

SET ~ 2

प्रश्न-पत्र कोड 30/5/2
Q.P. Code

Candidates must write the Q.P. Code
on the title page of the answer-book.

NOTE

- (I) Please check that this question paper contains **23** printed pages.
- (II) Please check that this question paper contains **38** questions.
- (III) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- (IV) **Please write down the serial number of the question in the answer-book at the given place before attempting it.**
- (V) 15 minutes time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the candidates will read the question paper only and will not write any answer on the answer-book during this period.

MATHEMATICS (Standard)

Time allowed : 3 hours

Maximum Marks : 80

General Instructions :

Read the following instructions very carefully and strictly follow them :

- (i) *This question paper contains **38** questions. **All** questions are **compulsory**.*
- (ii) *This question paper is divided into **FIVE** Sections – **A, B, C, D** and **E**.*
- (iii) *In Section–**A**, question numbers **1** to **18** are Multiple Choice Questions (MCQs) and question numbers **19** and **20** are Assertion-Reason based questions of **1** mark each.*
- (iv) *In Section–**B**, question numbers **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*
- (v) *In Section–**C**, question numbers **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*
- (vi) *In Section–**D**, question numbers **32** to **35** are Long Answer (LA) type questions, carrying **5** marks each.*
- (vii) *In Section–**E**, question numbers **36** to **38** are Case Study based integrated questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case-study.*
- (viii) *There is no overall choice. However, an internal choice has been provided in **2** questions in Section–**B**, **2** questions in Section–**C**, **2** questions in Section–**D** and **3** questions of **2** marks in Section–**E**.*
- (ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*
- (x) *Use of calculators is **NOT** allowed.*

SECTION – A

This section consists of 20 multiple choice questions of 1 mark each.

1. Following data shows the marks obtained by 100 students in a class test : 1

Marks obtained	20	29	28	33	42	38	43	25
Number of students	6	28	24	15	2	4	1	20

The median will be the average of which two observations ?

- (A) 29 and 33 (B) 25 and 28
(C) 28 and 29 (D) 33 and 38

2. The probability of getting a composite number greater than 3 on throwing a die is 1

- (A) $\frac{1}{6}$ (B) $\frac{1}{3}$
(C) $\frac{1}{2}$ (D) $\frac{2}{3}$

3. $(\sqrt{3} + 2)^2 + (\sqrt{3} - 2)^2$ is a/an 1

- (A) positive rational number (B) negative rational number
(C) positive irrational number (D) negative irrational number

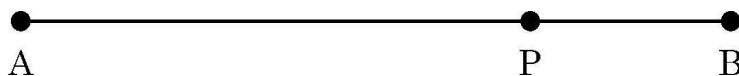
4. Let $a = p^2 q^3 r^n$ and $b = p^3 q^m r^2$, where p, q, r are prime numbers. If LCM of a and b is $p^3 q^4 r^3$, then the value of $3n - 2m$ is 1

- (A) -1 (B) 1
(C) 3 (D) -3

5. For any prime number p , if p divides a^2 , where a is any real number then p also divides 1

- (A) a (B) $a^{\frac{1}{2}}$
(C) $a^{\frac{3}{2}}$ (D) $a^{\frac{1}{8}}$

6. The point P divides the line segment AB in the ratio 3 : 1 as shown below : **1**

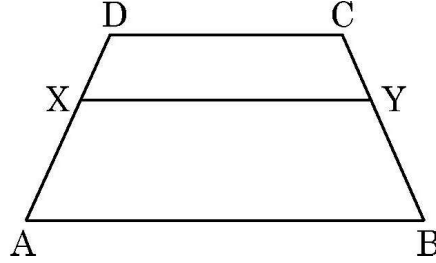


The value of $\frac{AB}{PB}$ is

- (A) 3 (B) $\frac{1}{4}$
(C) 4 (D) $\frac{1}{3}$
7. If $x^2 + bx + b = 0$ has two real and distinct roots, then the value of b can be **1**
(A) 0 (B) 4
(C) 3 (D) -3
8. Which of the following equations is a quadratic equation ? **1**
(A) $x^3 = (x - 1)^3 + 3x^2$ (B) $x^3 = (x + 1)^3$
(C) $x^2 = \sqrt{x}$ (D) $x^2 + 1 = \frac{1}{x}$
9. A piggy bank contains ₹ 1 coins and ₹ 2 coins in the ratio 9 : 11 respectively. The piggy bank is accidentally dropped and a coin pops out of it. The probability that it is a ₹ 2 coin is **1**
(A) $\frac{9}{11}$ (B) 0.45
(C) 0.55 (D) $\frac{1}{11}$
10. Which of the following statements is false ? **1**
(A) Two right triangles are always similar.
(B) Two squares are always similar.
(C) Two equilateral triangles are always similar.
(D) Two circles are always similar.

11. दी गई आकृति में, ABCD एक समलंब है जिसमें $XY \parallel AB \parallel CD$ है। यदि $AX = \frac{2}{3}AD$ है, तो $CY : YB =$

1



- (A) 2 : 3 (B) 3 : 2
(C) 1 : 3 (D) 1 : 2

12. $\frac{2 \tan 60^\circ}{1 - \tan^2 60^\circ}$ का मान, निम्न में से किसके मान के बराबर है ?

1

- (A) $-\tan 30^\circ$ (B) $-\tan 60^\circ$
(C) $2 \sin 60^\circ$ (D) $2 \cos 60^\circ$

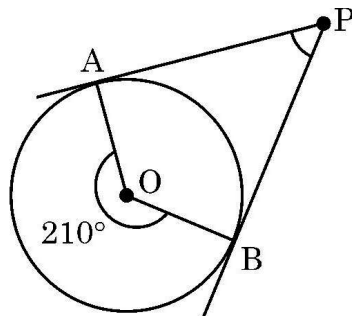
13. निम्न में से कौन सा कथन गलत है ?

1

- (A) किसी वृत्त पर अनंत संख्या में स्पर्श-रेखाएँ खींची जा सकती हैं।
(B) एक बाह्य बिंदु से वृत्त पर अनंत संख्या में स्पर्श-रेखाएँ खींची जा सकती हैं।
(C) बाह्य बिंदु से वृत्त पर अनंत संख्या में छेदक रेखाएँ खींची जा सकती हैं।
(D) वृत्त के स्पर्श बिंदु पर स्पर्श-रेखा और व्यास के बीच का कोण 90° होता है।

14. दी गई आकृति में, PA तथा PB वृत्त जिसका केन्द्र O है, पर दो स्पर्श-रेखाएँ हैं। कोण APB की माप है :

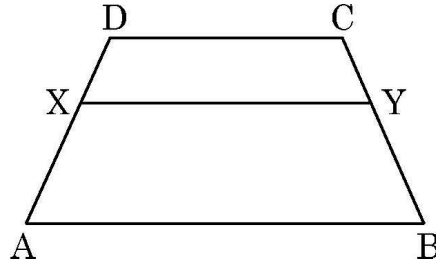
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- (A) 210° (B) 150°
(C) 105° (D) 30°

11. In the adjoining figure, ABCD is a trapezium in which $XY \parallel AB \parallel CD$. If $AX = \frac{2}{3}AD$, then $CY : YB =$

1



- (A) 2 : 3 (B) 3 : 2
(C) 1 : 3 (D) 1 : 2

12. The value of $\frac{2 \tan 60^\circ}{1 - \tan^2 60^\circ}$ is same as the value of

1

- (A) $-\tan 30^\circ$ (B) $-\tan 60^\circ$
(C) $2 \sin 60^\circ$ (D) $2 \cos 60^\circ$

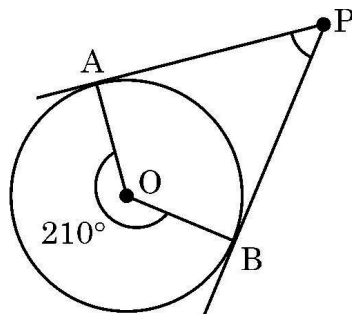
13. Which of the following statements is false ?

1

- (A) Infinite number of tangents can be drawn to a circle.
(B) Infinite number of tangents can be drawn to a circle from a point outside the circle.
(C) Infinite number of secants can be drawn to a circle from a point outside the circle.
(D) Angle between tangent and diameter at point of contact is 90° .

14. In the adjoining figure, PA and PB are tangents to a circle with centre O. The measure of angle APB is

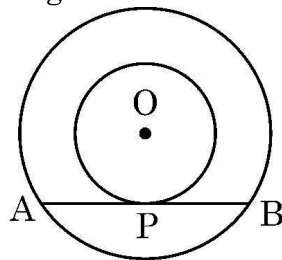
1



- (A) 210° (B) 150°
(C) 105° (D) 30°

15. An observer 1.8 m tall stands away from a chimney at a distance of 38.2 m along the ground. The angle of elevation of top of chimney from the eyes of observer is 45° . The height of chimney above the ground is 1
- (A) 38.2 m (B) 36.4 m
(C) 40 m (D) $(38.2)\sqrt{2}$ m

16. In the adjoining figure, the sum of radii of two concentric circles is 16 cm. The length of chord AB which touches the inner circle at P is 16 cm. The difference of the radii of the given circles is 1



- (A) 8 cm (B) 4 cm
(C) 2 cm (D) 3 cm
17. A cone of height 12 cm and slant height 13 cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is 1
- (A) 17 cm (B) 18 cm
(C) 22 cm (D) 23 cm
18. If x median + y mean = z mode; is the empirical relationship between mean, median and mode, then the value of $x + y + z$ is 1
- (A) 6 (B) 3
(C) 2 (D) 1

Directions : In Question Numbers **19** and **20**, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option from following :

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.

19. **Assertion (A) :** For an A.P., 3,6,9, ..., 198, 10th term from the end is 168.

Reason (R) : If 'a' and 'l' are the first term and last term of an A.P. with common difference 'd', then nth term from the end of the given A.P. is $l - (n - 1) d$.

1

20. **Assertion (A) :** For an acute angle θ , $\sec \theta = 3 \Rightarrow \tan \theta = 2\sqrt{2}$.

Reason (R) : $\sec^2 \theta = 1 + \tan^2 \theta$ for all values of θ .

1

SECTION – B

This section has 5 very short answer type questions of 2 marks each.

21. AD and PS are angle bisectors of $\angle A$ and $\angle P$ of triangles ABC and PQR. If $\triangle ABC \sim \triangle PQR$, prove that $\triangle ACD \sim \triangle PRS$.

2

22. All the face cards are removed from the pack of 52 cards and a card is drawn at random from the remaining cards. Find the probability that the card so drawn is

2

(i) a spade.

(ii) not an ace.

23. (a) The cost of 2 kg apples and 1 kg of grapes on a day was found to be ₹ 320. The cost of 4 kg apples and 2 kg grapes was found to be ₹ 600. If cost of 1 kg of apples and 1 kg of grapes is ₹ x and ₹ y respectively, represent the given situation algebraically as a system of equations and check whether the system so obtained is consistent or not.

2

OR

(b) Solve for x and y :

$$\sqrt{2}x + \sqrt{3}y = 5 \text{ and}$$

$$\sqrt{3}x - \sqrt{8}y = -\sqrt{6}$$

2

24. The coordinates of the end points of the line segment AB are A(−2, −2) and B(2, −4). P is the point on AB such that $BP = \frac{4}{7} AB$. Find the coordinates of point P.

2

25. (a) It is given that $\sin (A - B) = \sin A \cos B - \cos A \sin B$. Use it to find the value of $\sin 15^\circ$. 2

OR

- (b) If $\sin A = y$, then express $\cos A$ and $\tan A$ in terms of y . 2

SECTION – C

This section has 6 short answer type questions of 3 marks each.

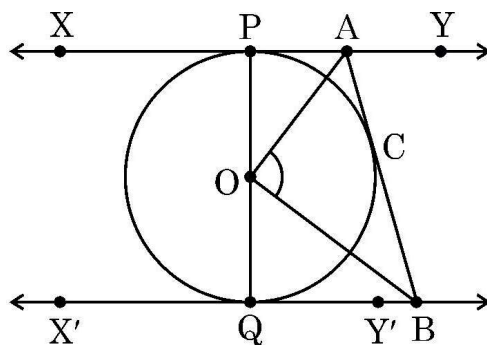
26. (a) Prove the following trigonometric identity : 3

$$\frac{1 + \operatorname{cosec} A}{\operatorname{cosec} A} = \frac{\cos^2 A}{1 - \sin A}$$

OR

- (b) Let $2A + B$ and $A + 2B$ be acute angles such that $\sin(2A + B) = \frac{\sqrt{3}}{2}$ and $\tan(A + 2B) = 1$. Find the value of $\cot(4A - 7B)$. 3

27. In the adjoining figure, XY and $X'Y'$ are parallel tangents to a circle with centre O . Another tangent AB touches the circle at C intersecting XY at A and $X'Y'$ at B . Prove that AB subtends right angle at the centre of the circle; or $\angle AOB = 90^\circ$. 3



28. (a) Prove that $\sqrt{3}$ is an irrational number. 3

OR

- (b) State true or false for each of the following statements and justify in each case : 3
- (i) $2 \times 3 \times 5 \times 7 + 7$ is a composite number.
 - (ii) $2 \times 3 \times 5 \times 7 + 1$ is a composite number.

29. Obtain the zeroes of the polynomial $p(x) = 2x^2 - 5x - 3$. Hence, obtain a polynomial each of whose zeroes is one less than each of the zero of $p(x)$. 3
30. Solve the following system of equations graphically : 3
 $2x + y = 5$ and $4x - y = 7$. Hence, write the coordinates of the points where given lines meet y-axis.
31. Find a relation between x and y such that $P(x, y)$ is equidistant from the points $A(3, 5)$ and $B(7, 1)$. Hence, write the coordinates of the points on x -axis and y -axis which are equidistant from points A and B . 3

SECTION – D

This section has 4 long answer questions of 5 marks each.

32. During a medical checkup, height of 35 students of a class were recorded as follows : 5

Height (in cm)	90-100	100-110	110-120	120-130	130-140	140-150
Number of Students	3	2	4	5	14	7

Find the difference between the mean height and median height.

33. (a) A 2-digit number is seven times the sum of its digits and two (2) more than 5 times the product of its digits. Find the number. 5

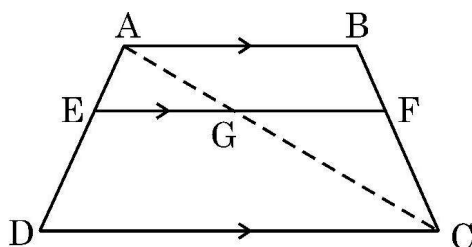
OR

- (b) Find the value(s) of p for which the quadratic equation given as $(p + 4)x^2 - (p + 1)x + 1 = 0$ has real and equal roots. Also, find the roots of the equation(s) so obtained. 5

34. State the converse of basic proportionality theorem. 5

Also find $\frac{BF}{FC}$ in the following figure, given that $AB \parallel DC \parallel EF$ and $\frac{AE}{ED} = \frac{2}{3}$.

Also, find the length of EF if $AB = 10$ cm and $DC = 15$ cm.



35. (a) From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.

5

OR

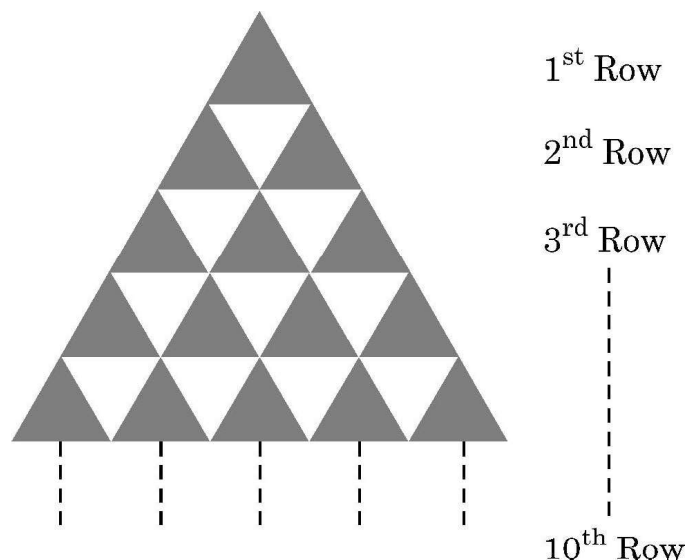
- (b) From a solid cylinder of height 24 cm and radius 5 cm, two cones of height 12 cm and radius 5 cm are hollowed out. Find the volume and surface area of the remaining solid.

5

SECTION – E

This section has 3 case study based questions of 4 marks each.

36. In an equilateral triangle of side 10 cm, equilateral triangles of side 1 cm are formed as shown in the figure below, such that there is one triangle in the first row, three triangles in the second row, five triangles in the third row and so on.



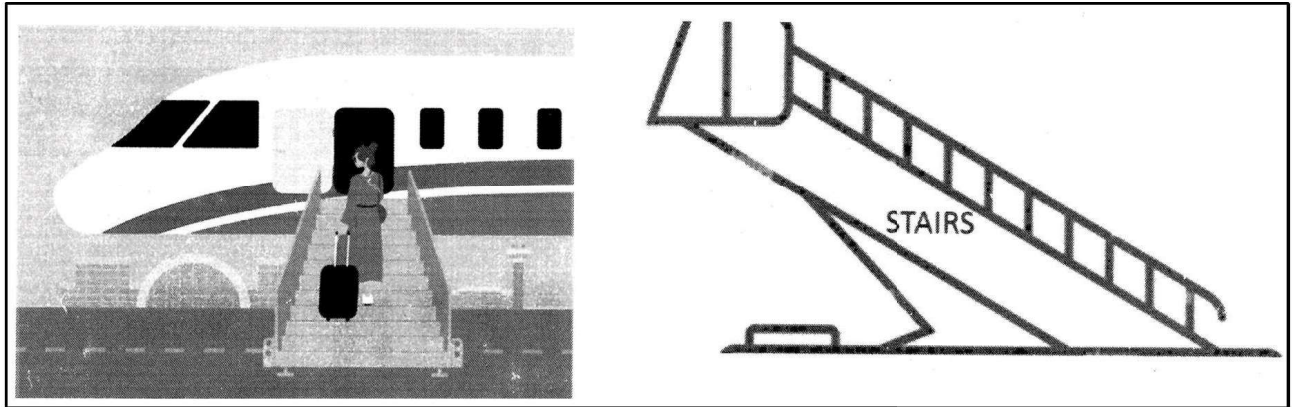
Based on given information, answer the following questions using Arithmetic Progression.

- (i) How many triangles will be there in bottom most row ? 1
- (ii) How many triangles will be there in fourth row from the bottom ? 1
- (iii) (a) Find the total number of triangles of side 1 cm each till 8th row. 2

OR

- (iii) (b) How many more number of triangles are there from 5th row to 10th row than in first 4 rows ? Show working. 2

37. Passenger boarding stairs, sometimes referred to as boarding ramps, stair cars or aircraft steps, provide a mobile means to travel between the aircraft doors and the ground. Larger aircraft have door sills 5 to 20 feet (1 foot = 30 cm) high. Stairs facilitate safe boarding and de-boarding.



An aircraft has a door sill at a height of 15 feet above the ground. A stair car is placed at a horizontal distance of 15 feet from the plane.

Based on given information, answer the questions given in part (i) and (ii).

- (i) Find the angle at which stairs are inclined to reach the door sill 15 feet high above the ground. 1
- (ii) Find the length of stairs used to reach the door sill. 1

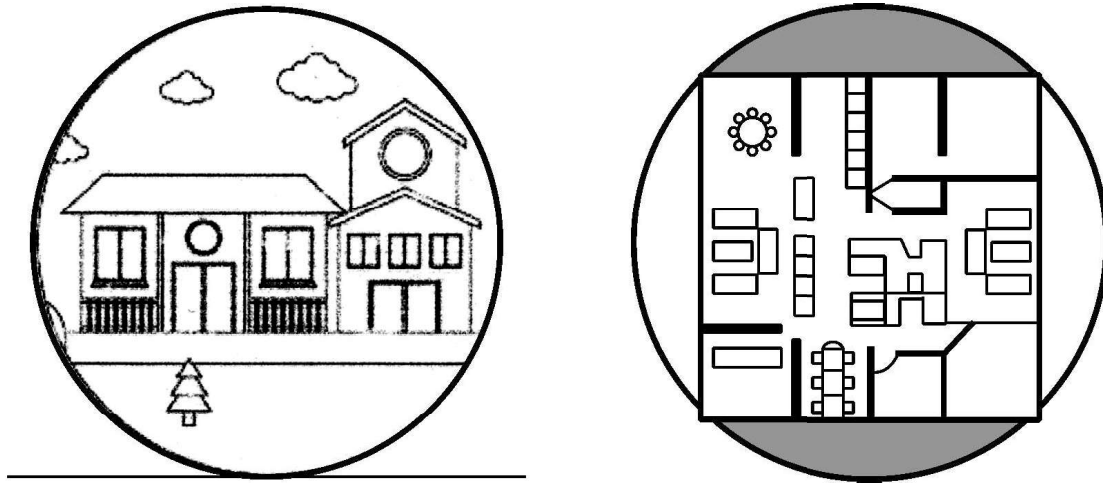
Further, answer any **one** of the following questions :

- (iii) (a) If the 20 feet long stairs is inclined at an angle of 60° to reach the door sill, then find the height of the door sill above the ground. (use $\sqrt{3} = 1.732$) 2

OR

- (iii) (b) What should be the shortest possible length of stairs to reach the door sill of the plane 20 feet above the ground, if the angle of elevation cannot exceed 30° ? Also, find the horizontal distance of base of stair car from the plane. 2

38. A farmer has a circular piece of land. He wishes to construct his house in the form of largest possible square within the land as shown below.



The radius of circular piece of land is 35 m.

Based on given information, answer the following questions :

- (i) Find the length of wire needed to fence the entire land. 1
- (ii) Find the length of each side of the square land on which house will be constructed. 1
- (iii) (a) The farmer wishes to grow grass on the shaded region around the house. Find the cost of growing the grass at the rate of ₹ 50 per square metre. 2

OR

- (iii) (b) Find the ratio of area of land on which house is built to remaining area of circular piece of land. 2