DESIGN OF THE SAMPLE QUESTION PAPERS
MATHEMATICS-CLASS X

Time : 3 Hours
Max. Mark : 100

The weightage or the distribution of marks over different dimensions of the question paper shall be as follows:

1. **Weightage to Learning Outcomes**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Learning Outcomes</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Knowledge</td>
<td>31</td>
</tr>
<tr>
<td>2.</td>
<td>Understanding</td>
<td>45</td>
</tr>
<tr>
<td>3.</td>
<td>Application</td>
<td>12</td>
</tr>
<tr>
<td>4.</td>
<td>Skill</td>
<td>12</td>
</tr>
</tbody>
</table>

2. **Weightage to content/subject Unit**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Learning Outcomes</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Algebra</td>
<td>26</td>
</tr>
<tr>
<td>2.</td>
<td>Commercial Mathematics</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>Mensuration</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Trigonometry</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>Geometry</td>
<td>22</td>
</tr>
<tr>
<td>6.</td>
<td>Statistics</td>
<td>12</td>
</tr>
<tr>
<td>7.</td>
<td>Coordinate Geometry</td>
<td>8</td>
</tr>
</tbody>
</table>

Total : 100

3. **Weightage to form of questions**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Form of Question</th>
<th>Marks for each question</th>
<th>Number of questions</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>SA I</td>
<td>3</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>2.</td>
<td>SA II</td>
<td>4</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>3.</td>
<td>LA</td>
<td>6</td>
<td>05</td>
<td>30</td>
</tr>
</tbody>
</table>

4. The expected length of answer under different forms of questions and expected time would be as follows:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Form of Questions</th>
<th>No. of credit points</th>
<th>Approx. Time</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Short answer type (SA I)</td>
<td>Upto 4 Credit Points</td>
<td>3-5 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Short answer type (SA II)</td>
<td>Upto 6 Credit Points</td>
<td>5-7 minutes</td>
</tr>
<tr>
<td>3.</td>
<td>Long answer type (LA)</td>
<td>Upto 8 Credit Points</td>
<td>8-10 minutes</td>
</tr>
</tbody>
</table>
These ranges of steps and time requirements for the answers are, however, suggestive. In practice, actual number of steps and time needed may vary. As the total time is calculated on the basis of the number of questions required to be answered and the length of their anticipated answers, it would, therefore, be advisable for the candidates to budget their time properly by cutting out the superfluous lengths and be within the expected limits.

5. **Scheme of Options**

All questions are compulsory i.e. there is no overall choice in the question paper. However, internal choices have been provided in two questions of 3 marks each, two questions of 4 marks each and two questions of 6 marks each. These choices have been given from within the same topic and in questions which test higher mental abilities of students.

6. **Weightage to difficulty level of questions**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Estimated Difficulty Level of Questions</th>
<th>% of Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Easy</td>
<td>15%</td>
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<tr>
<td>2.</td>
<td>Average</td>
<td>70%</td>
</tr>
<tr>
<td>3.</td>
<td>Difficult</td>
<td>15%</td>
</tr>
</tbody>
</table>

A question may vary in difficulty level from individual to individual. As such, the assessment in respect of each question will be made by the paper setter on the basis of general anticipation from the group as whole taking the examination. This provision is only to make the paper balanced in its weight, rather to determine the pattern of marking at any stage.

Based on the above design, there are two separate sample papers along with their Blue Prints as well as questionwise analysis. For the examination of the Board, while the design of the question papers will remain same, blue prints based on this design may change.

Note: Though weightages to content/subject units, objectives and forms of questions etc. have been clearly assigned, yet depending on the exigencies of the paper, these can vary to some extent in Board's examination.
**BLUE PRINT-I**

**Subject**: Mathematics  
**Class**: X  
**Time**: Three Hours  
**Maximum Marks**: 100

<table>
<thead>
<tr>
<th>Form of questions</th>
<th>Objective Knowledge</th>
<th>Understanding</th>
<th>Application</th>
<th>Skill</th>
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<tr>
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<td>SA</td>
<td>SAI</td>
<td>LA</td>
<td>SA</td>
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<td><strong>Algebra</strong></td>
<td></td>
<td>II</td>
<td>I</td>
<td></td>
<td></td>
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<tr>
<td>Linear Eqns</td>
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<td>-</td>
<td>3(1)</td>
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<td>-</td>
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<tr>
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<td>-</td>
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<td>-</td>
<td>4(1)</td>
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<td>II</td>
<td>I</td>
<td></td>
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<td>6(1)</td>
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<td>I</td>
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<td>4 **(1)</td>
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<td>6(2)</td>
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<td>I</td>
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<td>-</td>
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<td>Statistics</td>
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<td>4(1)*</td>
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<td>-</td>
<td>4(1)</td>
</tr>
<tr>
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<td>-</td>
<td>8(2)</td>
<td>16(4)</td>
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<td>II</td>
<td>I</td>
<td></td>
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<tr>
<td>-</td>
<td>16(4)</td>
<td>15(5)</td>
<td>6(1)</td>
<td>20(5)</td>
<td>19(5)*</td>
</tr>
</tbody>
</table>

Note: * indicates additional marks for skill development.
SAMPLE QUESTION PAPER-I

Class X

Subject : Mathematics  Time : 3 Hours
Max Marks : 100

General Instructions :
1. All questions are compulsory.
2. The question paper consists of 25 questions divided into three sections A, B and C. Section A contains 10 questions of 3 marks each, Section B is of 10 questions of 4 marks each and Section C is of 5 questions of 6 marks each.
3. There is no overall choice. However, internal choice has been provided in two questions of three marks each, two questions of four marks each and two questions of six marks each.
4. In question on construction, the drawing should be neat and exactly as per the given measurements.
5. Use of calculators is not permitted. However, you may ask for Mathematical tables.

SECTION A

Q1. Solve the following system of equations :
15x + 4y = 61
4x + 15y = 72

Q2. Reduce the following rational expression to its lowest terms :
\[
\frac{x^2 + 3x + 9}{x^2 - 25} \div \frac{x^3 - 27}{(x^2 + 3x - 10)}
\]

Q3. PQ and RS are two parallel chords of a circle and the lines RP and SQ meet at O on producing (as shown in the given figure)

Prove that OP=OQ
Q4. A suit is available for Rs. 1500 cash or for Rs. 500 cash down payment followed by 3 monthly instalments of Rs. 345 each. Find the rate of interest charged under the instalment scheme.

Q5. A loan has to be returned in two equal annual instalments. If the rate of interest is 16% per annum compounded annually and each instalment is of Rs. 1682, find the sum borrowed and the total interest paid.

Q6. If \((x - 2)\) is a factor of \(x^2 + ax + b\) and \(a + b = 1\), find the values of \(a\) and \(b\).

Q7. Using quadratic formula, solve the following equation for \(x\):
\[abx^2 + (b^2 - ac) x - bc = 0\]

OR

The sum of the squares of two positive integers is 208. If the square of the larger number is 18 times the smaller, find the numbers.

Q8. Which term of the A.P. 3, 15, 27, 39.... is 132 more than its 54th term?

OR

Derive the formula for the sum of first \(n\) terms of an A.P. whose first term is 'a' and the common difference is 'd'.

Q9. Find the sum of the following arithmetic progression
\[1+3+5+7+............+199\]

Q10. Show that a line drawn parallel to the parallel sides of a trapezium divides the non-parallel sides proportionally.

SECTION B

Q11. Solve for \(x\),
\[\frac{1}{x+1} + \frac{2}{x+2} = \frac{4}{x+4}, \quad (x \neq -1, -2, -4)\]

Q12. Find graphically, the vertices of the triangle formed by the x-axes and the lines
\[2x - y + 8 = 0\]
\[8x + 3y - 24 = 0\]

Q13. Construct a triangle ABC in which BC = 13cm, CA = 5cm and AB = 12cm. Draw its incircle and measure its radius.

Q14. The total surface area of a closed right circular cylinder is 6512 cm², and the circumference of its base is 88 cm. Find the volume of the cylinder (use \(\pi = \frac{22}{7}\)).

Q15. Prove the identity:
\[(1 + \cot \theta - \csc \theta)(1 + \tan \theta + \sec \theta) = 2.\]
OR

Without using trigonometric tables, evaluate:

\[
\cos 35^\circ + \frac{\tan 27^\circ \tan 63^\circ}{\sin 30^\circ} - 3\tan^2 60^\circ
\]

Q16. Show that the points (7, 10), (-2, 5) and (3, -4) are the vertices of an isosceles right triangle.

OR

Using distance formula, show that the points (-1, -1), (2, 3) and (8, 11) are collinear.

Q17. Find the ratio in which the point (-3, p) divides the line segment joining the points (-5, -4) and (-2, 3). Hence find the value of p.

Q18. Compute the missing frequencies 'f_1' and 'f_2' in the following data if the mean is 166 and the sum of observations is 52.

<table>
<thead>
<tr>
<th>Classes</th>
<th>140-150</th>
<th>150-160</th>
<th>160-170</th>
<th>170-180</th>
<th>180-190</th>
<th>190-200</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5</td>
<td>f_1</td>
<td>20</td>
<td>f_2</td>
<td>6</td>
<td>2</td>
<td>=52</td>
</tr>
</tbody>
</table>

Q19. An unbiased dice is tossed
i) Write the sample space of the experiment
ii) Find the probability of getting a number greater than 4
iii) Find the probability of getting a prime number.

Q20. The pie chart (as shown in the figure) represents the amount spent on different sports by a sports club in a year. If the total money spent by the club on sports is Rs. 1,08,000/-, find the amount spent on each sport.
SECTION C

Q21. Prove that the angle subtended by an arc of a circle at its center is double the angle subtended by it at any point on the remaining part of the circle.

Using the above result prove that the angle in a major segment is acute.

Q22. Prove that the ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides.

Using the above, prove that the area of an equilateral triangle described on the side of a square is half the area of the equilateral triangle described on its diagonal.

Q23. From the top of a tower 60m. high, the angles of depression of the top and bottom of a building whose base is in the same straight line with the base of the tower are observed to be 30° and 60° respectively. Find the height of the building.

OR

An aeroplane flying horizontally at a height of 1.5km above the ground is observed at a certain point on earth to subtend an angle of 60°. After 15 seconds, its angle of elevation at the same point is observed to be 30°. Calculate the speed of the aeroplane in km/h.

Q24. A solid toy is in the form of a hemisphere surmounted by a right circular cone. If the height of the cone is 4 cm and diameter of the base is 6 cm calculate:

i) the volume of the toy

ii) surface area of the toy (use \( \pi = 3.14 \))

OR

A bucket of height 8cm. and made up of copper sheet is in the form of frustrum of a right circular cone with radii of its lower and upper ends as 3 cm and 9 cm respectively. Calculate:

i) the height of the cone of which the bucket is a part

ii) the volume of water which can be filled in the bucket.

iii) the area of copper sheet required to make the bucket (Leave the answer in terms of \( \pi \))
Q25. Anil's total annual salary excluding HRA is Rs. 1,96,000. He contributes Rs. 5000 per month in his G.P.F. How much should he invest in N.S.C. to get maximum rebate? After getting maximum rebate he wants to pay income tax in equal monthly instalments. Find the amount which should be deducted per month towards tax from his salary.

Assume the following for calculating income tax:

a) Standard deduction:
   - (i) 40% of the total income subject to a maximum of Rs. 30,000/- in case the total annual income is up to Rs. 100,000.
   - (ii) Rs. 30,000/- in case the total annual income is from Rs. 100,001 to Rs. 500,000.

b) Rate of income Tax:

<table>
<thead>
<tr>
<th>Slab</th>
<th>Income Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Up to Rs. 50,000</td>
<td>No tax</td>
</tr>
<tr>
<td>ii) From Rs. 50,001 to Rs. 60,000</td>
<td>10% of the amount exceeding Rs. 50,000</td>
</tr>
<tr>
<td>iii) From Rs. 60,001 to Rs. 1,50,000</td>
<td>Rs. 1000 + 20% of the amount exceeding Rs. 60,000</td>
</tr>
<tr>
<td>iv) Above Rs. 1,50,000</td>
<td>Rs. 19,000 + 30% of the amount exceeding Rs. 1,50,000</td>
</tr>
</tbody>
</table>

c) Rebate in income tax:
   - i) 20% of the amount of saving subject to maximum Rs. 14,000/-, if gross income is upto Rs. 1,50,000
   - ii) 15% of the amount of saving subject to a maximum of Rs. 10,500/- if gross income is above Rs. 1,50,000 but not exceeding Rs. 500,000
MARKING SCHEME
SECTION A

Q. NO. | VALUE POINTS | Marks
---|---|---
Q1. | 15x + 4y = 61
   | 4x + 15y = 72
   | Adding the equations we get
   | x + y = 7 ............................... (i) 1
   | Subtracting we get
   | x - y = -1 ............................... (ii) 1
   | Solving (i) & (ii)
   | x = 3, y = 4 1
Q2. | Writing as \[ \frac{x^2 + 3x + 9}{(x+5)(x-5)} \] \[ \frac{x}{x^3 - 3^3} \]
   | = \[ \frac{x^2 + 3x + 9}{(x+5)(x-5)} \] \[ \frac{x}{x} \]
   | = \[ \frac{x - 2}{(x-5)(x-3)} \] 1
Q3. | \( \angle POQ = \angle RSQ \) - Ext. angle of cyclic quad PRSQ 1
   | \( \angle OQP = \angle RSQ \) - .......... (PQ \parallel RS) 1
   | \( \therefore \angle OPQ = \angle OQP \) ½
   | \( \because \ OP = OQ \) ½
Q4. | Cash Price = Rs. 1500 1
   | Price under Instalment Plan = Rs. 500 + Rs. 1035 = Rs. 1535
   | Interest Charged = Rs. 35 1
   | Principal for each month = Rs. 1000 + Rs. 655 + Rs. 310
   | \( \therefore \) Total Principal = Rs. 1965 1
   | Rate = \[ \frac{35 \times 100 \times 12}{1965 \times 1} = \frac{2800}{131} = 21.31\% \text{ approx} \] 1
Q5. Principal of 1st instalment = $\frac{1682}{1 + \frac{16}{100}} = Rs. 1450$

Principal of 2nd instalment = $\frac{1682}{\left(\frac{29}{25}\right)^2} = Rs. 1250$

Total Sum borrowed = Rs. 1450

\[+ \text{ Rs. 1250} \]

= Rs. 2700

Interest Charged \[= \text{ Rs. 3364} - \text{ Rs. 2700} \]

= Rs. 664

Q6. \((x - 2)\) is a factor of \(x^2 + ax + b\)

\[\therefore 4 + 2a + b = 0 \Rightarrow 2a + b = -4 \]

also \[a + b = 1 \]

Solving to get \(a = -5\)

\[b = 6 \]

Q7. \[x = \frac{- (b^2 - ac) \pm \sqrt{(b^2 - ac)^2 - 4(ab)(-bc)}}{2ab} \]

\[= \frac{- (b^2 - ac) \pm \sqrt{(b^2 + ac)^2}}{2ab} \]

\[= \frac{- (b^2 - ac) \pm (b^2 + ac)}{2ab} \]

\[= \frac{2ac}{2ab} \text{ or } \frac{-2b^2}{2ab} \]

\[= \frac{c}{b} \text{ or } \frac{-b}{a} \]

OR

Let two positive numbers be \(x\) & \(y\) and \(x > y\)

\[\therefore x^2 + y^2 = 208 \] \[\text{.................................(i)} \]

\[x^2 = 18y \] \[\text{.................................(ii)} \]

Putting the value of (ii) in (i)

\[y^2 + 18y - 208 = 0 \]

\[\Rightarrow (y + 26)(y - 8) = 0 \]

\[\Rightarrow y = -26 \text{ or } y = 8 \]

Putting \(y = 8\) in (ii) \(x = 12, x = -12 \text{ (false)}\)

\[\therefore x = 12, y = 8 \]
Q8. Here a = 3, d = 12

\[ t_{54} = 3 + (54 - 1) \times 12 = 639 \]

Let \( n \) be number of terms

\[ t_n = 639 + 132 = 771 \]

\[ \Rightarrow 3 + (n - 1) \times 12 = 771 \]

\[ \therefore n = 65 \]

OR

Writing \( S_n = a + (a+d) + (a+2d) + \ldots \), Where \( \ell = a + (n-1) d \)

\[ S_n = \ell + (\ell-d) + (\ell-2d) + \ldots + a \]

\[ \Rightarrow 2S_n = (a+\ell) + (a+\ell) + (a+\ell) + \ldots + (a+\ell) = n(a+\ell) \]

\[ S_n = \frac{n}{2}(a+\ell) = \frac{n}{2}[2a+(n-1)d] \]

Q9. Here a=1, d=2

Let \( t_n = 199 \)

\[ \therefore 1 + (n-1) \times 2 = 199 \]

\[ \therefore n = 100 \]

\[ \therefore S_{100} = \frac{100}{2} \times [2 \times 1 + (100-1) \times 2] \]

\[ = 50 \times [200] \]

\[ = 10,000 \]

Q10. Correct figure

\[ \frac{DE}{EA} = \frac{DO}{OB} \quad \ldots \quad (i) \quad [EO\parallel AB] \]

Similarly in \( \Delta BCD \),

\[ \frac{DO}{OB} = \frac{CF}{FB} \quad \ldots \quad (ii) \]

\( i \) and \( ii \) \( \Rightarrow \frac{DE}{EA} = \frac{CF}{FB} \)

SECTION B

Q11. \[ \frac{3x + 4}{(x+1)(x+2)} = \frac{4}{x+4} \]

\[ \Rightarrow 4(x+1)(x+2) = (x+4)(3x+4) \]

or \[ 4x^2 + 12x + 8 = 3x^2 + 16x + 16 \]

or \[ x^2 - 4x - 8 = 0 \]

Solving to get \[ x = 2 + 2\sqrt{3}, \quad 2 - 2\sqrt{3} \]
Q12.  \[2x - y + 8 = 0\]
\[
\begin{array}{l}
\begin{array}{c|c|c|c}
\text{x} & -3 & -4 & 0 \\
\text{y} & 2 & 0 & 8 \\
\end{array}
\end{array}
\]
\[8x + 3y - 24 = 0\]
\[
\begin{array}{l}
\begin{array}{c|c|c|c}
\text{x} & 0 & 3 & 6 \\
\text{y} & 8 & 0 & -8 \\
\end{array}
\end{array}
\]
Correct graph of two lines with vertices as \((0, 8), (-4, 0)\) and \((3, 0)\)

Q13. Correct Construction:
Correct Measurement of radius: 3 marks

Q14. Let radius of base of cylinder = \(r\) cm.
\[
\therefore 2x \frac{22}{7} = 88
\]
\[
\Rightarrow r = 14 \text{ cm}
\]
Again \(2\pi rh + 2\pi r^2 = 6512 \text{ cm}^2\)
\[
\therefore h = \frac{6512}{88} - 14 = 60 \text{ cm}
\]
Volume = \(\frac{22}{7} \times 14 \times 14 \times 60\)
\[= 36960 \text{ cm}^3\]

Q15. L.H.S.
\[
\left(\frac{\sin \theta + \cos \theta - 1}{\sin \theta}\right) = \left(\frac{\sin \theta + \cos \theta + 1}{\cos \theta}\right)
\]
\[= \frac{(\sin \theta + \cos \theta)^2 - 1}{\sin \theta \cdot \cos \theta}\]
\[= \frac{2\sin \theta \cdot \cos \theta}{\sin \theta \cdot \cos \theta} = 2\]

L.H.S. = R.H.S.

147
\[
\frac{\cos 35^\circ}{\sin (90^\circ - 35^\circ)} + \frac{\tan 27^\circ \tan (90^\circ - 27^\circ)}{\sin 30^\circ} - 3 \tan^2 60^\circ
\]

\[
= \frac{\cos 35^\circ}{\cos 35^\circ} + \frac{\tan 27^\circ \cot 27^\circ}{\sin 30^\circ} - 3 \tan^2 60^\circ
\]

\[
= 1 + 2 - 9
\]

\[
= -6
\]

Q16. Let \(A = (7, 10) \); \(B = (-2, 5) \); \(C = (3, -4)\)

\[
\therefore \quad \text{AB} = \sqrt{(-2-7)^2 + (5-10)^2}
\]

\[
= \sqrt{106}
\]

\[
\text{BC} = \sqrt{(3+2)^2 + (-4-5)^2}
\]

\[
= \sqrt{106}
\]

\[
\text{CA} = \sqrt{(7-3)^2 + (10+4)^2}
\]

\[
= \sqrt{16 + 196}
\]

\[
= \sqrt{212}
\]

\(\Rightarrow \quad \text{AB} = \text{BC}\)

and \(\text{CA}^2 = \text{AB}^2 + \text{BC}^2\)

\(\therefore \quad \text{A}, \text{B} \& \text{C} \text{ are vertices of an isosceles rt. triangle}\)

OR

Let \(A = (-1, -1) \); \(B = (2, 3) \); \(C = (8, 11)\)

\[
\text{AB} = \sqrt{(2+1)^2 + (3+1)^2}
\]

\[
= \sqrt{25} = 5
\]

\[
\text{BC} = \sqrt{(8-2)^2 + (11-3)^2}
\]

\[
= \sqrt{56 + 64}
\]

\[
= 10
\]

\[
\text{CA} = \sqrt{(-1-8)^2 + (-1-11)^2}
\]

\[
= \sqrt{225}
\]

\[
= 15
\]

\(\therefore \quad \text{CA} = \text{AB} + \text{BC}\)

\(\therefore \quad (-1, -1) \); \((2, 3)\) and \((8, 11)\) are collinear
Q17. Let the ratio be $K : 1$ in which $x$, $y$ divides the join of $(-5, -4)$ and $(-2, 3)$

$$\therefore x = \frac{-2K - 5}{K + 1}$$

$$y = \frac{3K - 4}{K + 1}$$

$$\therefore \frac{-2K - 5}{K + 1} = -3 \text{ (i) and } \frac{3K - 4}{K + 1} = p \text{ (ii)}$$

$\Rightarrow K = 2 \therefore \text{Ratio is 2:1}$

Putting value of $K$ in (ii) we get $p = \frac{2}{3}$

Q18. 

<table>
<thead>
<tr>
<th>$x$</th>
<th>145, 155, 165, 175, 185, 195 sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f$</td>
<td>5, 20, 6, 2, 52</td>
</tr>
</tbody>
</table>

$x \cdot f = 725, 155f_1, 3300, 175f_2, 1110, 390, 5525+155f_1+175f_2$  

Mean = $166 \frac{9}{26} = \frac{4325}{26} \therefore \sum fx = \frac{4325}{26} \cdot 52 = 8650$

Also $f_1 + f_2 = 52 - 33 = 19 \Rightarrow f_2 = 19 - f_1$

$\therefore 8650 = 5525 + 155f_1 + 175 (19 - f_1)$

$\Rightarrow f_1 = 10$

$\therefore f_2 = 19 - 10 = 9$

Q19. (i) Sample space = $\{1, 2, 3, 4, 5, 6\}$

(ii) Numbers greater than 4 = 5, 6

$\therefore$ Probability = $\frac{2}{6} = \frac{1}{3}$

(iii) Prime numbers = 2, 3, 5

$\therefore$ Probability = $\frac{3}{6} = \frac{1}{2}$

Q20. For total expenditure on sports Rs. 108,000, Central angle = $360^\circ$

$\therefore$ Expenditure on Hockey = $108,000 \times \frac{100}{360} \text{ = Rs. 30,000}$

Expenditure on cricket = $108,000 \times \frac{150}{360} \text{ = Rs. 45,000}$

Expenditure on football = $108,000 \times \frac{60}{360} \text{ = Rs. 18,000}$

Expenditure on Tennis = $108,000 \times \frac{50}{360} \text{ = Rs. 15000}$
Q21. No Figure no marks
Correct, Fig. given, To prove and Construction
Correct Proof
Proof: \(2 \angle APB = \angle AOB\)
\[(\angle AOB < 180^\circ)\]
\[\Rightarrow \angle APB < 90^\circ\]

Q22. No figure no marks
Correct fig, given, to prove, construction 2 marks (½each)
correct proof 2
(ii) Proof Let side of square = \(a\) cm \(\therefore\) diagonal = \(\sqrt{2a}\) cm
\[\Delta APD \quad \Delta AQC\ (Equilateral)\]
\[\therefore \quad \frac{\text{area } \Delta APD}{\text{area } \Delta AQC} = \frac{AD^2}{AC^2}\]
\[= \frac{1}{2}\]

Q23. Let Tower AB = 60 m and Building be DC
In \(\Delta ADB \quad ---\)
\[\frac{AB}{BD} = \tan 60^\circ\]
\[\therefore BD = \frac{60}{\sqrt{3}} = 20\sqrt{3}\ m\]
\[\therefore CP = 20\sqrt{3}\m\]
Again in \(\Delta ACP\quad ---\)
\[\frac{AP}{CP} = \tan 30^\circ\]
\[\Rightarrow AP = 20m\]
Height of Building = CD = PB = AB — AP
\[= 60 — 20\]
\[= 40\ m\]
Let A and B are two positions of the aeroplane. Let AB = d 

\[ \frac{OL}{AL} = \cot 60^\circ \Rightarrow OL = 1.5 \left( \frac{1}{\sqrt{3}} \right) = (0.5) \sqrt{3} \text{ km} \]

\[ \frac{OM}{BM} = \cot 30^\circ \Rightarrow OM = (1.5) (\sqrt{3}) \text{ km} \]

\[ \therefore d = OM - OL = (1.5) \sqrt{3} - (0.5) \sqrt{3} = \sqrt{3} \text{ km} \]

\[ \therefore \text{speed} = \frac{\text{Distance}}{\text{time}} = \frac{\sqrt{3}}{15} = 240 \sqrt{3} \text{ km/hr} \]

or 415.68 km/hr

Q24.

Volume of toy = \( \left[ \frac{1}{3} \pi (3)^2.4 + \frac{2}{3} \pi (3)^3 \right] \text{ cm}^3 \)

\[ = [12\pi + 18\pi] \text{ cm}^3 \]

\[ = 30 \times 3.14 = 94.20 \text{ cm}^3 \]

Slant height of cone = \( \sqrt{3^2 + 4^2} = 5 \text{ cm} \)

Total surface area

\[ = [\pi (3) (5) + 2\pi (3^2)] \text{ cm}^2 \]

\[ = (15\pi + 18\pi) \text{ cm}^2 \]

\[ = 33 (3.14) = 103.62 \text{ cm}^2 \]

OR

Let ABCD be the bucket which is the frustum of a cone with vertex O (as in fig.)

Let ON = \( x \)

\( \Delta ONB \sim \Delta OMC \) \( \therefore \frac{x}{x+8} = \frac{3}{9} \Rightarrow x = 4 \)

\[ \therefore \text{height of cone} = 8 + 4 = 12 \text{ cm} \]

Volume of bucket = \( [\pi (9)^2.12 - \pi (3)^2.4] \text{ cm}^3 \)

\[ = 312 \pi \text{ cm}^3 \]

Slant height of cone of radius 9 cm = \( 9^2 + 12^2 \text{ cm} \)

\[ \therefore L = 15 \text{ cm} \]

Slant height of cone of radius 3 cm = \( 3^2 + 4^2 \text{ cm} \)

\[ = 5 \text{ cm} \]

Area of the copper sheet used to form bucket

\[ = [\pi (9) (15) - \pi (3) (5) + \pi (3)^2] \text{ cm}^2 \]

\[ = 129\pi \text{ cm}^2 \]
Q25. Taxable Income = Rs. \(1,96,000 - 30,000\) = Rs. 1,66,000  
Income Tax = Rs. \(19,000 + 30\% \text{ of } 16,000\) = Rs. 23,800  
Savings in GPF = Rs. \(12 \times 5,000\) = Rs. 60,000  
∴ Amount to be invested in NSC for maximum rebate  
= Rs. \(70,000 - 60,000\) = Rs. 10,000  
∴ Maximum rebate availed = Rs. \(70,000 \times \frac{15}{100}\) = Rs. 10,500  
Net tax = Rs. \(23800 - 10500\) = Rs. 13300  
Total tax to be paid per month = Rs. \(\frac{13300}{12}\) = Rs. 1108
<table>
<thead>
<tr>
<th>Objective Knowledge</th>
<th>Understanding</th>
<th>Application</th>
<th>Skill</th>
<th>Total</th>
<th>Grand</th>
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<td><strong>SA1</strong></td>
<td><strong>SA2</strong></td>
<td><strong>LA</strong></td>
<td><strong>SA1</strong></td>
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<td>6(1)</td>
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<td>8(2)</td>
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<td><strong>Sub-Total</strong></td>
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<td>8(2)</td>
<td>-</td>
<td>8(2)</td>
<td>6(2)</td>
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<td>-</td>
<td>8(2)</td>
<td>6(2)</td>
</tr>
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<td>45(11)</td>
<td>12(3)</td>
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Sample Question Paper-II

Class X

Subject : Mathematics

Max Marks : 100

Time : 3 Hours

General Instructions :

1. All questions are compulsory.
2. The question paper consists of 25 questions divided into three sections A, B and C. Section A contains 10 questions of 3 marks each, Section B is of 10 questions of 4 marks each and Sections C is of 5 questions of 6 marks each.
3. There is no overall choice. However, internal choice has been provided in two questions of three marks each, two questions of four marks each and two questions of six marks each.
4. In question on construction, the drawing should be neat and exactly as per the given measurements.
5. Use of calculators is not permitted. However, you may ask for Mathematical tables.

SECTION A

Q1. Solve the following system of equations graphically

\[ 5x - y = 7 \]
\[ x - y = -1 \]

Q2. Find the Arithmetic Progression whose third term is 16 and the seventh term exceeds its fifth term by 12.

Q3. ABD is a triangle in which \( \angle \text{DAB} = 90^\circ \). AC is drawn perpendicular from A to DB. Prove that :

\[ AD^2 = BD \times CD \]

Q4. A loan of Rs. 48,800/- is to be paid back in three equal annual instalments. If the rate of interest is 25% per annum compounded annually, find the instalment.

Q5. A watch is available for Rs. 970 cash or Rs. 210 as cash down followed by three equal monthly instalments. If the rate of interest is 16% per annum, find the monthly instalment.

Q6. Construct the pair of tangents drawn from a point, 5cm away from the centre of a circle of radius 2cm. Measure the lengths of the tangents.

Q7. A solid metallic cylinder of radius 14cm and height 21 cm is melted and recast into 72 equal small spheres. Find the radius of one such sphere.
Q8. The rain water from a roof 22 m x 20 m drains into a conical vessel having diameter of base as 2 m and height 3.5 m. If the vessel is just full, find the rainfall (in cm.)

OR

The largest sphere is carved out of a cube of side 7 cm; find the volume of the sphere.

Q9. The following table shows the marks secured by 100 students in an examination

<table>
<thead>
<tr>
<th>Marks</th>
<th>0-10</th>
<th>10-20</th>
<th>20-30</th>
<th>30-40</th>
<th>40-50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>15</td>
<td>20</td>
<td>35</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

Find the mean marks obtained by a student.

Q10. A dice is thrown once. Find the probability of getting.

(i) a number greater than 3

(ii) a number less than 5

OR

A bag contains 5 red balls, 8 white balls, 4 green balls and 7 black balls. A ball is drawn at random from the bag. Find the probability that it is.

(i) black

(ii) not green

SECTION B

Q11. Solve for x and y

(a—b)x + (a+b)y = a² —2ab —b²

(a+b) (x+y) = a² + b²

Q12. If (x+3) (x —2) is the G.C.D. of

f(x) = (x+3) (2x²—3x+a)

and g(x) = (x—2) (3x² + 10x—b)

find the value of a and b

Q13. If

\[ A = \frac{2x+1}{2x−1}, \quad B = \frac{2x−1}{2x+1} \]

find

\[ \frac{A+B}{A−B} + \frac{A−B}{A+B} \]

Q14. Solve for x:

\[ \frac{x−1}{x−2} + \frac{x−3}{x−4} = \frac{10}{3} \quad (x \neq 2, x \neq 4) \]

Q15. A passenger train takes 2 hours less for a journey of 300 km if its speed is increased by 5 km/h from its usual speed. Find the usual speed of the train.
Q16. AB is a diameter of a circle with centre O and chord CD is equal to radius of the circle. AC and BD are produced to meet at P. Prove that \( \angle CPD = 60° \).

Q17. A circus tent is in the shape of a cylinder surmounted by a cone. The diameter of the cylindrical part is 24m and its height is 11 m. If the vertex of the tent is 16m above the ground, find the area of canvas required to make the tent.

Q18. Prove that:
\[
\frac{\tan \theta}{1 - \cot \theta} + \frac{\cot \theta}{1 - \tan \theta} = 1 + \sec \theta \cosec \theta
\]

OR

Evaluate:
\[
\frac{\sin 39°}{\cos 51°} + 2 \tan 11° \tan 31° \tan 45° \tan 59°. \tan 79° - 3 (\sin^2 21° + \sin^2 69°)
\]

Q19. Find a point on the x-axis which is equidistant from the points (7, 6) and (—3, 4).

Q20. Three consecutive vertices of a parallelogram ABCD are A(1, 2), B(1, 0) and C (4, 0). Find the fourth vertex D.

OR

If A (4, -8), B (-9, 7) and C (18, 13) are the vertices of a triangle ABC, find the length of the median through A and coordinates of centroid of the triangle.

SECTION C

Q21. The number of hours spent by a school boy on various activities on a working day are given below:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Number of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep</td>
<td>7</td>
</tr>
<tr>
<td>School</td>
<td>8</td>
</tr>
<tr>
<td>Homework</td>
<td>4</td>
</tr>
<tr>
<td>Play</td>
<td>3</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
</tr>
</tbody>
</table>

Present the above information by a pie-chart.
Q22. A vertical tower is surmounted by a flagstaff of height \( h \) metres. At a point on the ground, the angles of elevation of the bottom and top of the flagstaff are \( \alpha \) and \( \beta \) respectively. Prove that the height of lower is:

\[
\frac{h \tan \alpha}{\tan \beta - \tan \alpha}
\]

OR

If the angle of elevation of a cloud from a point \( h \) meters above a lake is \( \alpha \) and the angle of depression of its reflection in the lake is \( \beta \), prove that the distance of the cloud from the point of observation is

\[
\frac{2h \sec \alpha}{\tan \beta - \tan \alpha}
\]

Q23. If a line is drawn parallel to one side of a triangle, prove that the other two sides are divided in the same ratio. Using the above result, prove the following:

The diagonals of a trapezium divide each other in the same ratio.

Q24. Prove that the sum of either pair of the opposite angles of a cyclic quadrilateral is 180°. Using the above result, determine as under:

ABCD is a cyclic trapezium with \( AD \parallel BC \). If \( \angle B = 70^\circ \), determine the other three angles of the trapezium.

OR

If two circles touch each other internally or externally, prove that the point of contact lies on the line joining their centers.

Using the above result prove the following:

Two circles with centers \( O \) and \( O' \) and radii \( r_1 \) and \( r_2 \) touch each other externally at \( P \). AB is a line through \( P \) intersecting the two circles at \( A \) & \( B \) respectively. Prove that \( OA \parallel OB' \).
Q25. Ramlal has a total annual income of Rs. 1,45,000/-. He contributes Rs. 2000 per month in his GPF and pays an annual LIC premium of Rs. 15,000. If he pays Rs. 250 per month for the first 11 months as advance income tax, find the income tax liability for the last month. Use the following for calculating income tax:

a) Standard Deduction
   i) 40% of the total income subject to a maximum of Rs. 30,000/- in case the total annual income is up to Rs. 100,000/-
   ii) Rs. 30,000/- in case the total annual income is from Rs. 100,001 to Rs. 500,000/-

b) Rates of Income tax
   i) Upto Rs. 50,000 No tax
   ii) Rs. 50,001 to Rs. 60,000 10% of the amount exceeding Rs. 50,000
   iii) Rs. 60,001 to Rs. 1,50,000 Rs. 1000 + 20% of the amount exceeding Rs. 60,000.

c) Rebate on Savings
   20% of the total savings if the gross income is up to Rs. 1,50,000 subject to a maximum of Rs. 14,000.
Q1. Forming the table of values:

\[
\begin{array}{c|c|c|c}
5x - y &= 7 \\
x & 1 & 0 & 2 \\
y & -2 & -7 & 3 \\
\end{array}
\]

\[
\begin{array}{c|c|c|c}
x - y + 1 &= 0 \\
x & -1 & 0 & 2 \\
y & 0 & 1 & 3 \\
\end{array}
\]

Graph of lines

Getting the solution \( x = 2, y = 3 \)

Q2. Let \( a \) be the first term and \( d \), the common difference

\[
\Rightarrow \text{Third term} = t_3 = a + 2d = 16 \]

\[
\Rightarrow \text{Also,} \quad t_7 - t_5 = 12 \quad \Rightarrow (a+6d) - (a+4d) = 12 \quad \Rightarrow d = 6
\]

From (i) and (ii), getting \( a = 4 \)

\[
\Rightarrow \text{The arithmetic progression is} \quad 4, 10, 16, 22, 28
\]

Q3. Correct Figure

Showing \( \Delta DCA \sim \Delta DAB \)

\[
\frac{AD}{CD} = \frac{BD}{AD}
\]

\[
\Rightarrow AD^2 = BD \cdot CD
\]

Q4. Let the instalment be Rs \( x \)

Present values of 1st, 2nd and 3rd instalments are

\[
\frac{4}{5}x, \quad \left(\frac{4}{5}\right)^2x, \quad \left(\frac{4}{5}\right)^3x
\]

\[
\Rightarrow \frac{4}{5}x \left[ 1 + \frac{4}{5} + \frac{16}{25} \right] = 48800
\]

OR \( x = 25000 \)

\[
\Rightarrow \text{each instalment} = \text{Rs. 25000}
\]
Q5. Cash price of watch = Rs. 970
Cash down payment= Rs. 210
∴ Payment to be made in instalments = Rs. (970-210) = Rs 760
Let Rs. $x$ be each instalment
∴ $x + \left[ x + \frac{16x}{1200} \right] + \left[ x + \frac{16x}{1200} \right] = Rs. 760$

or, $3x + \frac{16x}{1200} \times 3 = 760$

or, $\frac{76}{25} \times x = 760 \Rightarrow x = 250$

Q6. Correct construction

Q7. Volume of metallic cylinder = $\left[ \pi (14)^2 \times 21 \right] \text{cm}^3$
This has been melted to form 72 spheres
Let $r$ be the radius of the sphere
∴ $\frac{24}{72} \times \frac{4}{3} \pi r^3 = \pi 196.21$

$r^3 = \frac{(196)(21)}{24 \times 4}$

$= \left( \frac{7}{2} \right)^3$

$\Rightarrow r = 3.5 \text{ cm}$

Q8. Let $h$ cm be the rainfall on the roof
∴ volume of water collected on roof = $\left( \frac{22 \times 20 \times h}{100} \right) \text{m}^3 = \frac{22}{5} \times h \text{ m}^3$

Volume of water in conical vessel = $\frac{1}{3} \pi (1)^2 \times \frac{7}{2} \text{ m}^3$
\[
\begin{align*}
\text{Volume} &= \frac{1}{3} \times \frac{22}{7} \times \frac{7}{2} \text{ m}^3 = \frac{11}{3} \text{ m}^3 \\
\Rightarrow \quad h &= \frac{11}{3} \\
\Rightarrow h &= \frac{11}{3} \times \frac{5}{22} = \frac{5}{6} \quad \Rightarrow \text{rainfall} = \frac{5}{6} \text{ cm}
\end{align*}
\]

OR

The diameter of sphere = side of cube

\[\therefore \text{Radius of sphere} = \frac{7}{2} \text{ cm}\]

Volume = \(\frac{4}{3} \pi r^3\)

\[
= \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} = 179 \times \frac{2}{3} \text{ cm}^3
\]

Q9.

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<th>Value Points</th>
<th>Marks</th>
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<td>20-30</td>
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<td>30-40</td>
<td>35</td>
<td>4</td>
</tr>
<tr>
<td>40-50</td>
<td>45</td>
<td>5</td>
</tr>
</tbody>
</table>

Correctly finding

\[
\text{\(\overline{x} = \frac{\Sigma \text{fixi}}{\Sigma \text{fi}}\)}
\]

\[
= \frac{2400}{100} = 24
\]

Q10.

Total possible cases = 6

Numbers greater than 3 on the die = 3 (4,5,6)

\[\therefore \quad \text{(i) Probability of getting a number > 3} = \frac{3}{6} = \frac{1}{2}\]

\[\text{(ii) Numbers less than 5} = 4 \quad [1,2,3,4]\]

\[\therefore \quad \text{Required probability} = \frac{4}{6} \text{ or } \frac{2}{3}\]
Total no. of balls in the bag = 24 ½
(i) Numbers of black balls = 7
∴ Required probability = $\frac{7}{24}$
(ii) Number of balls which are not green = Total - green = 24 - 4 = 20
∴ Required probability = $\frac{20}{24} = \frac{5}{6}$

Q11.
(a-b)x + (a+b)y = a² - 2ab - b² (i)
(a+b)x + (a+b)y = a² + b² (ii)
(i) — (ii) $\Rightarrow$ 2bx = 2(a-bx)
$\Rightarrow$ x = -2(a+b)
substituting in (i) or (ii) to get $y = -\frac{2ab}{a+b}$

Q12.
(x+3)(x-2) divides f(x)
∴ 2x² - 3x + a has a factor (x-2)
$\therefore$ 2(2)² - 3(2) + a = 0
8 - 6 + a = 0 $\Rightarrow$ a = -2
1½
Similarly, (x + 3) divides 3x² + 10x - b
$\therefore$ 3(-3)² - 30 - b = 0
$\Rightarrow$ b = -3
½

Q13.
A+B = (2x+1)² - (2x-1)² = $\frac{2(4x² + 1)}{4x² - 1}$
4x² - 1
A - B = (2x+1)² - (2x - 1)² = $\frac{8x}{4x² - 1}$
4x² - 1
$\therefore$ A+B = 2 $\frac{4x² + 1}{4x² - 1}$ x $\frac{4x² - 1}{8x}$ = $\frac{4x² + 1}{4x}$
1

$\therefore$ A+B = 2 $\frac{4x² + 1}{4x² - 1}$ x $\frac{4x² - 1}{8x}$ = $\frac{4x² + 1}{4x}$
$\frac{A+B}{A-B} = \frac{4x}{4x² + 1}$
$\therefore$ $\frac{A+B}{A-B}$ + $\frac{A-B}{A+B}$ = $\frac{4x² + 1}{4x}$ + $\frac{4x}{4x² + 1}$ = $\frac{(4x² + 1)² + 16x²}{4x(4x² + 1)}$ = $\frac{16x⁴ + 24x² + 1}{16x³ + 4x}$
1
Q14. $1 + \frac{1}{x-2} + 1 + \frac{1}{x-4} = \frac{10}{3}$

$\Rightarrow \frac{1}{x-2} + \frac{1}{x-4} = \frac{10}{3} - 2 = \frac{4}{3}$

$\Rightarrow \frac{2x-6}{x^2-6x+8} = \frac{4}{3}$

$\Rightarrow 4x^2 - 30x + 50 = 0$

$\Rightarrow 2x^2 - 10x - 5x + 25 = 0 \Rightarrow (x-5)(2x-5) = 0$

$\Rightarrow x = 5, \frac{5}{2}$

Q15. Let the usual speed of train be $x$ km/hour

According to the problem

$\frac{300}{x} - \frac{300}{x+5} = 2$

OR $\frac{1500}{x(x+5)} = 2 \Rightarrow x^2 + 5x - 750 = 0$

or $(x+30)(x-25) = 0$

$\Rightarrow x = 25$ [Rejecting $x = -30$ as speed cannot be negative]

$\therefore$ The usual speed of train = 25 km/hour

Q16. $OC = CD = OD \Rightarrow OCD$ is an equilateral triangle

$\therefore \angle 1 = \angle 2 = \angle 3 = 60^0$

Again $OA = OC$ and $OB = OD$

$\therefore \angle OAC = \angle OCA = \beta$ and $\angle OBD = \angle ODB = \alpha$

$\angle 5 = 180^0 - 2\beta$

$\angle 4 = 180^0 - 2\alpha$

$180^0 - \angle 1 = \angle 5 + \angle 4 = 120^0$

$120^0 = 360^0 - 2(\alpha + \beta) \Rightarrow \alpha + \beta = 120^0$

$\therefore \angle 6 = 60^0$ i.e, $\angle CPD = 60^0$
Q17. Area of canvas required to build the tent

= curved surface area of cylindrical part + curved surface of conical part

\[ OA^2 = 5^2 + 12^2 = 169 \Rightarrow OA = 13 \text{ m} \]

\[ \therefore \text{Required area} = 2\pi rh + \pi rl = \pi r(2h+l) \]

\[ = \frac{22}{7} \times 12(22+13) \text{ m}^2 = 1320 \text{ m}^2 \]

Q18. \[
\frac{\tan \theta}{1-\cot \theta} + \frac{\cot \theta}{1-\tan \theta} = 1 + \sec \theta \cot \theta
\]

L.H.S \[
= \frac{\tan \theta}{1-\cot \theta} + \frac{1}{\tan \theta (1-\tan \theta)}
= \frac{1}{\tan \theta (1-\tan \theta)} \left( \frac{\tan \theta}{1-\cot \theta} + 1 + \tan \theta + \tan^2 \theta \right)
\]

\[ = \frac{1}{\tan \theta (1-\tan \theta)} \left( 1 + \sec \theta \csc \theta \right) = \text{R.H.S.} \]

OR

\[ \cos 51^0 = \cos(90-39)^0 = \sin 39^0 \]
\[ \tan 79^0 = \tan(90-11)^0 = \frac{1}{\tan 11^0} \]
\[ \tan 59^0 = \tan (90-31)^0 = \frac{1}{\tan 31^0} \]
\[ \tan 45^0 = 1 \]
\[ \sin 69^0 = \sin(90-21)^0 = \cos 21^0 \]

\[ \therefore \text{Given expression becomes} \]

\[ \frac{1}{\tan 11^0} - 3(\sin^2 21^0 + \cos^2 21^0) = 1 \]

\[ = 1 + 2 - 3(1) = 0 \]
Q19. Any point P on x axis is given by (x,0) ½

(Distance) between (x, 0) and (7, 6) is given by \[ \sqrt{(x - 7)^2 + 6^2} \] ……(i) 1

(Distance) between (x, 0) and (−3, 4) is given by \[ \sqrt{(x + 3)^2 + 4^2} \] ……(ii) 1

(i) = (ii) \[ x^2 - 14x + 49 + 36 = x^2 + 6x + 9 + 16 \]

OR, 20x = 60

x=3

∴ The point is (3,0) ½

Q20. Let the point D be (x, y)

∴ mid point of BD = \( \left( \frac{x+1}{2}, \frac{y}{2} \right) \) 1 ½

Mid point of AC = (5/2, 1)

This is the same point

∴ \[ \frac{x+1}{2} = \frac{5}{2} \Rightarrow x=4 \]

and \[ \frac{y}{2} = 1 \Rightarrow y = 2 \]

∴ The co-ordinates of D are (4, 2) ½

OR

Co-ordinates of D are \( \left( \frac{9}{2}, 10 \right) \)

∴ The length of AD

= \[ \sqrt{(4- \frac{9}{2})^2 + (-8 -10)^2} \]

= \[ \sqrt{\frac{1}{4} + 324} = \sqrt{\frac{1297}{4}} \]

= \[ \frac{1}{2} \sqrt{1297} \] ½

Co-ordinates of centroid

= \( \left( \frac{4-9+18}{3}, \frac{-8+7+13}{3} \right) \)

= \( \left( \frac{13}{3}, 4 \right) \) ½
Q. No. | Value Points | Marks
--- | --- | ---

**SECTION C**

**Q21.** Making the table:
Correct Central angles

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration in hours</th>
<th>Central angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep</td>
<td>7</td>
<td>105º</td>
</tr>
<tr>
<td>School</td>
<td>8</td>
<td>120º</td>
</tr>
<tr>
<td>Home work</td>
<td>4</td>
<td>60º</td>
</tr>
<tr>
<td>Play</td>
<td>3</td>
<td>45º</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>30º</td>
</tr>
</tbody>
</table>

Drawing correct Pie chart with markings

**Q22.** figure
Writing the trigonometric equation

\[
\frac{b}{x} = \tan \alpha \Rightarrow x = b \cot \alpha
\]

Again \(\frac{b + h}{x} = \tan \beta \Rightarrow \frac{b + h}{b \cot \alpha} = \tan \beta\)

\(\Rightarrow (b+h) = \frac{b \tan \beta}{\tan \alpha}\)

\(\Rightarrow b \tan \alpha + h \tan \alpha = b \tan \beta\)

\(\Rightarrow h \tan \alpha = b(\tan \beta - \tan \alpha)\)

\(\Rightarrow b = \frac{h \tan \alpha}{\tan \beta - \tan \alpha}\)
We have to find $AD$.

Let $AC = A'C = x$

$\therefore AB = x-h , A'B = x+h$

Let $BD = y$

$\therefore \frac{AB}{BD} = \frac{x-h}{y} = \tan \alpha \Rightarrow x = h + y \tan \alpha$ \hspace{1cm} 1 ½

$\frac{A'B}{BD} = \tan \beta$

$\frac{x + h}{y} = \tan \beta \Rightarrow x = y \tan \beta - h$ \hspace{1cm} 1

$\therefore h + y \tan \alpha = y \tan \beta - h$ \hspace{1cm} 1

$\therefore \frac{BD}{AD} = \cos \alpha \Rightarrow AD = y \sec \alpha$ \hspace{1cm} 1

$AD = \frac{2h \sec \alpha - \tan \beta - \tan \alpha}{\tan \beta - \tan \alpha}$ \hspace{1cm} ½

**Q23.**

Given, to prove, construction and correct figure

1 ½ x 4 = 2

Correct proof

Draw $OE \parallel AB$

In $\triangle DAB$, $OE \parallel AB \Rightarrow \frac{AE}{ED} = \frac{BO}{OD}$ (i) \hspace{1cm} ½

Similarly, in $\triangle ADC$, $EO \parallel AB \parallel DC$

$\therefore \frac{AE}{ED} = \frac{AO}{OC}$ (ii) \hspace{1cm} ½

From (i) and (ii), we get $\frac{BO}{DO} = \frac{AO}{OC}$ \hspace{1cm} ½

**Q24.**

Given, to prove, construction and correct figure

1 ½x4=2

Correct proof

$ABCD$ is cyclic, therefore $\angle D = 180^\circ - 70^\circ = 110^\circ$ \hspace{1cm} ½

Also $\angle C + \angle D = 180^\circ \Rightarrow \angle C = 180^\circ - 110^\circ = 70^\circ$

$\therefore \angle A = 180^\circ - 70 = 110^\circ$ \hspace{1cm} ½
Given, to prove construction & correct figure
Correct proof

\[ \frac{1}{2} \times 4 = 2 \]

Figure \( \frac{1}{2} \)

\[ \text{OPO} \text{ is a straight line} \]
Since \( OA = OP = r \):
\[ \angle A = \angle 1, \] Similarly \( \angle B = \angle 2 \)
But \( \angle 1 = \angle 2 \) (vert. Opp. \( \angle s \)):
\[ A = \angle B \]
But these are alternate angles:
\[ OA \parallel O'B \]

Q25. Taxable income = Rs. 145000 - 30,000 = Rs. 1,15,000

Income tax = Rs. \[ 1000 + \frac{55000 \times 20}{100} \] = Rs. 12,000

Annual savings = Rs [2000 x 12 + 15000] = Rs. 39,000

Rebate = 20% of Rs. 39000 = Rs. 7800

\[ \therefore \text{Tax} = \text{Rs.} (12000 - 7800) = \text{Rs.} 4200 \]

Income tax paid for first 11 months = Rs. (250 x 11) = Rs. 2750

\[ \therefore \text{Income tax to be paid in the last month} = \text{Rs.} (4200 - 2750) = \text{Rs.} 1450 \]