmetry, or otherwise, prove that $am \perp bc$ and hence deduce that the two triangles abn and $bm n$ are equiangular.



Prove that

$$|nm| \cdot |na| = |nb|^2.$$

6. Prove that the three points $a(-1, 3)$, $b(5, -5)$ and $c(8, -9)$ are collinear and find the ratio

$$|ab| : |bc|$$

(no marks for diagram only).

A line through c perpendicular to ac cuts the X axis at u and the Y axis at v .
 Find the coordinates of u and v .

Investigate if

$$\frac{\text{area of } \Delta avu}{\text{area of } \Delta ovu} = \frac{|ab|}{|bc|},$$

where o is the origin.

7. (a) Construct a triangle def such that $|df| = 4$ cm, $|\angle dfe| = 90^\circ$ and $\sin |\angle def| = \frac{8}{11}$, showing all construction lines clearly.

- (b) Calculate the area of the parallelogram $klmn$.

