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INTERMEDIATE CERTIFICATE EXAMINATION, 1975

MATHEMATICS—LOWER COURSE—PAPER I

WEDNESDAY, 11 JUNE—MORNING, 9.45 to 12.15

Six questions to be answered.

All questions are of equal value.

Mathematics Tables may be obtained from the Superintendent.

1. A rectangular room is 4·5 m long, 3·5 m wide and 3·2 m in height. Find the area of the walls. $12\frac{1}{2}\%$ of the area of the walls is taken up with doors and windows. Find the cost of papering the room at £1·25 per m².

2. A solid cylinder is 25 cm in diameter and 14 cm in height. Taking $\frac{22}{7}$, as an approximation for π, show that the volume of the cylinder is 6875 cm³.

Four of these cylinders standing upright will just fit into a rectangular box of height 14 cm. Find

   (i)   the internal volume of the box

   (ii)   the volume of the box not occupied by the cylinders.

3. (a)   A, B, C and D are lines. $A \perp B$, $B \| C$, $C \perp D$. Say which of the following statements are true and which are false:

     $B \perp A$, $D \perp B$, $C \| A$, $B \| D$, $C \| C$, $A \perp D$.

(b)   P, Q and R are lines as described in the Venn diagram opposite. Draw the lines and indicate on them possible positions for the points a, b, c, d and k.
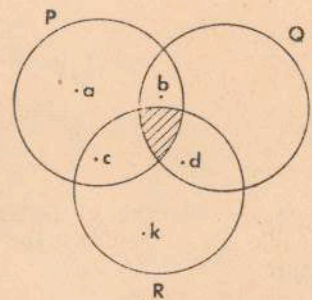
In the case of each one of the following sets name an element in the diagram which belongs to it:

     $P \cap Q$, $P \setminus (Q \cup R)$, $(Q \cup R) \setminus P$.

Write the empty set in the diagram in terms of P, Q and R.

4. Construct a quadrilateral $abcd$ given $|ab|=4$ cm, $|bc|=5$ cm, $\angle abc=50°$, $|bd|=9$ cm and $|da|=|dc|$. Construct a triangle equal in area to $abcd$.

5. Prove that the sum of the measures of the three angles of a triangle is $180°$.

In the diagram c is the image of a by a reflection (axial symmetry) in bd. If $\angle bad$ and $\angle bac$ measure $100°$ and $35°$, respectively, calculate the measures of $\angle abd$ and $\angle bdc$.

With regard to the diagram say which of the following statements is true and which is false. In each case give your reason:

   (i) ad is the image of ab by axial symmetry in ac.

   (ii) bd is the image of bd by axial symmetry in ac.
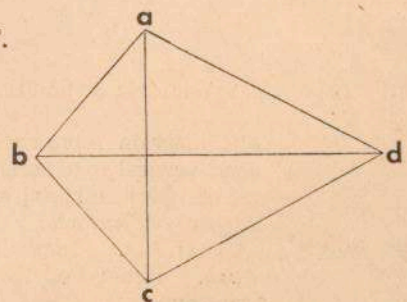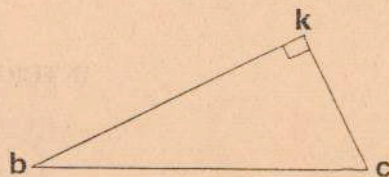
6. Prove that the opposite angles of a parallelogram have the same measure.

   bkc is a triangle in which $\angle bkc$ is a right angle, $|kb|=3.5$ cm, $|kc|=2.5$ cm. Construct

   (i) *x*, the image of *b* by the translation $\overrightarrow{kc}$

   (ii) *y*, the image of *b* by the translation $\overrightarrow{ck}$.

   Show that *x*, *b*, *y* are in the same straight line and find the area of the triangle *cyx*.

7. If *x* represents a point, draw and name each of the following sets:

   (i) $A=\{x|\ x$ is always the same distance from a fixed point $c\}$

   (ii) $B=\{x|\ x$ is always the same distance from two intersecting lines$\}$

   (iii) $C=\{x|\ x$ is always the same distance from two fixed points p and $q\}$.

   L and *M* are two lines and *S* is a circle. Show how to find a point $q\in S$ such that *q* is equidistant from *L* and *M*: See diagram.
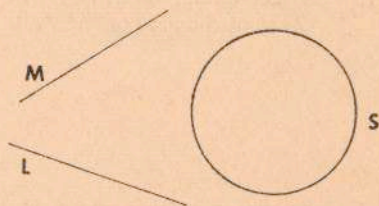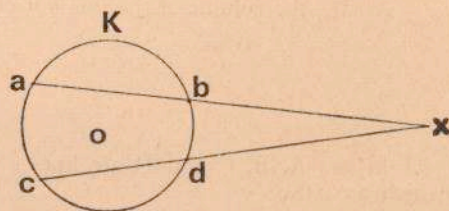
8. Prove that in a circle chords of equal length are the same distance from the centre of the circle.

   In the diagram $|ab|=|cd|$, *o* is the centre of the circle *K*, *ab* and *cd* cut in *x*. Prove that *xo* is the bisector of $\angle axc$.
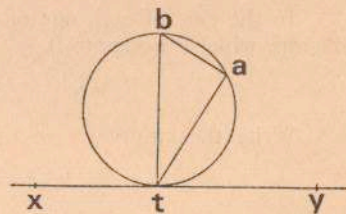
   What is the image of *K* by the reflection in *xo*?

   What is the image of *ax* by the reflection in *xo*?

9. [*bt*] is a diameter of the circle in the diagram. *xy* is a tangent to the circle at *t*. Show that the angles $\angle aty$ and $\angle tba$ have the same measure.

   Hence show that the $\angle xta$ has the same measure as the angle in the alternate segment.

10. (*a*) Use your tables to find the value of: tan 22°, cos 58°, sin 75°.

    (*b*) The diagram represents two poles [*ab*] and [*dc*] which stand vertical to a horizontal line through the points *b*, *x* and *c*. [*ax*] and [*dx*] are tightly drawn ropes such that $ax\perp dx$. The angle $\angle dax$ measures 22°, $|ax|=25\ m$ and $|bx|=21.2\ m$. Find the length $|dx|$ and also the size of $\angle axb$. Hence find the length $|bc|$ correct to two significant figures.