रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।
Candidates must write the Q.P. Code on the title page of the answer-book.

गणित (मानक) – सैद्धान्तिक

MATHEMATICS (Standard) – Theory

निर्धारित समय : *3 घण्टे*
Time allowed : *3 hours*

अधिकतम अंक : *80*
Maximum Marks : *80*

नोट / *NOTE* :

(i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 23 हैं ।
Please check that this question paper contains 23 printed pages.

(ii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
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.

(iii) कृपया जाँच कर लें कि इस प्रश्न-पत्र में 38 प्रश्न हैं ।
Please check that this question paper contains 38 questions.

(iv) कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।
Please write down the serial number of the question in the answer-book before attempting it.

(v) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
15 minute 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.

General Instructions :

Read the following instructions carefully and follow them :

(i) This question paper contains 38 questions. **All questions are compulsory.**

(ii) This Question Paper is divided into FIVE Sections – **Section A, B, C, D and E.**

(iii) In Section–A question number 1 to 18 are Multiple Choice Questions (MCQs) and question number 19 & 20 are Assertion-Reason based questions of 1 mark each.

(iv) In Section–B question number 21 to 25 are Very Short-Answer-I (SA-I) type questions of 2 marks each.

(v) In Section–C question number 26 to 31 are Short Answer-II (SA-II) type questions carrying 3 marks each.

(vi) In Section–D question number 32 to 35 are Long Answer (LA) type questions carrying 5 marks each.

(vii) In Section–E question number 36 to 38 are Case Study / Passage based integrated units of assessment questions carrying 4 marks each. Internal choice is provided in 2 marks question 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 question in Section–E.

(ix) Draw neat figures wherever required. Take $\pi = \dfrac{22}{7}$ wherever required if not stated.

(x) Use of calculator is NOT allowed.

SECTION – A

(Multiple Choice Questions)

Each question is of 1 mark.

1. Curved surface area of a cylinder of height 5 cm is 94.2 cm². Radius of the cylinder is (Take $\pi = 3.14$)
   - (A) 2 cm
   - (B) 3 cm
   - (C) 2.9 cm
   - (D) 6 cm

2. The distribution below gives the marks obtained by 80 students on a test :

Marks	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60
Number of Students	3	12	27	57	75	80

The modal class of this distribution is :
   - (A) 10 – 20
   - (B) 20 – 30
   - (C) 30 – 40
   - (D) 50 – 60

3. The area of metal sheet required to make a closed hollow cylinder of height 2.4 m and base radius 0.7 m, is
   - (A) 10.56 m²
   - (B) 13.52 m²
   - (C) 13.64 m²
   - (D) 14.08 m²

4. The distance between the points $(0, 2\sqrt{5})$ and $(-2\sqrt{5}, 0)$ is
   - (A) $2\sqrt{10}$ units
   - (B) $4\sqrt{10}$ units
   - (C) $2\sqrt{20}$ units
   - (D) 0

5. If α, β are zeroes of a polynomial $p(x) = 2x^2 - x - 1$ then $\alpha^2 + \beta^2$ is equal to
   - (A) $\dfrac{-3}{4}$
   - (B) $\dfrac{5}{4}$
   - (C) $\dfrac{1}{4}$
   - (D) $\dfrac{3}{4}$

6. The least positive value of k, for which the quadratic equation $2x^2 + kx - 4 = 0$ has rational roots, is
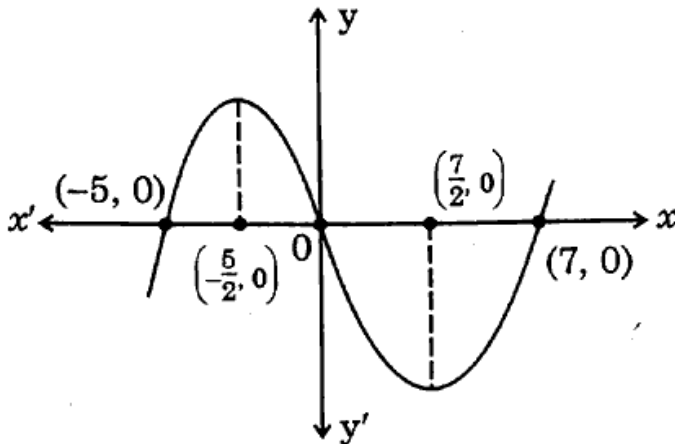   - (A) $\pm 2\sqrt{2}$
   - (B) 2
   - (C) ± 2
   - (D) $\sqrt{2}$

7. $\left[\dfrac{3}{4}\tan^2 30° - \sec^2 45° + \sin^2 60°\right]$ is equal to

(A) −1

(B) $\dfrac{5}{6}$

(C) $\dfrac{-3}{2}$

(D) $\dfrac{1}{6}$

8. The graph of y = p(x) is given in the adjoining figure. Zeroes of the polynomial p(x) are

(A) −5, 7

(B) $\dfrac{-5}{2}, \dfrac{-7}{2}$

(C) −5, 0, 7

(D) −5, $\dfrac{-5}{2}, \dfrac{7}{2}$, 7

9. The value of k for which the pair of equations kx = y + 2 and 6x = 2y + 3 has infinitely many solutions,

(A) is k = 3

(B) does not exist

(C) is k = −3

(D) is k = 4

10. If p − 1, p + 1 and 2p + 3 are in A.P., then the value of p is

(A) −2

(B) 4

(C) 0

(D) 2

11. In what ratio, does x-axis divide the line segment joining the points A(3, 6) and B(−12, −3) ?

(A) 1 : 2

(B) 1 : 4

(C) 4 : 1

(D) 2 : 1

12. Probability of happening of an event is denoted by p and probability of non-happening of the event is denoted by q. Relation between p and q is

(A)   p + q = 1   (B)   p = 1, q = 1
(C)   p = q − 1   (D)   p + q + 1 = 0

13. A girl calculates that the probability of her winning the first prize in a lottery is 0.08. If 6000 tickets are sold, how many tickets has she bought ?

(A)   40   (B)   240
(C)   480   (D)   750

14. In the given figure, PQ is tangent to the circle centred at O. If $\angle AOB = 95°$, then the measure of $\angle ABQ$ will be
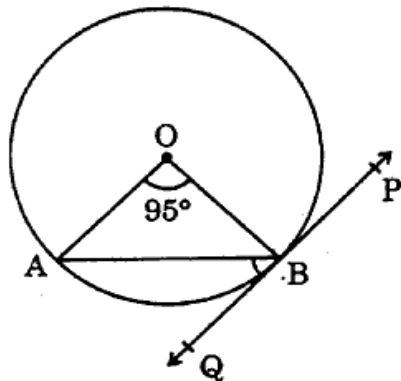
(A)   47.5°   (B)   42.5°
(C)   85°   (D)   95°

15. If $2 \tan A = 3$, then the value of $\dfrac{4 \sin A + 3 \cos A}{4 \sin A - 3 \cos A}$ is

(A) $\dfrac{7}{\sqrt{13}}$ (B) $\dfrac{1}{\sqrt{13}}$

(C)   3   (D)   does not exist

16. In a survey, it is found that every fifth person has a vehicle. The probability of a person NOT having a vehicle, is

(A) $\dfrac{1}{5}$ (B)   5%

(C) $\dfrac{4}{5}$ (D)   95%

17. If the value of each observation of a statistical data is increased by 3, then the mean of the data

    (A) remains unchanged

    (B) increases by 3

    (C) increases by 6

    (D) increases by 3n

18. Which of the following is a quadratic polynomial having zeroes $\frac{-2}{3}$ and $\frac{2}{3}$?

    (A) $4x^2 - 9$

    (B) $\frac{4}{9}(9x^2 + 4)$

    (C) $x^2 + \frac{9}{4}$

    (D) $5(9x^2 - 4)$

Assertion-Reason Type Questions

In Question 19 and 20, an Assertion (A) statement is followed by a statement of Reason (R). Select the correct option out of the 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 Assertion (A).

(C) Assertion (A) is true but Reason (R) is false.

(D) Assertion (A) is false but Reason (R) is true.

19. **Assertion (A)** : The perimeter of ΔABC is a rational number.

    Reason (R) : The sum of the squares of two rational numbers is always rational.
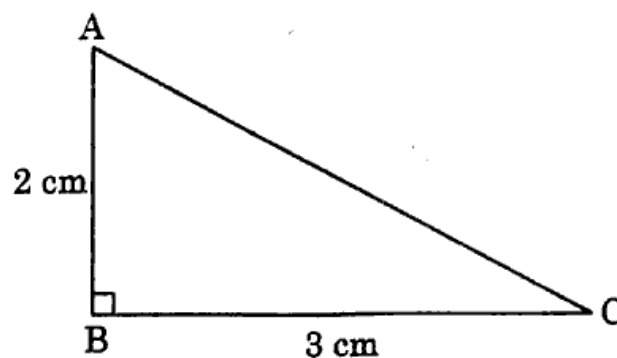
20. **Assertion (A)** : Point P(0, 2) is the point of intersection of y-axis with the line $3x + 2y = 4$.

    Reason (R) : The distance of point P(0, 2) from x-axis is 2 units.

(This section comprises of Very Short Answer (SA-I) type questions. Every question is of 2 marks.)

21. (a) If $\sin \theta + \sin^2 \theta = 1$, then prove that $\cos^2 \theta + \cos^4 \theta = 1$.

OR

(b) If $\tan \theta = \dfrac{1}{\sqrt{7}}$, then show that $\dfrac{\operatorname{cosec}^2 \theta - \sec^2 \theta}{\operatorname{cosec}^2 \theta + \sec^2 \theta} = \dfrac{3}{4}$.

22. Find the greatest number which divides 85 and 72 leaving remainders 1 and 2 respectively.

23. A bag contains 4 red, 3 blue and 2 yellow balls. One ball is drawn at random from the bag. Find the probability that drawn ball is (i) red (ii) yellow.

24. In the given figure, ABCD is a parallelogram. AE divides the line segment BD in the ratio 1 : 2. If BE = 1.5 cm, then find the length of BC.
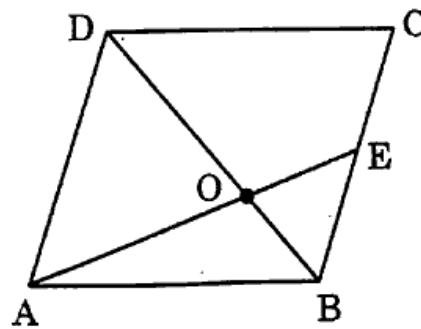
25. (a) Solve the pair of equations $x = 3$ and $y = -4$ graphically.

OR

(b) Using graphical method, find whether following system of linear equations is consistent or not :
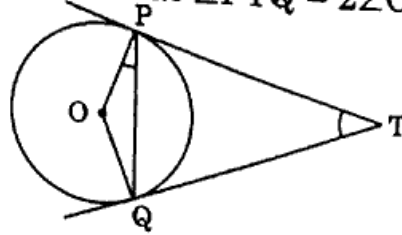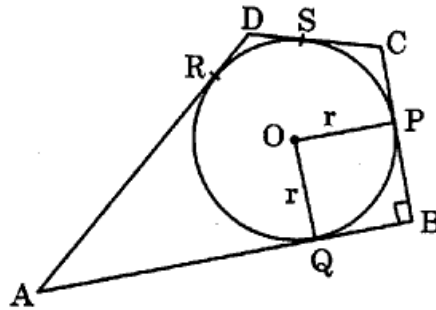
$x = 0$ and $y = -7$

SECTION – C

26. (a) Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2\angle OPQ$.

OR

(b) In the given figure, a circle is inscribed in a quadrilateral ABCD in which $\angle B = 90°$. If AD = 17 cm, AB = 20 cm and DS = 3 cm, then find the radius of the circle.


27. Prove that : $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1 = 0$.

28. (a) A room is in the form of cylinder surmounted by a hemi-spherical dome. The base radius of hemisphere is one-half the height of cylindrical part. Find total height of the room if it contains $\left(\dfrac{1408}{21}\right)$ m³ of air. $\left(\text{Take } \pi = \dfrac{22}{7}\right)$

OR

(b) An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $\left(\dfrac{1}{6}\right)^{th}$ of the volume of the cone is unfilled but hemisphere is formed on the top. Find volume of the ice-cream. (Take $\pi = 3.14$)
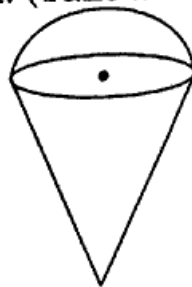
29. If (−5, 3) and (5, 3) are two vertices of an equilateral triangle, then find co-ordinates of the third vertex, given that origin lies inside the triangle. (Take $\sqrt{3}$ = 1.7)

30. Prove that $\sqrt{5}$ is an irrational number.

31. Jaya scored 40 marks in a test getting 3 marks for each correct answer and losing 1 mark for each incorrect answer. Had 4 marks being awarded for each correct answer and 2 marks were deducted for each incorrect answer then Jaya again would have scored 40 marks. How many questions were there in the Test ?

SECTION – D

(This section comprises of Long Answer (LA) type questions of 5 marks each.)

32. A chord of a circle of radius 14 cm subtends an angle of 60° at the centre. Find the area of the corresponding minor segment of the circle. Also find the area of the major segment of the circle. https://www.cbseboardonline.com

33. (a) The ratio of the 11th term to 17th term of an A.P. is 3 : 4. Find the ratio of 5th term to 21st term of the same A.P. Also, find the ratio of the sum of first 5 terms to that of first 21 terms.

OR

(b) 250 logs are stacked in the following manner :

22 logs in the bottom row, 21 in the next row, 20 in the row next to it and so on (as shown by an example). In how many rows, are the 250 logs placed and how many logs are there in the top row ?
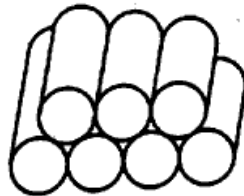
(Example)

34. (a) Sides AB and AC and median AM of a ΔABC are proportional to sides DE and DF and Median DN of another ΔDEF. Show that ΔABC ~ ΔDEF.
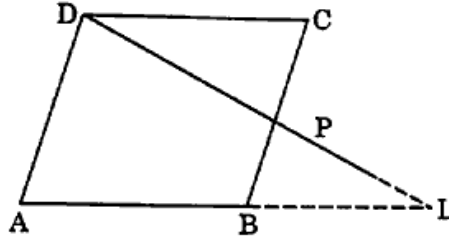
OR

(b) ABCD is a parallelogram, P is a point on side BC and DP when produced meets AB produced at L. Prove that

(i) $\dfrac{DP}{PL} = \dfrac{DC}{BL}$

(ii) $\dfrac{DL}{DP} = \dfrac{AL}{DC}$

(iii) If LP : PD = 2 : 3 then find BP : BC.

35. An aeroplane when flying at a height of 3000 m from the ground passes vertically above another aeroplane at an instant when the angles of elevation of the two planes from the same point on the ground are 60° and 45° respectively. Find the vertical distance between the aeroplanes at that instant. Also, find the distance of first plane from the point of observation. (Take $\sqrt{3} = 1.73$)

SECTION – E

(In this section, there are 3 case study/passage based questions. Each question is of 4 marks.)

Case Study

36. India meteorological department observes seasonal and annual rainfall every year in different sub-divisions of our country.

It helps them to compare and analyse the results. The table given below shows sub-division wise seasonal (monsoon) rainfall (mm) in 2018 :

| Rainfall (mm)	Number of Sub-divisions
200-400	2
400-600	4
600-800	7
800-1000	4
1000-1200	2
1200-1400	3
1400-1600	1
1600-1800	1

Based on the above information, answer the following questions :

(I)   Write the modal class.   1

(II) Find the median of the given data.   2

OR

Find the mean rainfall in this season.

(III) If sub-division having at least 1000 mm rainfall during monsoon season, is considered good rainfall sub-division, then how many sub-divisions had good rainfall ?   1

37. The discus throw is an event in which an athlete attempts to throw a discus. The athlete spins anti-clockwise around one and a half times through a circle, then releases the throw. When released, the discus travels along tangent to the circular spin orbit.

Tangent line
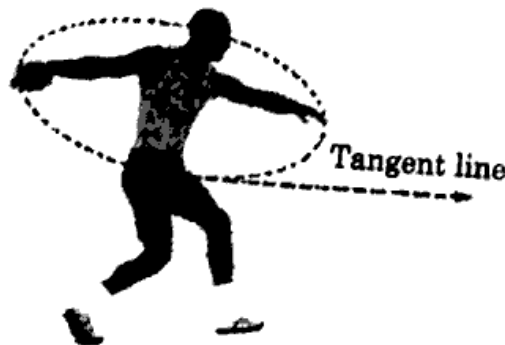
In the given figure, AB is one such tangent to a circle of radius 75 cm. Point O is centre of the circle and $\angle ABO = 30°$. PQ is parallel to OA.
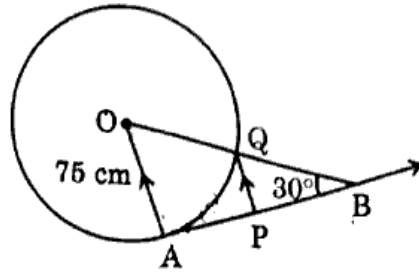
Based on above information :

(a) find the length of AB.   1

(b) find the length of OB.   1

(c) find the length of AP.   2

OR

find the length of PQ.

38. While designing the school year book, a teacher asked the student that the length and width of a particular photo is increased by x units each to double the area of the photo. The original photo is 18 cm long and 12 cm wide.

Based on the above information, answer the following questions :

(I) Write an algebraic equation depicting the above information.   1

(II) Write the corresponding quadratic equation in standard form.   1

(III) What should be the new dimensions of the enlarged photo ?   2
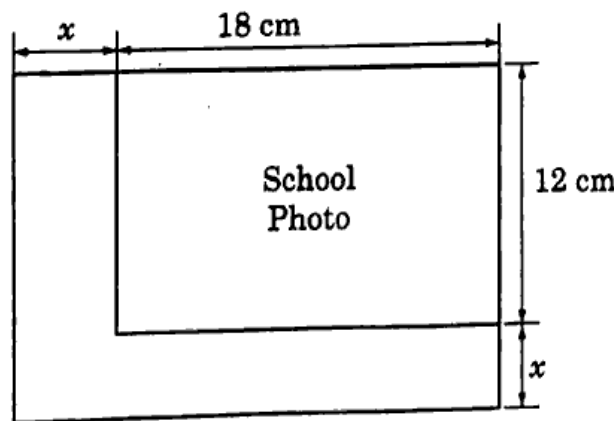
OR

Can any rational value of x make the new area equal to 220 cm^2 ?