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ICSE 2002 : MATHEMATICS

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MATHEMATICS

(Two hours and a half)

Answers to this Paper must be written on the paper provided separately.

*You will **not** be allowed to write during the first 15 minutes.*

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

*Attempt **all** questions from **Section A** and **any four** questions from **Section B**.*

All working, including rough work, must be clearly shown and must be done on the same sheet as the rest of the answer. Omission of essential working will result in the loss of marks.

The intended marks for questions or parts of questions are given in brackets [].

Mathematical tables are provided.

SECTION A (40 Marks)

*Attempt **all** questions from this Section.*

Question 1

(a) The price of a T. V. set inclusive of sales tax of 9% is Rs. 13407/-. Find its marked price. If the sales tax is increased to 13%, how much more does the customer pay for the T. V.? [3]

(b) On a certain sum of money, the difference between the compound interest for a year, payable half-yearly, and the simple interest for a year is Rs. 180. Find the sum lent out, if the rate of interest in both the cases is 10%. [3]

Question 2

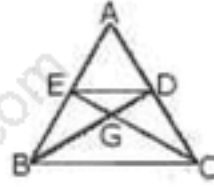
(a) If $a : b = 5 : 3$, find $(5a + 8b) : (6a - 7b)$. [2]

(b) Using Factor theorem, show that $(x - 3)$ is a factor of $x^3 - 7x^2 + 15x - 9$. Hence, factorise the given expression completely. [3]

Question 3

[5]

(a) In the adjoining figure, the medians BD and CE of a $\triangle ABC$ meet at G.



Prove that:-

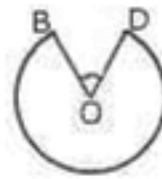
(i) $\triangle EGD \sim \triangle CGB$

Prove that:-

(ii) $BG = 2GD$ from (i) above.

(b) The shape of the top of a table in a restaurant is that of a segment of a circle with centre O and $\angle BOD = 90^\circ$.

$BO = OD = 60$ cm.



Find:-

(i) The area of the top of the table.

Find:-

(ii) The perimeter of the table.

Note : Take $\pi = 3.14$

Question 4

(a) Without using tables, evaluate:-

$$3 \cos 80^\circ \operatorname{cosec} 10^\circ + 2 \cos 59^\circ \operatorname{cosec} 31^\circ$$

[2]

(b) Solve the following inequation, and graph the solution on the number line:-

$$2x - 5 \leq 5x + 4 < 11, X \in \mathbb{R}.$$

[3]

Question 5

Using only a ruler and compasses, construct $\angle ABC = 120^\circ$, where $AB = BC = 5$ cm.

(a) Mark two points D and E which satisfy the condition that they are equidistant from both BA and BC.

[2]

(b) In the above figure, join AE and EC. Describe the figure:

[1]

(i) ABCD

(b) In the above figure, join AE and EC. Describe the figure:

[1]

(ii) ABD

(b) In the above figure, join AE and EC. Describe the figure:

[1]

(iii) ABE

Question 6

(a) The marks of 20 students in a test were as follows:-

[1]

5, 6, 8, 9, 10, 11, 11, 12, 13, 13, 14, 14, 15, 15, 15, 16, 16, 18, 19, 20. Calculate:-

(i) The Mean

(a) The marks of 20 students in a test were as follows:-

[1]

5, 6, 8, 9, 10, 11, 11, 12, 13, 13, 14, 14, 15, 15, 15, 16, 16, 18, 19, 20. Calculate:-

(ii) The Median

(a) The marks of 20 students in a test were as follows:-

[1]

5, 6, 8, 9, 10, 11, 11, 12, 13, 13, 14, 14, 15, 15, 15, 16, 16, 18, 19, 20. Calculate:-

(iii) The Mode

(b) Construct a $\triangle ABC$, in which $AB = AC = 3$ cm and $BC = 2$ cm. Using a ruler and compasses only, draw the reflection $A'BC$ of $\triangle ABC$, in BC . Draw the lines of symmetry of the figure $ABA'C$.

[6]

Question 7

(a) The point $P(3, 4)$ is reflected to P' in the x -axis; and O' is the image of O (the origin) when reflected in the line PP' . Using graph paper, give:-

[1]

(i) The coordinates of P' and O'

(a) (ii) The lengths of the segment PP' and OO'

[1]

(a) (iii) The perimeter of the quadrilateral $POP'O'$

[1]

(a) (iv) The geometrical name of the figure POP'O'

[1]

(b) Find x and y , if:

[2]

$$\begin{bmatrix} x & 3x \\ y & 4y \end{bmatrix} \begin{bmatrix} 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 5 \\ 12 \end{bmatrix}$$

(Type in the answers separated by commas. Leave no spaces around the commas.)

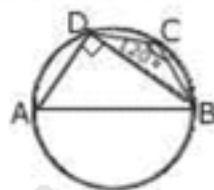
Question 8

[10]

(a) Prove the following identity:

$$\frac{1}{\sin \theta + \cos \theta} + \frac{1}{\sin \theta - \cos \theta} = \frac{2 \sin \theta}{1 - 2 \cos^2 \theta}$$

(b) In the given figure, AB is the diameter of a circle with centre O and $\angle BCD$ is 120° .



Find:

(i) $\angle DBA$

(b) Find:

(ii) $\angle BAD$

(c) Find the equation of a line passing through the point $(-2, 3)$ and having the x -intercept of 4 units.

Question 9

(a) The annual salary of Mr. Ram Kumar is Rs. 1,91,734/-. He contributes Rs. 875/- per month to provident fund, and pays Rs. 260/- per month as L.I.C. premium. He buys National Saving Certificates worth Rs. 40,000/- and invests Rs. 12,000/- in Mutual Funds. He donates Rs. 2,500/- towards the Prime Minister's Relief Fund (eligible for 100% deduction) and Rs. 500/- to a Charitable Trust (eligible for 50% deduction). If Rs. 1000/- per month has been deducted by his employer as income tax at source in the first eleven months, find:-

[2]

(i) His taxable income

Tax slab:-

Upto Rs. 50,000

: No tax.

Rs. 50,001 to Rs. 60,000 : 10% of the income exceeding Rs. 50,000.

Rs. 60,001 to Rs. 1,50,000 : Rs. 1,000 + 20% of the income exceeding Rs. 60,000.

Above Rs. 1,50,000 : Rs. 19,000 + 30% of the income exceeding Rs. 1,50,000.

Standard Deduction : Rs. 20,000.

Rebate in tax : 20% of the total savings or Rs. 14,000, whichever is less.

Surcharge : 10% of the total tax payable after rebate.

A surcharge of 10% is levied on the income tax payable (after deducting rebate) if taxable income is more than Rs. 60,000/-.

Standard Deduction : Rs. 20,000/-

Tax Rebate : 20% of money invested in Provident Fund, Mutual Fund, L.I.C., P.P.F, National Savings Certificate, etc., subject to a limit of Rs. 12,000/-.

(Type in the answers separated by commas. Leave no spaces around the commas.)

(a) [2]

(ii) The balance of tax he has to pay in the last month of the financial year.

(b) A man wants to buy 62 shares available at Rs. 132/- (par value of Rs. 100/-). [2]

(i) How much should he invest?

(ii) If the dividend is 7.5%, what will be his annual income? [2]

(iii) If he wants to increase his annual income by Rs. 150/-, how many extra shares should he buy? [2]

Question 10

(a) Solve graphically the simultaneous equations given below. Take the scale as 2 cm = 1 unit on both the axes. [6]

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

$$2x + y = 3$$

(b) The following table gives the weekly wages of workers in a factory: [1]

Weekly wages in Rs.	No. of workers
50 - 55	5
55 - 60	20
60 - 65	10

65 - 70	10
70 - 75	9
75 - 80	6
80 - 85	12
85 - 90	8

Calculate :

(i) The mean.

(b) (ii) The modal class.

[1]

(b) (iii) The number of workers getting weekly wages, below Rs. 80/-

[1]

(b) (iv) The number of workers getting Rs. 65 or more, but less than Rs. 85/- as weekly wages.

[1]

Question 11

(a) Using a ruler and compasses only, construct:

[3]

(i) The triangle ABC in which $AB = 9$ cm, $BC = 10$ cm and $\angle ABC = 45^\circ$.

(a) (ii) Construct a circle of radius 2 cm to touch the arms of $\angle ACB$ in (i) above.

[3]

(b) A hollow sphere of internal and external diameters 4 cm and 8 cm respectively, is melted into a cone of base diameter 8 cm. Find the height of the cone.

[4]

Question 12

Mr. Shiv Kumar has a Saving Bank account in Punjab National Bank. His pass book has the following entries:

[5]

Date	Particulars	Withdrawals in Rs.	Deposits in Rs.	Balance in Rs.
April 1, 1997	B/F	--	--	3220.00

April 15	By transfer	--	2010.00	5230.00
May 8	To cheque No. 355	298.00	--	4932.00
July 15	By clearing	--	4628.00	9560.00
July 29	By cash	--	5440.00	15,000.00
Sept. 10	To self	698.00	--	8020.00
Jan. 10, 1998	By cash	--	8000.00	16020.00

Calculate the interest due to him at the end of the financial year (March 31st 1998) at the rate of 6% per annum.

(b) An aeroplane travelled a distance of 400 km at an average speed of x km/hr. On the return journey, the speed was increased by 40 km/hr. Write down an expression for the time taken for:

[5]

(i) The onward journey.

(ii) The return journey.

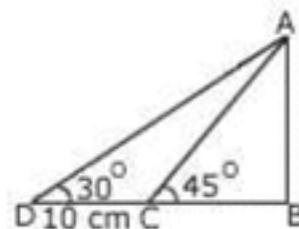
If the return journey took 30 minutes less than the onward journey, write down an equation in x and find its value.

Question 13

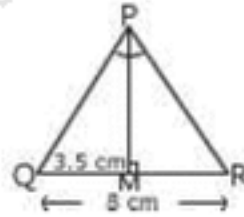
[10]

(a) The shadow of a vertical tower AB on level ground is increased by 10 m, when the altitude of the sun changes from 45° to 30° , as shown in the given figure:

Find the height of the tower and give your answer, correct to $1/10$ of a metre.



(b) In the right angle $\triangle QPR$, PM is an altitude. Given that $QR = 8$ cm and $MQ = 3.5$ cm, calculate the value of PR.



(c) A function f is given by the formula $f(x) = 25 - 4x^2$. Find:

(i) $f(3)$

(c)

(ii) Find x , such that $f(x) = 0$

Question 14

(a) The marks obtained by 120 students in a Mathematics test is given below:

[2]

Marks	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
No. of Students	5	9	16	22	26	18	11	6	4	3

Draw an Ogive for the given distribution on a graph sheet. Use a suitable scale for your Ogive. Use four Ogive to estimate:

(i) The median.

(a)(ii) The lower quartile.

[2]

(a)(iii) The number of students who obtained more than 75% in the test

[2]

(a)(iv) The number of students who did not pass in the test if the pass percentage was 40.

[2]

(b) A (1, 4), B (3, 2) and C (7, 5) are the vertices of a $\triangle ABC$. Find:

[2]

(i) The coordinates of the centroid G of $\triangle ABC$.

(b)

[2]

(ii) The equation of a line, through G and parallel to AB.