SAMPLE PAPER

MATHEMATICS – HIGHER COURSE – PAPER I (300 marks)

SECTION A (100 marks)

Attempt <u>all</u> questions.   You should not spend more than <u>50 minutes</u> 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.
This paper <u>must</u> be enclosed in your answer book.

1.   5% of £10 is

   (a) 25p   (b) £1   (c) £2   (d) 50p

2.   The greatest common divisor of 10, 15, 18, 21 is

   (a) 1   (b) 5   (c) 3   (d) 2.

3.   If there are $2 \cdot 4$ dollars to the £, then for 12 dollars a person gets

   (a) £5   (b) £2   (c) £24   (d) £12

4.   A car travels 1900 m in 2 minutes.   Its speed in kilometres per hour is

   (a) 570   (b) 57   (c) 9500   (d) 5700

5.   If 40% of x is £2, then £x is

   (a) £4   (b) £5   (c) £20   (d) £40

6.   It takes 4 men 3 days to do a job of work.   3 men, working at the same rate, would do the same amount of work in

   (a) 1 day   (b) 4 days   (c) 4/3 of a day   (d) $2\frac{1}{4}$ days.

7.   A, B, C are any three lines. $A \cup B \cup C$ is

   (a) a set of points   (b) a set of lines   (c) a direction   (d) a triangle.

8.   Transitivity of equipollence means that from $(a, b) \uparrow (c, d)$ and $(c, d) \uparrow (e, f)$ we can conclude

   (a) $(c, d) \uparrow (c, d)$ (b) $(b, a) \uparrow (d, c)$ (c) $(a, c) \uparrow (b, d)$ (d) $(a, b) \uparrow (e, f)$.

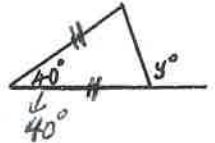9. The image of a set of points by a parallel projection is a set of

(a) points   (b) parallel lines   (c) couples   (d) parallelograms.

10. The composition of two central symmetries is

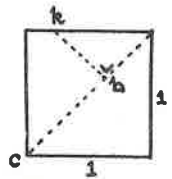(a) a central symmetry   (b) a translation   (c) a rotation   (d) an axial symmetry.

11. The value of y in the diagram is

(a) 110   (b) 140   (c) less than 90   (d) impossible to find.

12. k is any point on the side of a unit square and $|\angle kbc| = 90°$. Then $|kb| + |bc|$ is

(a) 1   (b) $\sqrt{2}$ (c) $\sqrt{3}$ (d) impossible to find.

13. X is a line. The image of X by an axial symmetry in a line L is X. Then the number of such lines L is

(a) none   (b) only 1   (c) only 2   (d) more than 2.

14. c is the centre of the circle in the diagram. Then $\alpha° + \beta°$ equals

(a) 180°   (b) 60°   (c) 120°   (d) 90°

15. p and q are the points $(-2, 1)$ and $(4, 3)$. k is the centre of (p, q). The image of k by S_Y, the axial symmetry in the Y-axis, is

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

16. K is the line $y = 2x + 1$. T is the image of K by S_O, the central symmetry in the origin. The slope of T is

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

17. If $2\sin 2A = 1$, $0° \leqslant A \leqslant 90°$, then A is

(a) 15°   (b) 30°   (c) 45°   (d) 14° 29′.

18. If $\tan A = \sin A$, then A is

(a) 0°   (b) 30°   (c) 60°   (d) 90°.

19. If $\sin A = 0\cdot4$, then $\cos A$ is

(a) 0·9165   (b) 0·9163   (c) 0·2348   (d) 0·9721.

20. If $\dfrac{a}{\sin A} = \dfrac{b}{\sin B}$, then a is equal to

(a) $\sin A + \dfrac{b}{\sin B}$ (b) $\dfrac{b}{\sin A \sin B}$ (c) $\dfrac{\sin B}{b \sin A}$ (d) $\dfrac{b \sin A}{\sin B}$

Attempt QUESTION 21 and THREE other questions

21. The present reading of an electricity meter is 17 237 units. The last previous reading was 16 549 units. Calculate the total electricity bill if the first 360 units are charged at 1·05p per unit and the remainder at 1·01p per unit and the V.A.T. charge is 6·75% on the total charge. Give your answer correct to the nearest penny.

(40 marks)

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

(25 marks)

In the triangle abc, $|ab| = 6$ cm $= |bc|$ and $|\angle abc| = 90°$. If p and q are the midpoints of $[ab]$ and $[ac]$, respectively, find the area of the $\triangle apq$.
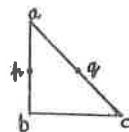
(15 marks)

23. (a) $[ab]$ and $[cd]$ are two chords of a circle. If the two chords intersect, when produced, at k, prove that $|ak| \cdot |kb| = |ck| \cdot |kd|$.
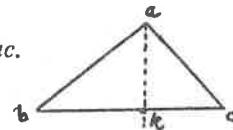
(20 marks)

(b) Prove that the perpendicular bisector (mediator) of a line segment $[rs]$ is the locus of all points equidistant from r and s.
Deduce that the perpendicular bisectors of the three sides of a triangle are concurrent.

(20 marks)

24. Prove that the areas of two triangles of equal height are proportional to the lengths of their bases.

(10 marks)

In the $\triangle abc$, $\angle bac$ is a right angle and ak is the bisector of $\angle bac$. Prove that area of $\triangle abk$: area of $\triangle ack = |ab| : |ac|$.

(20 marks)

Deduce that $|ba| : |ac| = |bk| : |kc|$.

(10 marks)

25. a, b, c are the points $(3, 2)$, $(-1, 2)$, $(-1, -1)$, respectively. Find
(i) $|ac|$ (ii) slope of ac (iii) $|\angle abc|$ (iv) equation of ac (v) where ac cuts the y-axis.
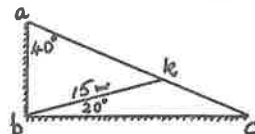
(50 marks)

26. Using the usual notation prove that

$$\frac{a}{\sin A} = \frac{b}{\sin B} \cdot$$

(25 marks)

$[ab]$ is a wall which is perpendicular to the ground bc. A beam of timber $[bk]$ is held in the fixed position by another beam $[ac]$. If $|bk| = 15$ m, $|\angle bac| = 40°$, $|\angle kbc| = 20°$, calculate, correct to two significant figures, the length of $[ak]$.
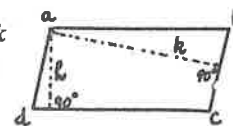

(25 marks)

27. Prove that the area of a triangle abc is $\frac{1}{2} |ab| \cdot h$, where h is the distance of c from ab.
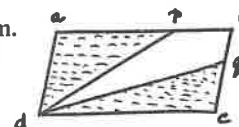
(15 marks)

$abcd$ is a parallelogram. h is the distance of a from cd and k is the distance of a from bc. Prove that
$|ab| : |ad| = k : h \cdot$

(20 marks)

$abcd$ is a parallelogram in which $|ab| = 6$ cm and $|bc| = 3$ cm. p and q are points in $[ab]$ and in $[bc]$, respectively, such that $|ap| = 4$ cm and $|cq| = 2$ cm. Prove that area of $\triangle pad$ = area of $\triangle qcd$.

(25 marks)