AN ROINN OIDEACHAIS M.43(a)

INTERMEDIATE CERTIFICATE EXAMINATION, 1977

MATHEMATICS - HIGHER COURSE - PAPER I (300 marks)

MONDAY, 13 JUNE - MORNING 9.30 to 12

SECTION A (100 marks)

Examination Number

Attempt all questions. You should not spend more than 50 minutes 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. 110% of x is 22. Then 90% of x is

(a) 20 (b) 19·8 (c) 18 (d) 17·6

2. Two taps are pouring water. One pours 6 litres per minute, the other 12 litres per minute. In 20 seconds they will together pour

(a) 0·3 litres (b) 2 litres (c) 6 litres (d) 8 litres

3. If $3\frac{1}{2} : 14 = 1 : x$, then x is

(a) 4 (b) $3\frac{1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{2}{7}$

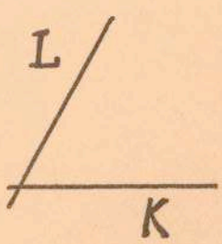
4. p, q and r are prime numbers. Their least common multiple is 42. Then the numbers are:

(a) 1, 3, 21 (b) 2, 6, 7 (c) 2, 3, 13 (d) 2, 3, 7

5. Two trains travel in opposite directions, one at twice the speed of the other. One hour after they pass each other they are 300 km apart. Then the speed of the faster in km per hour is

(a) 300 (b) 600 (c) 150 (d) 200

6. (x,y) is a couple of the projection parallel to a line L onto a line K. $x \neq y$. Which one of the following is false:



(a) $x \in K$ (b) $y \in K$

(c) $x \in L \Rightarrow y \in L$ (d) $x \in L \Rightarrow y \in K$

7. Under which of the following maps in Π is one and only point mapped onto itself ?

(a) Parallel Projection (b) Axial Symmetry

(c) Translation (d) Central Symmetry.

8. p and q are two distinct points and (x,y) is a couple of $S_p \circ S_q$. Then

(a) $pq \parallel xy$ (b) $(x,y) \in S_p$

(c) $pqxy$ is a parallelogram (d) $(q,p) \uparrow (x,y)$

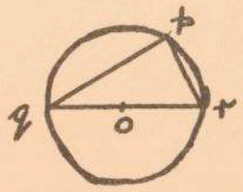
9. A and B are two perpendicular lines meeting at o. h and k are two distinct points such that (h,k) is a couple of $S_A \circ S_B$. Which one of the following is false ?

(a) $(h,k) \in S_B \circ S_A$ (b) $(h,k) \in S_o$

(c) $h \in A \Rightarrow k \in B$ (d) $|\angle hok| = 180°$.

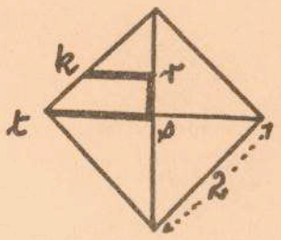
OVER→

10. o is the centre of the circle.
$|pr| = 3 = |po|$. Then $|pq|$ is



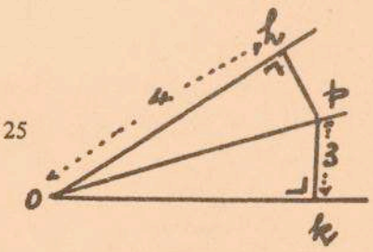
(a) $\sqrt{45}$ (b) 6 (c) $\sqrt{27}$ (d) $\sqrt{324}$

11. k is any point on the side of the square and $kr \perp rs$. A side of the square is of length 2. Then $|kr| + |rs| + |st| =$



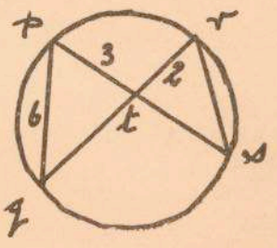
(a) 2 (b) $\sqrt{2} + \frac{1}{\sqrt{2}}$ (c) $2\sqrt{2}$ (d) $\sqrt{2}$.

12. op is the bisector of the $\angle hok$.
$|op|$ is equal to



(a) 4 (b) 5 (c) $\sqrt{7}$ (d) 25

13. $|pq| = 6$, $|pt| = 3$, $|rt| = 2$.
Then $|rs| =$



(a) 4 (b) 2 (c) $1\frac{1}{2}$ (d) 6

14. x and y have coordinates (6,3) and (-3,2). Then $|xy|$ is

(a) $\sqrt{10}$ (b) $\sqrt{82}$ (c) 2 (d) 82

15. The slope of the line containing the points $(-4, 3)$, and $(3, -5)$ is

(a) $-\frac{7}{8}$ (b) 2 (c) $-\frac{8}{7}$ (d) -2

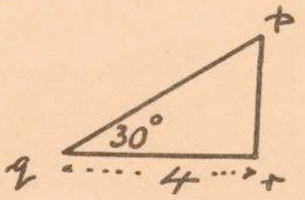
16. The area of the triangle having vertices (0,0), (2,-3), (-3,2) is

(a) - 5 (b) 12 (c) 5 (d) 0

17. The image of the point $(-4,1)$ by S_o after S_X, where o is the origin and X is the x-axis is

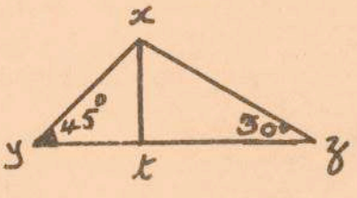
(a) (4,- 1) (b) (−4,1) (c) (4,1) (d) (- 4,- 1)

18. $|pr|$ is



(a) $\sin 30°$ (b) $4 \sin 30°$
(c) $4 \tan 30°$ (d) $4 \cos 60°$

19. $xt \perp yz$ and $|yt| = 1$. Then $|xz|$ is



(a) $\sqrt{2}$ (b) $\sqrt{3}$
(c) 2 (d) $2\sqrt{2}$

20. If $\sin 2A = 2 \sin A \cos A$, then $\tan A$ is

(a) $\frac{\sin 2A}{\cos^2 A}$ (b) $\frac{\sin 2A}{2 \cos A}$ (c) $\frac{\sin 2A}{2\cos^2 A}$ (d) $\frac{\sin 2A}{2\sin^2 A}$

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INTERMEDIATE CERTIFICATE EXAMINATION, 1977

MATHEMATICS - HIGHER COURSE - PAPER 1

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SECTION B (200 marks)

Attempt QUESTION 1 and THREE other questions

1. Two men A and B earn £4200 and £5600, respectively. Each has his tax bill calculated as follows:

The first £1700 is tax free.
The next £1550 is taxed at 26%.
The remainder is taxed at 38·5%.

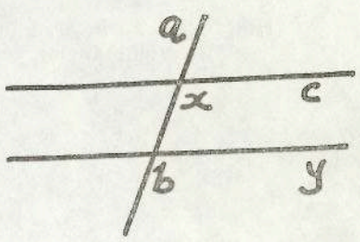
Calculate the difference in the men's earnings

(i) before tax (ii) after tax.

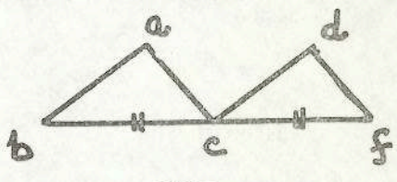
Calculate also the percentage reduction in (i) due to the tax.

(50 marks)

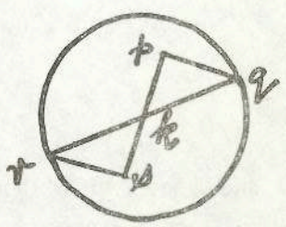
2. (i) In the diagram $xc \parallel by$.
Prove that $|\angle axc| = |\angle xby|$



(ii) In the diagram
c is the midpoint of $[bf]$
$|\angle abc| = |\angle dcf|$
$|\angle acb| = |\angle dfc|$
Prove that the two triangles are congruent.



(iii) Using the results above, or otherwise, prove that if k is the centre of the circle in the diagram and if $pq \parallel rs$, then $|kp| = |ks|$.

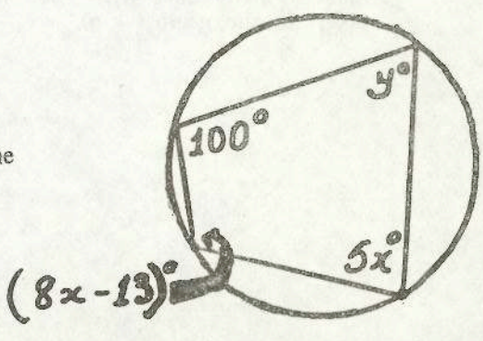


(40 marks)

3. Prove that the measure of the angle at the centre of a circle is twice the measure of an angle at the circle standing on the same arc.

Deduce that the sum of two opposite angles in a cyclic quadrilateral has a measure of 180°.

Calculate the value of y in the diagram.

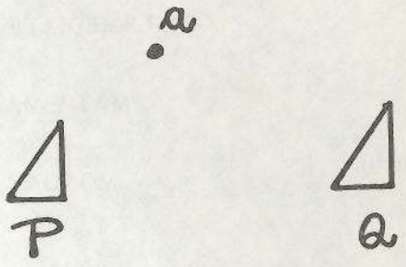


(40 marks)

OVER→

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

The triangle Q is the image of the triangle P by the composition of central symmetries $S_a \circ S_x$. The point a is given. Show how to find the point x.



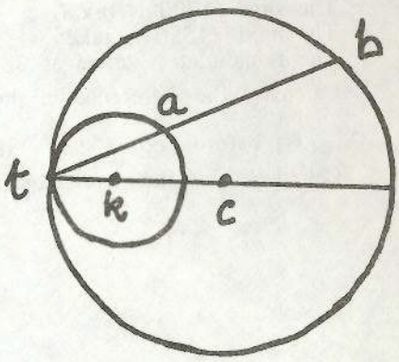
(50 marks)

5. Prove that two sides of a triangle are divided proportionally by a line drawn parallel to the third side.

The diagram shows two circles which touch at t and which have radii of lengths r_1 and r_2, where $r_1 < r_2$. The centres are k and c and a line through t cuts the circles at a and b. Prove that

$$|ta| : |tb| = r_1 : r_2$$

(Hint: An angle at a circle standing on a diameter is a right angle).



(50 marks)

6. (a) Write down the equation of the line which contains the point (3,2) and which makes an angle of 45° with the positive sense of the x-axis.

(b) Investigate if the point of intersection of the lines

$$2y - 3x + 4 = 0$$

$$2x + 3y - 7 = 0$$

is on the line

$$13x - 25y + 1 = 0.$$

(50 marks)

7. h and k are two lighthouses 50 km apart and k is due East from h. x is a ship such that

$$|\angle xhk| = 35° 27'$$

$$|\angle xkh| = 76° 07'.$$

Calculate, to the nearest km, the distance of the ship from k.

If the ship is sailing on a course which is parallel to the line hk, how far, to the nearest km, must it travel until it is again the same distance from k ? (The distance from k may be taken to the nearest km).

(50 marks)