

INTERMEDIATE CERTIFICATE EXAMINATION, 1986

MATHEMATICS - HIGHER COURSE - PAPER I (300 marks)

THURSDAY, 12 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. $(0.1)^3 = 0.1 \times 0.1 \times 0.1$

- (a) 0.1 (b) 0.01 (c) 0.001 (d) 0.0001

2. $33\% = 110$
 $34\% = 120$
 $36 = 120$
 33% of a number is 110. Then 36% of the same number is

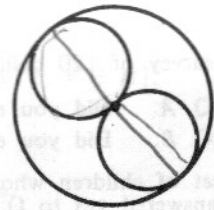
- (a) 113 (b) 120 (c) 143 (d) 147

3. A person travels at a speed of 3.6 km per hour. This speed in metres per second is

- (a) 1 (b) 10 (c) 100 (d) 1000

4. Two circles of equal size fit exactly inside a larger circle. If l is the length of each small circle and L is the length of the larger circle, then

- (a) $L = l$ (b) $L = 2l$
 (c) $L = 3l$ (d) $L = \pi l$



5. If $P(1.1)^2 = 1210$, then P is

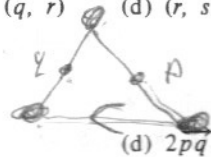
- (a) 1100 (b) 1000 (c) 210 (d) 100

6. If $(p, s) \uparrow (q, r)$ and p, q, r, s are distinct points, then

- (a) $(p, q) \uparrow (r, s)$ (b) $(p, r) \uparrow (s, q)$ (c) $(s, p) \uparrow (q, r)$ (d) $(r, s) \uparrow (q, p)$

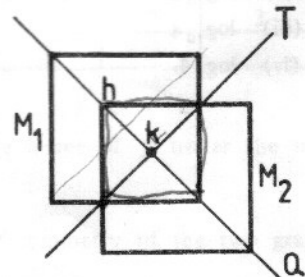
7. p and q are two points. Then $S_q \circ S_p =$

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



8. M_1 and M_2 are squares of equal size. Which one of the transformations does NOT map $M_1 \cup M_2$ onto itself?

- (a) S_Q (b) S_T
 (c) S_k (d) S_h



9. K makes an angle of 60° with pq and $|pq| = 3$. The image of $[pq]$ under the projection on a line L where the projection is taken parallel to K could NOT be of length

- (a) 1
 (b) 3
 (c) 30
 (d) 300

10. $K \rightarrow Q$ under

- (a) $S_H \circ S_K$
 (b) $S_Q \circ S_K$
 (c) $S_P \circ S_Q$
 (d) $S_K \circ S_H$

11. P, Q, R, S are four distinct lines such that $P \perp Q \perp R \perp S$. Which one of the following is NOT true?

- (a) $P \parallel R$
 (b) $Q \parallel S$
 (c) $P \perp R$
 (d) $P \perp S$

12. $(x + y)^\circ$ is

- (a) 90°
 (b) 180°
 (c) 360°
 (d) 540°

13. If $|yp| : |pz| = 2 : 1$ then area of Δxyz : area of Δxpz is

- (a) $2 : 1$
 (b) $3 : 1$
 (c) $3 : 2$
 (d) $9 : 1$

14. If $y^\circ < 90^\circ$, then

- (a) $x = y$
 (b) $x < y$
 (c) $x > y$
 (d) $x + y = 180^\circ$

15. The image of $(-5, 2)$ under the translation $(-1, 2) \rightarrow (2, -1)$ is

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

16. The slope of the line $x - 2y = 2x + y$ is

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

17. The lines $x - y = 2$ and $y - 4 = 0$ intersect at the point

- (a) $(6, 0)$
 (b) $(6, 4)$
 (c) $(0, -2)$
 (d) $(4, 2)$

18. The equation of the line parallel to the y -axis and containing the point $(-\frac{1}{2}, 0)$ is

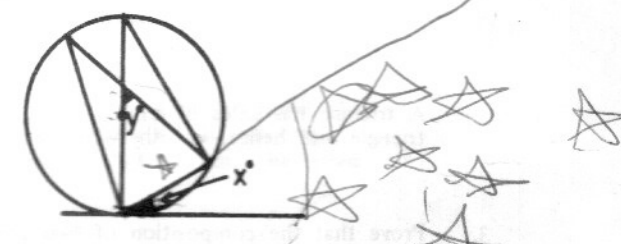
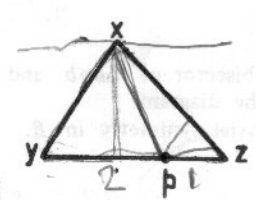
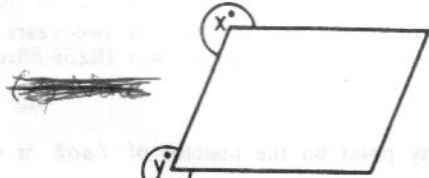
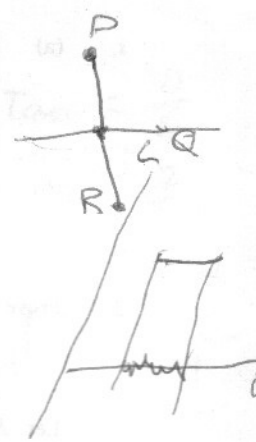
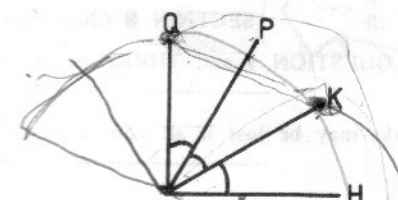
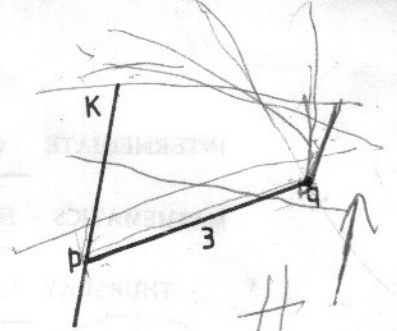
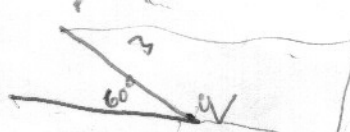
- (a) $2y + 1 = 0$
 (b) $2x + 1 = 0$
 (c) $2y - 1 = 0$
 (d) $2x - 1 = 0$

19. If $\tan A = 0.75$ and $0^\circ < A < 90^\circ$ then $\sin A$ is

- (a) 0.6004
 (b) 0.6002
 (c) 0.6
 (d) 1

20. If $\cos A \geq \sin A$, then A cannot be

- (a) 0°
 (b) 30°
 (c) 45°
 (d) 60°



Wo
Correct
Answer

b

3/1

$$\begin{aligned} x - y &= 2 \\ -4 + y &= 0 \\ \hline x - 4 &= 2 \\ x &= 6 \end{aligned}$$

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MATHEMATICS - HIGHER COURSE - PAPER I (300 marks)

THURSDAY, 12 JUNE - MORNING, 9.30 to 12.00

SECTION B (200 marks)

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

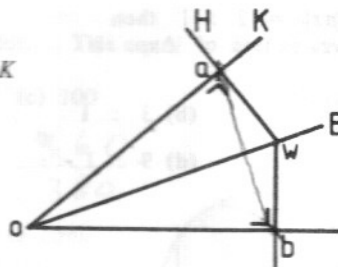
Marks may be lost if all your work is not clearly shown

1. (a) A half grapefruit is in the shape of a hemisphere of radius 5 cm and has a mass of 125 grammes. The inside of the grapefruit (juice and fibre) has a mass of 85 grammes. If the skin is of uniform thickness of 1 cm, calculate, correct to one place of decimals, the mass per cc of the skin. Take π to be $\frac{22}{7}$.
- (b) A sum of money was invested for two years at 8% per annum, compound interest. The interest for the 2nd year was IR£38.88. Find the sum invested.
2. Prove that any point on the bisector of $\angle aob$ is equidistant from oa and ob .

Let B be the bisector of $\angle aob$ and let H, K be lines as in the diagram.

Let f be the axial symmetry in B . Say why

$$f(H) \cap f(K) = f(H \cap K).$$



A triangle has sides of length 3 cm, 4 cm, 5 cm. Calculate the area of the triangle and hence, or otherwise, calculate the radius of its incircle.

3. Prove that the composition of two central symmetries is a translation. $abcd$ is a parallelogram. Express $2b\vec{a}$ as the composition of two central symmetries and show that

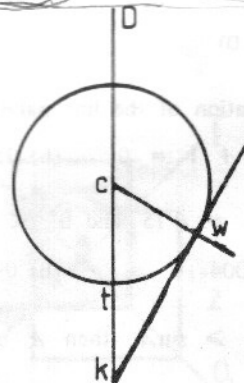
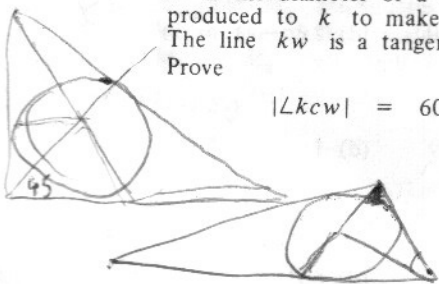
$$S_a \circ S_b = S_d \circ S_c.$$

Use a rough diagram to indicate the image of the parallelogram under $S_a \circ S_b \circ S_c$.

4. Prove that the diameter of a circle which is perpendicular to a tangent contains the point of contact.

D is the diameter of a circle of centre c which is produced to k to make $|ct| = |tk|$. The line kw is a tangent at w . Prove

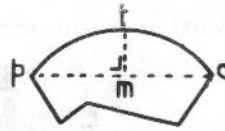
$$|\angle kcw| = 60^\circ.$$



5. $[ab]$ and $[cd]$ are two chords of a circle.
If the lines ab and cd intersect internally at k , prove
 $|ak| \cdot |kb| = |ck| \cdot |kd|$.

The diagram shows a piece of metal which has broken off from a (circular) disc where ptq is part of the original circle.

If $|pq| = 36$ cm, $|tm| = 12$ cm where $|pm| = |mq|$, calculate the length of the radius of the disc.



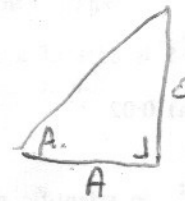
6. The points $a(2, 5)$, $b(5, 8)$, $c(2, -1)$, $d(x, y)$ form a parallelogram $abcd$.
Find the midpoint of $[ac]$ and hence, or otherwise, find the coordinates of the point d .

A circle is drawn on $[ac]$ as diameter.

Investigate if t , the point of intersection of ad and the x -axis, is inside or outside or on this circle.

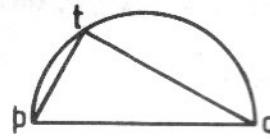
(Note: No marks will be awarded for an accurate drawing)

$$\tan = \frac{O}{A} = \frac{2}{1}$$

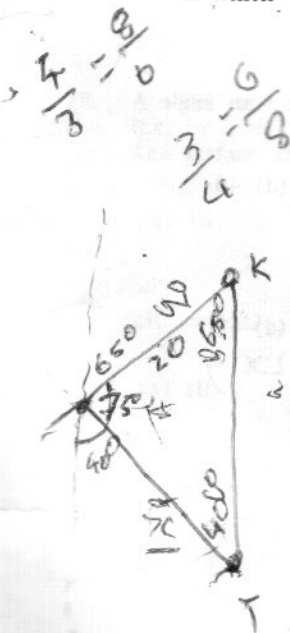


7. (a) Construct an angle A such that $\tan A = 7$.
(Use of Tables is not allowed.)

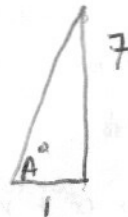
- (b) The diagram shows a semicircle ptq where $|pq| = 1$ and $\angle tpq = 70^\circ$.
Find two points x and y in $[pq]$, such that $|px| = \cos 70^\circ$ and $|qy| = \sin 20^\circ$ and show that $|xy| < \frac{1}{3}$.



- (c) Two ships K and T leave harbour at the same time. T sails South 40° East while K sails North 65° East. After 1 hour K has travelled 20 km and T is then directly South of K . Calculate, correct to the nearest km, the speed at which T is travelling.



$$\begin{array}{r} 17.32 \\ 1.556 \\ \hline 10.392 \\ 86.600 \\ 866.000 \\ \hline 1732.000 \\ \hline 269.492 \end{array}$$



$$17.32$$

$$27 \text{ km/h} \sin 40^\circ = \frac{20}{\sin 60^\circ}$$

$$\begin{aligned} x \sin 40^\circ &= 20 \sin 60^\circ \\ x \cdot 6428 &= 866 \times 20 \\ x &= \frac{17.32}{.6428} \end{aligned}$$