AN ROINN OIDEACHAIS   M.43(a)

INTERMEDIATE CERTIFICATE EXAMINATION, 1980

MATHEMATICS – HIGHER COURSE – PAPER I (300 marks)

FRIDAY, 13 JUNE – MORNING 9.30 to 12

Examination Number

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 one of (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.
Mathematics tables may be obtained from the Superintendent.

THIS PAPER MUST BE ENCLOSED IN YOUR ANSWER BOOK

1.   Which one of the following amounts to £138 after 1 year if the rate of interest is 15%
        per annum ?

(a) £123   (b) £158·7   (c) £120   (d) £117·30

2. $0·0\dot{6}$ (i.e. $0·0666 \cdots$) can be written as

(a) $\frac{2}{3}$ (b) $\frac{6}{10}$ (c) $\frac{6}{100}$ (d) $\frac{1}{15}$

3.   30 km per minute in metres per second is

(a) 2000   (b) 500   (c) 1800   (d) 30 000

4.   27% of a number is 12.   Then 18% of the same number is

(a) 8   (b) 3   (c) 27   (d) 21

5. $\frac{1}{3} : \frac{1}{2} = 3 : y$.   Then y is

(a) 2   (b) 1   (c) $4\frac{1}{2}$ (d) 9

6.   A rotation of 180° about a point is equal to

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

7.   Which one of the following has the greatest number of axes of symmetry ?

(a) square   (b) semi-circle   (c) circle   (d) equilateral triangle

8.   Which one of the following maps the plane onto a proper subset of the plane ?

(a) a translation   (b) a parallel projection
(c) an axial symmetry   (d) a central symmetry

9. P and Q are two identical rectangles. Q is the image of P
        under the translation

(a) $\overrightarrow{kt}$ (b) $\overrightarrow{gt}$ (c) $\overrightarrow{th}$ (d) $\overrightarrow{ty}$
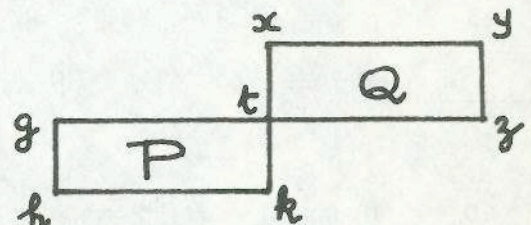
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10. *M* and *N* are the two diagonals of the square *pqrs*.   Then $S_M \, o \, S_N$ maps

(a) $q \to p$

(b) $\triangle \, pqr \to \triangle \, prs$

(c) $[qp] \to [qs]$

(d) $\triangle \, pqr \to \triangle \, pqs$
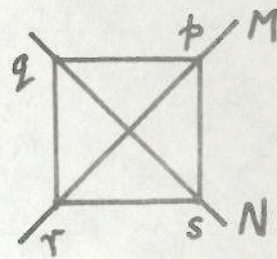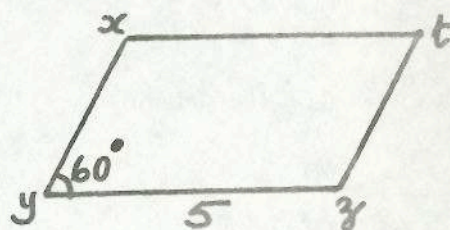
11. *xy* ‖ *rt*.   Then $| \angle rkt | =$
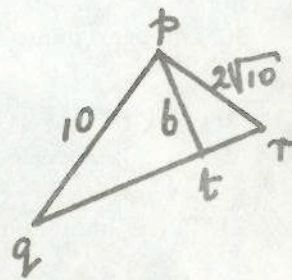
(a) 70°

(b) 80°

(c) 50°

(d) 60°
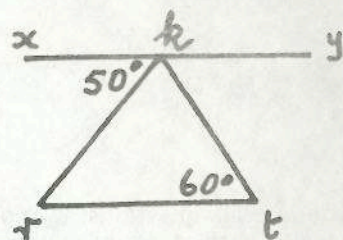
12. *o* is the centre of the circle. $|\angle yot| = 160°$ as shown.
Then $|\angle yxt| =$

(a) 80°

(b) 90°

(c) 100°

(d) 110°
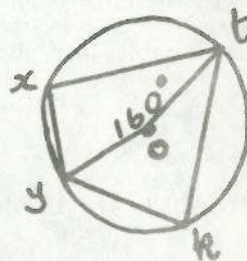
13. If the area of the parallelogram is 10, then $|xy|$ is equal to

(a) $\dfrac{8}{\sqrt{3}}$

(b) 2

(c) 4

(d) $\dfrac{4}{\sqrt{3}}$

14. If $pt \perp qr$, then $|qr| =$

(a) $\sqrt{68}$

(b) 12

(c) 8

(d) 10

15. $(\frac{1}{2}, 1)$ are the coordinates of the midpoint of $[h\,k]$.   If $(0, 3)$ are the coordinates of
h, then the coordinates of *k* are

(a) $(\frac{1}{2}, -\frac{1}{2})$

(b) $(1, -\frac{1}{2})$

(c) $(\frac{1}{2}, -1)$

(d) $(1, -1)$

16. The axial symmetry in the *x*-axis maps the line $y = x + 3$ onto the line

(a) $y = -x + 3$

(b) $y = x - 3$

(c) $y = -x - 3$

(d) $y = x + 3$

17. The slope of the line $2x - 5y - 10 = 0$ is

(a) $\frac{2}{5}$

(b) $-\frac{5}{2}$

(c) 2

(d) 5

18. The area of the triangle formed by the three points $(-1, 2), (2, 3), (1, 6)$ is

(a) 10

(b) 5

(c) 14

(d) 7

19. If $\tan A = \frac{1}{2}$ and $A < 90°$, then $\sin A$ is

(a) $\dfrac{2}{\sqrt{5}}$

(b) $\dfrac{1}{\sqrt{3}}$

(c) $\dfrac{\sqrt{3}}{2}$

(d) $\dfrac{1}{\sqrt{5}}$

20. If $\tan 2A = \dfrac{2\tan A}{1 - \tan^2 A}$, then $\tan 120°$ is

(a) $\sqrt{3}$

(b) $-\sqrt{3}$

(c) $\dfrac{1}{\sqrt{3}}$

(d) $\dfrac{-1}{\sqrt{3}}$

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SECTION B (200 marks)

Attempt **QUESTION 1** and **THREE** other questions   (50 marks each)

1. (a) Calculate the compound interest on £2500 for 2 years at 13% per annum.

   (b) The capacity of the petrol tank of a car is 15 gallons.   How much does the tank-full
        of petrol cost at £1·35 per gallon ?
        In Belgium petrol costs 22 Belgian francs per litre.   Calculate the cost in £ of the
        tank-full in Belgium when the rate of exchange is £1 = 60 Belgian francs.
        (Note: 1 litre = 0·22 gallons).

2. (a) Prove that any point on the bisector of an angle is equidistant from the arms of
        the angle.

   (b) Construct the $\triangle abc$ given that $|bc|$ = 6 cm, $|ba|$ = 4 cm and area of
        $\triangle abc$ is 9 cm^2.
        Construct the incircle of the triangle abc and measure its radius as accurately as you can.
        All construction lines must be clearly shown.

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

    p and q are the midpoints of two sides of a square as shown.
    Construct the image of the square under the composition of
    central symmetries $S_q \ o \ S_p$.
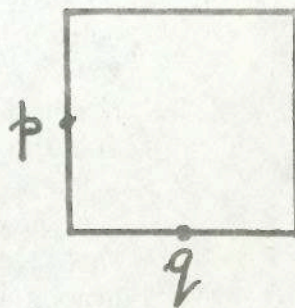
4. Prove that a diameter of a circle which is perpendicular to a chord of the circle bisects
the chord.

   K is a circle of radius 13 and of centre c.   A chord of length 24 is drawn in the circle.
Find the distance of this chord from c.   Hence, or otherwise, show how to draw a chord of
length 24 in K.

   $[ab]$ is any chord of length 24 in the circle K.   Find the locus of m, the midpoint
of the chord, and give a reason for your answer.
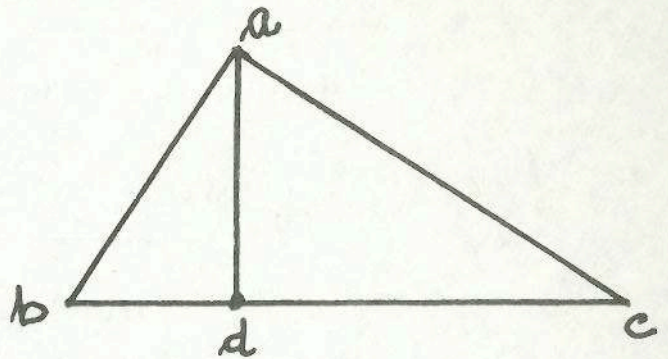
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5. Prove that if the angles of two triangles are equal in measure, then the lengths of the corresponding sides are in proportion.

In the $\triangle abc$,
$|\angle bac| = 90°$ and $ad \perp bc$.
Using similar triangles, or otherwise, prove
$$|bd| \, . \, |bc| = |ba|^2 .$$

6. The line $3y = 5x - 4$ cuts the x-axis at p and the y-axis at q. Find the coordinates of p and q and hence draw the line.
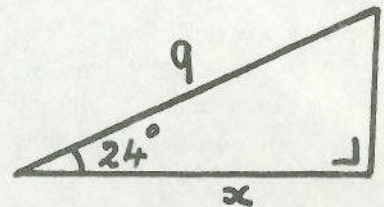
r is a point having coordinates $(\frac{8}{5}, 0)$. Write down the slope of qr and hence write the equation of qr in the form

$$by = ax + t.$$

Show that the point $(10, 7)$ is on qr and investigate if this point is nearer to the origin than it is to q.

7. (a) Use your tables to find the angle A such that $\sin A = 0·4$ and investigate if $\sin 3A$ is equal to $3 \sin A$.

(b) Calculate x correct to two places of decimals.

(c) Two ships K and T set sail from a point p at the same time. T sails West $65°$ North at a steady speed. K sails East $35°$ North at a speed of 30 km/hour. After two hours sailing T is at r and K is at q and q is directly East of r. Calculate $|rp|$ correct to the nearest km and hence find the speed of T.