

UNIVERSITIES OF MANCHESTER LIVERPOOL
LEEDS SHEFFIELD AND BIRMINGHAM

JOINT MATRICULATION BOARD

GENERAL CERTIFICATE OF EDUCATION

**MATHEMATICS (O 25)
SYLLABUS B, PAPER I**

ORDINARY

Thursday 13 June 1968 9-30—12

Careless work and untidy work will be penalised.

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

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

Mathematical tables and one sheet of graph paper are provided.

Section A

Answer all questions in this section.

A 1. (a) Find the cost of a ton of butter bought wholesale at 2s. 3d. a lb.

(b) Find x , given that

$$5x - 4y = 2,$$

$$3y = -4x.$$

(c) In a quadrilateral $ABCD$, $\angle A = 103^\circ$, $\angle B = 153^\circ$, $\angle C = 40^\circ$ and the bisector of $\angle D$ meets \overline{AB} at E . Calculate $\angle AED$.

Turn over

A 2. (a) Calculate the angle through which the minute hand of a clock rotates between noon and 12.26 p.m.

(b) Factorise

$$2x^2 - 207x + 505.$$

(c) Calculate the distance between the points (9, 5) and (2, -19).

A 3. (a) Use tables to find the values of

(i) $\cos 83^\circ 53'$,

(ii) $\log \tan 67^\circ 39'$,

(iii) $\sin 169^\circ 36'$.

(b) Integrate $3x^2 + \frac{x^5}{5}$ with respect to x .

A 4. (a) In a triangle ABC , $AB = 4$ cm., $\angle A = 66^\circ$ and $\angle B = 84^\circ$. Calculate AC .

(b) When a bird is at a height of h ft. above the sea, its range of visibility over the sea is p miles and p is proportional to the square root of h . When $h = 400$, $p = 24.5$. Obtain a formula for p in terms of h and calculate the range at a height of 256 ft.

A 5. An irregularly shaped pond has an area of 800 square yards. Calculate the number of gallons of water falling on the pond when an inch of rain is recorded. Take 1 cu. ft. as $6\frac{1}{4}$ gallons.

A surveyor draws a plan of the region to a scale of 1 inch to 10 yards. Calculate the area of the pond on the plan.

A 6. (a) In a triangle ABC , $BC=7.2$ cm. A line is drawn parallel to BC to cut AB at P and AC at Q so that

$$\frac{AP}{BP} = \frac{3}{5}$$

Calculate the length of PQ .

(b) The Arctic Circle is a circle of latitude and its circumference is 9,900 miles. Calculate the radius of the circle and its angle of latitude. Take the earth as a sphere of radius 3,960 miles and take π as $\frac{22}{7}$.

Section B

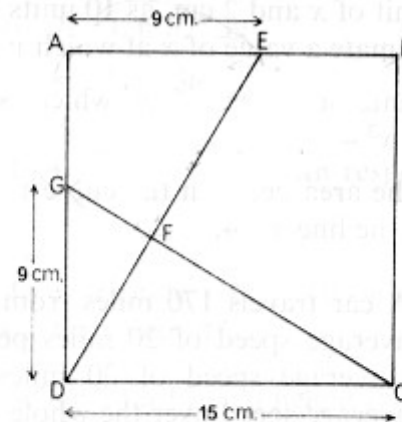
Answer three questions from this section.

B 7. A small factory makes 2,700 golf balls each week. The raw material for each ball costs 1s. 4d. Other expenses amount to £142 10s. 0d. per week. The balls are sold to a retailer at 3s. 0d. each. Calculate the weekly profit.

The factory cost £25,000 to set up. Taking a working year as 50 weeks, express the annual profit as a percentage of this sum.

In the following year, the cost of the raw material is increased by 1d. per ball, other expenses become £190 per week, but the sale price is unchanged. Calculate the least number of balls which have to be made and sold each week for the factory not to run at a loss.

B 8.



In the figure, $ABCD$ is a square. Prove that triangles ADE and CDG are congruent and prove that $AEFG$ is cyclic.

Calculate the radius of the circumcircle of $AEFG$ and calculate the length of a tangent from B to this circle. Give your answers to the nearest millimetre.

Turn over

B 9. A horizontal line AB , 90 m. long, is drawn on a plane hillside and a man stands at a point C higher up the hill than AB . The length of AC is 50 m. and $\angle CAB = 60^\circ$. Calculate the length of BC .

The man walks down the hill to reach the level of AB by the steepest possible route and does so in 30 seconds. Calculate his average speed in km. per hour, to one place of decimals.

Calculate the inclination of AC to the vertical if the difference in contour height between C and AB is 21.6 m.

B 10. Draw the graph of $y = 12x^2 - 2x^3$ from $x = 0$ to $x = 5$, plotting points at unit intervals of x . Take 2 cm. as the unit of x and 2 cm. as 10 units of y . From your graph estimate a value of x at which $y = 49$.

Also estimate a value of x which satisfies the equation $6x^2 - x^3 = 13$.

Calculate the area between the curve $y = 12x^2 - 2x^3$, the x -axis and the line $x = 4$.

B 11. (a) A car travels 170 miles from London to Exeter at an average speed of 20 miles per hour and returns at an average speed of 30 miles per hour. Calculate the average speed over the whole journey.

(b) The cost of a journey at x miles per hour is $\left(\frac{500}{x} + Kx\right)$ shillings, where K is a constant. At 20 miles per hour, the cost is £2 1s. 0d. Find K and calculate the speed at which the cost is minimum.