AN ROINN OIDEACHAIS

INTERMEDIATE CERTIFICATE EXAMINATION, 1972

MATHEMATICS—LOWER COURSE—PAPER 1
(150 marks)

THURSDAY, 8th JUNE—MORNING, 9.45 to 12.15

Six questions to be answered.
All questions are of equal value.
Mathematical Tables may be obtained from the Superintendent.

1. An open cylindrical vessel has an internal diameter of 70 cm and an internal height of 20 cm.
Calculate (i) its internal volume
(ii) its total internal surface area.
If 22 litres of water are put into the vessel, what percentage of it remains to be filled?

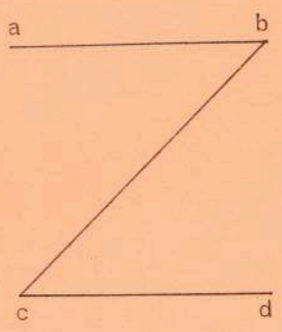
[1 litre = 1000 cm^3. Take $\frac{22}{7}$ as an approximate value of π]

2. Farmer A has 15 acres under beet yielding 16 tons per acre. On selling the beet to the factory he receives £2040. What price does the factory pay for one ton of beet?
Farmer B has 16 acres under beet and receives the same price per ton as did A. If B's income for his beet is, however, 10% higher than that of A's, what was B's yield per acre?

3. Construct the triangle abc given that
$|\,bc\,| = 12$ cm, $\angle acb$ measures 60°,
$\angle cab$ measures 40°.
Construct the circumcircle of this triangle and describe briefly your construction. Estimate its radius by measurement and hence find, approximately, the length of the circumcircle.

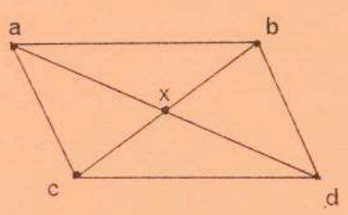
4. L_1 and L_2 are lines, C_1 and C_2 are circles.
$a, b, c, d, e, f, g, h, k, p$ and q are points.
Draw diagrams to illustrate each of the following statements:
(i) $L_1 \cap C_1 = \{a, b\}$
(ii) $L_1 \cap C_1 = \{c\}$
(iii) $L_1 \cap C_1 = \{d, e\}$ and $L_2 \cap C_1 = \{d, f\}$
(iv) $L_1 \cap C_1 = \{g, h\}$ and $L_1 \cap C_2 = \{g, k\}$
(v) $L_1 \cap C_1 = \{p\}$ and $L_1 \cap C_2 = \{p, q\}$.

5. In the diagram
$|\,ab\,| = |\,ac\,| = |\,cd\,|$,
$\angle abc$ measures 45°,
$\angle bcd$ measures 45°.



(i) Find the image of $abcd$ by S_b, the central symmetry in b.
(ii) Find the image of $abcd$ by S_{ab}, the axial symmetry (reflection) in ab.
(iii) Show, by means of diagrams, that
$$S_{ab} \circ S_b = S_{bd}.$$

6. $abdc$ is a parallelogram as in diagram. Write down



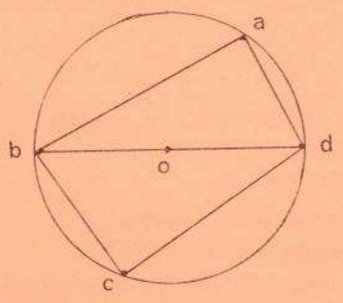
(i) the image of $[ab]$ by the translation $\vec{ac}$,
(ii) the image of $[ac]$ by the translation $\vec{ab}$,
and say which sides of the parallelogram are equal in length.
Prove that x is the midpoint of each diagonal.
If $|\,ax\,| = |\,bx\,|$, find the measure of $\angle bdc$.

[P.T.O.

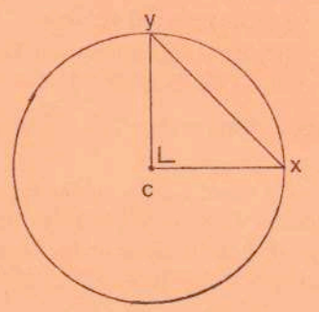
7. In a triangle abc, the angle bac is a right angle.
Prove that $|bc|^2 = |ab|^2 + |ac|^2$.
A rectangle measures 5 cm by 12 cm. What is the length of its diagonal?

8. Prove that the angle at the centre of a circle is twice the angle at the circle (circumference) standing on the same arc.

In the diagram o is the centre of the circle.
$\angle abd$ measures 28° and
$\angle bdc$ measures 34°.
Find the measure of
(i) $\angle bad$, (ii) $\angle aod$, (iii) $\angle cod$.



9. How many axes of symmetry has
(i) a square, (ii) a rectangle, (iii) an equilateral triangle, (iv) an isosceles triangle?
Illustrate your answer in each case by means of a diagram.
In the diagram, c is the centre of the circle and $\angle xcy$ measures 90°.
(*a*) Find D, the axis of symmetry of the $\triangle xcy$.
(*b*) Find the image of $\triangle xcy$ by
(i) S_c, the central symmetry in c,
(ii) the rotation $S_{cy} \circ S_D$, where S_{cy} and S_D are the reflections in cy and in D, respectively. Is $S_{cy} \circ S_{cx} = S_c$? Explain your answer.



10. A boat moves from a to b, a distance of 120 metres, parallel to a straight coastline $[cd]$ (see diagram). ac is perpendicular to cd, $|ac| = 400$ metres, the measure of $\angle bad$ is 40°, $bf \| ac$.
Calculate
(i) $|cd|$, to the nearest integer,
(ii) $|df|$,
(iii) the measure of $\angle dbf$ (x in diagram),
(iv) $|bd|$, to the nearest integer.