[English Version]

[The answers of the Question Nos. 1, 2, 3, 4 are to be written at the beginning of the answer-script mentioning the question numbers in the serial order. Necessary calculation and drawing must be given on the right hand side by drawing margins on the first few pages on the answer-script. Tables and Calculators of any type are not allowed. Approximate value of π may be taken as $\frac{22}{7}$, if necessary. Graph paper will be supplied, if required. Arithmetic problems may be solved by algebraic method.]

[Alternative Question No. 11 is given for sightless candidates on Page No. 31.]

[Question No. 16 on Page No. 31 and 32 is only for external candidates.]

1. Choose the correct option in each case from the following questions :— $1\times6=6$

(i) If a principal becomes twice of it in 10 years, then the rate of simple interest per annum is :

(a) 5%

(b) 10%

(c) 15%

(d) 20%

(ii) The product of two roots of the equation $x^2-7x+3=0$ is :

(a) 7

(b) –7

(c) 3

(d) –3

(iii) The length of two chords AB and CD of a circle of centre O are equal and $\angle AOB = 60°$, then $\angle COD$ is :

(a) 30°

(b) 60°

(c) 120°

(d) 180°

(iv) If the ratio of the volume of two right circular cones is 1 : 4 and the ratio of radii of their bases is 4 : 5, then the ratio of their heights is :

(a) 1 : 5

(b) 5 : 4

(c) 25 : 16

(d) 25 : 64

(v) If $sin\theta - cos\theta = 0$, $(0° < \theta < 90°)$ and $sec\theta + cosec\theta = x$, then the value of x is :

(a) 1

(b) 2

(c) $\sqrt{2}$

(d) $2\sqrt{2}$

(vi) The mode of 1, 3, 2, 8, 10, 8, 3, 2, 8, 8 is :

(a) 2

(b) 3

(c) 8

(d) 10

2. Fill up the blanks (any ***five***) :— 1×5=5

(i) Anisur invests ₹ 500 for 9 months in a business and Devid invests ₹ 600 for 5 months in the same business, the ratio of their profits will be _____.

(ii) The roots of the quadratic equation $ax^2 + 2bx + c = 0$ $(a \neq 0)$ are real and equal, then b^2 = _____.

(iii) If sum of two angles is _____, then they are called supplementary angles.

(iv) Maximum value of $sin\ 3\theta$ is _____.

(v) One solid sphere is melted and a solid right circular cylinder is made, then _____ of sphere and the cylinder will be equal.

(vi) Ages of some students are (in years) 10, 11, 9, 7, 13, 8, 14; the median of the ages of those students is 14 years.

3. Write *True* or *False* (any ***five***) :— 1×5=5

(i) The amount of ₹ $2p$ in t years at the rate of simple interest of $\frac{r}{2}$% per annum is ₹$\left(2p+\frac{prt}{100}\right)$.

(ii) If $2a = 3b = 4c$ then $a : b : c = 2 : 3 : 4$.

(iii) If the ratio of the lengths of three sides of a triangle is 5 : 12 : 13, then the triangle will always be a right angled triangle.

(iv) The angle formed by rotating a ray about its end point in anticlockwise direction is positive.

(v) If n is even number, then median is the mean of $\left(\frac{n}{2}\right)$th and $\left(\frac{n}{2}-1\right)$th observation.

(vi) If the length of the radius of the base of a right circular cone be halved and its height be doubled, then the volume remains same.

4. Answer any ***ten*** questions :— 2×10=20

(i) If the ratio of a principal and the amounts for 5 years is 5 : 6, then find the rate of simple interest per annum.

(ii) In a business, A and B get ₹ 1,050 as profit. If the principal and profit of A be ₹ 900 and ₹ 630 respectively. Find the principal of B.

(iii) If $x \propto y$, $y \propto z$ and $z \propto x$, find the product of three variation constants.

(iv) If the roots of the quadratic equation $5x^2 - 2x + 3 = 0$ be α and β, find the value of $\frac{1}{\alpha}+\frac{1}{\beta}$.

(v) The point O is situated within the rectangular region $ABCD$ in such a way that OB = 6 cm, OD = 8 cm and OA = 5 cm. Determine the length of OC.

(vi) In a right angled triangle ABC, $\angle ABC = 90°$, $AB = 3$ cm, $BC = 4$ cm and the perpendicular BD on the side AC from the point B which meets the side AC at the point D. Determine the length of BD.

(vii) The lengths of radii of two circles are 8 cm and 3 cm and the distance between two centres is 13 cm. What is the length of the direct common tangent of two circles ?

(viii) What is the circular measure of an angle formed by the rotation of hour hand of a clock in one hour duration ?

(ix) If $\tan 4\theta \tan 6\theta = 1$ and 6θ is a positive acute angle, find the value of θ.

(x) The height of a right circular cone is 12 cm and its volume is $100\ \pi\ cm^3$. Find the lateral height of the cone.

(xi) Curved surface areas of two spheres are in a ratio 1 : 4. Find the ratio of their volumes.

(xii) If $u_i = \frac{x_i - 35}{10}$, $\Sigma f_i u_i = 30$ and $\Sigma f_i = 60$, then determine the value of $\bar{x}$.

5. Answer any ***one*** question :— 5

(i) The price of a machine in a factory of your uncle depreciates at the rate of 10% every year. If its present price is ₹ 6,000 then what will be its price after 3 years ?

(ii) Three friends invested ₹ 1,20,000, ₹ 1,50,000 and ₹ 1,10,000 respectively to purchase a bus. The first person is a driver and the other two are conductors. They decided to divide $\frac{2}{5}$th of the profit among themselves in the ratio of 3 : 2 : 2 according to their work and the remaining in the ratio of their capitals. If they earn ₹ 29,260 in one month, find the share of each of them.

Answer any ***one*** question :— 3

(i) Solve : $\frac{1}{x-3}-\frac{1}{x+5}=\frac{1}{6}$.

(ii) The product of two consecutive positive odd numbers is 143. Construct the equation and determine the numbers by applying Sridhara Acharyya's formula.

7. Answer any ***one*** question :— 3

(i) $x=2+\sqrt{3}$ and $x+y=4$, then find the simplest value of $xy+\frac{1}{xy}$.

(ii) If $a \propto b$ and $b \propto c$, then prove that $a^3+b^3+c^3 \propto 3abc$.

8. Answer any ***one*** question :— 3

(i) If $x : a = y : b = z : c$, then show that $\frac{x^3}{a^3}+\frac{y^3}{b^3}+\frac{z^3}{c^3}=\frac{3xyz}{abc}$.

(ii) If $\frac{ay-bx}{c}=\frac{cx-az}{b}=\frac{bz-cy}{a}$, then prove that $\frac{x}{a}=\frac{y}{b}=\frac{z}{c}$.

9. Answer any ***one*** question :— 5

(i) Prove that angles in the same segment of a circle are equal.

(ii) Prove that if two tangents are drawn to a circle from a point outside it, then the line segments joining the point of contacts and the exterior point are equal.

10. Answer any ***one*** question :— 3

(i) Two circles intersect each other at the points P and Q. If the diameters of the two circles are PA and PB respectively, then prove that A, Q, B are collinear.

(ii) ABC is a right angled triangle whose $\angle A = 90°$, AD is perpendicular on BC.

Prove that $\frac{\text{area of } \Delta ABC}{\text{area of } \Delta ACD}=\frac{BC^2}{AC^2}$.

11. Answer any ***one*** question :— 5

(i) Draw the mean proportional of line segments of lengths 4 cm and 3 cm.

(ii) Draw a circle of radius 3 cm. Construct a tangent to the circle at a point A on the circle.

12. Answer any ***two*** questions :— 3×2=6

(i) If $\sin 17° = \frac{x}{y}$, show that

$$\sec 17° - \sin 73° = \frac{x^2}{y\sqrt{y^2 - x^2}}.$$

(ii) If the sum of two angles is 135° and their difference is $\frac{\pi}{12}$, then determine the sexagecimal and circular value of two angles.

(iii) Find the value of :

$$\frac{5\cos^2\frac{\pi}{3} + 4\sec^2\frac{\pi}{6} - \tan^2\frac{\pi}{4}}{\sin^2\frac{\pi}{6} + \cos^2\frac{\pi}{6}}.$$

13. Answer any ***one*** question :— 5

(i) If the angle of elevation of a cloud from a point h metres above a lake is α and the angle of depression of its reflection in the lake is β. Prove that the distance of the cloud from the point of observation is $\frac{2h\sec\alpha}{\tan\beta - \tan\alpha}$.

(ii) The heights of two towers are 180 metres and 60 metres respectively. If the angle of elevation of the top of the first tower from the foot of the second tower is 60°, then find the angle of elevation of the top of the second tower from the foot of the first.

14. Answer any ***two*** questions :— 4×2=8

(i) The length of outer and inner radii of a hollow right circular pipe are 5 cm and 4 cm respectively. If the total surface area of the pipe is 1188 sq. cm., find the length of the pipe.

(ii) A hemispherical pot with internal radius of 9 cm is completely filled with water. If we fill this water in cylindrical bottles with a diameter of 3 cm and height of 4 cm, then find the number of bottles to be required to make the pot empty.

(iii) The diameter of the base of a right circular cone is 21 metres and height is 14 metres. What will be the expenditure to colour the curved surface at the rate of ₹ 1.50 per square metre ?

15. Answer any ***two*** questions :— 4×2=8

(i) Find the mean of marks obtained by the girl students if their cumulative frequencies are as follows :

Marks	*No. of Girl Students*
Less than 10	6
Less than 20	10
Less than 30	18
Less than 40	30
Less than 50	46

(ii) Find the median of data from the following frequency distribution table :

Class Interval	*Frequency*
0-10	4
10-20	7
20-30	10
30-40	15
40-50	10
50-60	8
60-70	5

(iii) Find the mode of data from the following frequency distribution table :

Class	*Frequency*
3-6	2
6-9	6
9-12	12
12-15	24
15-18	21
18-21	12
21-24	3

[Alternative Question for Sightless Candidates]

11. Answer any ***one*** question :— 5

(i) Describe the process of drawing mean proportional of two line segments of given length.

(ii) A circle is given, describe the process of drawing a tangent to this circle at a point on it.

[Additional Question for External Candidates]

16. (a) Answer any ***three*** questions :— 2×3=6

(i) If the percentage of profit on sale price is 20%, then what is the percentage of profit on cost price ?

(ii) If $x = 3\cos\theta$; $y = 3\sin\theta$, then find the value of $x^2 + y^2$.

(iii) Simplify : $\sqrt{98} + \sqrt{8} - 2\sqrt{32}$.

(iv) The ratio of the lengths of the radii of the bases a right circular cylinder and a right circular cone is 3 : 4 and the ratio of their heights is 2 : 3; what is the ratio of their volume ?

(b) Answer any ***four*** questions :— 1×4=4

(i) Find the number of years for which a principal becomes double at the rate of simple interest of $6\frac{1}{4}\%$ per annum.

(ii) AB is a diameter of a circle and P is any point on the circle, if $\angle PAB = 30°$ find the value of $\angle PBA$.

(iii) Express 22° 30' in radian.

(iv) If the radius of a solid sphere be 10.5 cm, then what is the area of its whole surface ?

(v) If $x : y = 2 : 3$ and $y : z = 4 : 7$, then find $x : z$.