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(0 25, B II)

UNIVERSITIES OF MANCHESTER LIVERPOOL
LEEDS SHEFFIELD AND BIRMINGHAM

JOINT MATRICULATION BOARD

GENERAL CERTIFICATE OF EDUCATION

MATHEMATICS (025)

SYLLABUS B, PAPER II

ORDINARY

Friday 21 June 1963 2— 4-30

Negligently presented or slovenly work will be penalized.

Mathematical tables will be provided.

*Answer **all** questions in Section **A** and any **three** questions from Section **B**.*

In each question necessary details of working, including rough work, must be shown with the answer.

Section A

A 1. (a) A hot water system in a building uses 70 lb. of coke per day. It is used for only 200 days in the year. Calculate the cost of coke for the year at £8 8s. 0d. per ton.

(b) Factorize completely $12x^2 + 6x - 6$.

(c) In an isosceles triangle the angles are in the proportion 1 :2 :2. Calculate one of the equal angles.

[Turn over

A 2. (a) After paying tax at 3s. 3d. in the £ a man had £1,005 left. What had he paid in tax?

(b) Simplify

$$\frac{p^2 + 3p + 2}{p^2 + 2p}$$

(c) For what value of x on the curve $y = x - x^2$ is the tangent parallel to the x -axis?

A 3. (a) Solve the simultaneous equations

$$3x + 4y = 1$$

$$5x - 8y = 9$$

(b) Express 3 ft. $4\frac{1}{2}$ in. as a fraction of 9 ft. 9 in. giving your answer in its lowest terms.

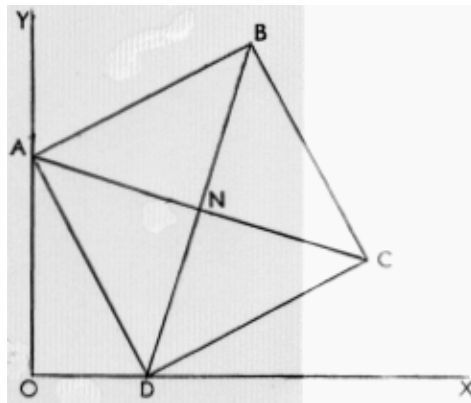
(c) The bisector of the exterior angle at A of the triangle ABC meets BC produced at D . Given that $AB = 6$ in., $BC = CD = 4$ in., calculate AC .

A 4. (a) The chord DC of a circle is produced to a point X and the secant XAB meets the circle at A and B . If $DC = CX = 6$ cm. and $AB = 1$ cm., calculate the length of AX .

(b) In the triangle ABC the angle $ABC = 60^\circ$, the angle $ACB = 72^\circ$ and $AC = 15.21$ in. Calculate the length of AB .

A5. (a) By how much does $(2x-5)(2x+3)$ exceed $(2x-7)^2$?

(b)



The figure represents a square $ABCD$ with vertices A and D lying on the lines OY and OX which are at right angles. $OA = 12$ in. and $OD = 5$ in. Calculate $\angle OAD$ and find the perpendicular distance of N from OY .

A 6. (a) Solve the equation

$$x + \frac{2}{x} = 11$$

giving your answers correct to one place of decimals.

(b) Two places A and B have the same latitude and both lie in the northern hemisphere. The longitude of A is 5° W and the longitude of B is 95° E. If the distance AB measured along the circle of latitude is 3,300 miles calculate (i) the radius of the circle of latitude, (ii) the latitude of the two places. (Take the radius of the earth to be 3,960 miles and take π as $\frac{22}{7}$)

Section B

Answer **three** questions from this section.

B 7. A book-seller had 600 books for sale at 9s. 0d. each at a profit of 35 per cent on the cost price. After selling 500 books he reduced the remainder to 6s. 0d. each. Supposing he had sold all these books at this price, calculate the percentage profit on cost price he would have made on the whole transaction.

He actually sold 70 of these books and he had to reduce the price again to clear the remaining 30 books. When he had sold all the books his percentage profit on his cost price for the whole transaction was 25. Find the reduced price of each of the last 30 books.

B 8. An aeroplane which flies at a speed of v m.p.h. in still air flies from A to B , a distance of b miles, with a following wind of u m.p.h. and then flies from B to A flying directly into the wind. Obtain and simplify an expression for the difference between the times for the two parts of the journey.

If the return journey takes t minutes longer than the outward journey prove that

$$v = \sqrt{u^2 + \frac{120ub}{t}}$$

Calculate the value of v when $u = 30$, $b = 120$ and $t = 6$.

[Turn over

B 9. Construct a triangle ABC in which $AC = 8$ cm., $BC = 7$ cm. and $\angle ACB = 90^\circ$. Construct

- (i) the circle on AB as diameter,
- (ii) a point X on AB dividing AB internally in the proportion 3: 2,
- (iii) two points on the circumference of the circle each of which is equidistant from XC and XA .

B 10. A box in the shape of a triangular prism stands with its base on a horizontal table. The base DEF and the lid ABC are both equilateral triangles of side 6 in. The other three rectangular faces $ABED$, $BCFE$ and $ACFD$ are at right angles to the base and the height of the box is 8 in. Calculate the angle between the planes CDE and DEF .

The lid ABC is hinged about AB and is opened into the position ABC' through an angle of 36° . Calculate (i) the height of C' above the table, (ii) the distance CC' .

B 11. A particle P moves on a straight line. At time t sec. its velocity is v ft. per sec. and its distance from a fixed point in the line is s ft. Given that

$$v = 2t + \frac{1}{t^2} \text{ find}$$

(i) the acceleration of P when $t = \frac{1}{2}$ explaining the significance of the sign of this answer,

- (ii) the distance P travels in the third second,
- (iii) the minimum velocity of P .