COMMON PRE-BOARD EXAMINATION 2022-23

Subject: MATHEMATICS (STANDARD) -041

Date:

General Instructions:

1. This Question Paper has 5 Sections A - E.
2. Section **A** has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section **B** has 5 questions carrying 02 marks each.
4. Section **C** has 6 questions carrying 03 marks each.
5. Section **D** has 4 questions carrying 05 marks each.
6. Section **E** has 3 Case Based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$, wherever required if not stated.

SECTION-A

Section A consist of 20 multiple choice questions of 1 mark each

1. If 3 is the least prime factor of a number m and 7 is the least prime factor of another number n, then the least prime factor of (m + n) is
   (a) 2 (b) 3 (c) 5 (d)10
2. The value(s) of k for which the quadratic equation $2x^2 - kx + k = 0$ has equal roots is
   (a) 0 and 4 (b) 4 and 8 (c) 0 and 8 (d) None of these
3. If one of the zeroes of the quadratic polynomial $x^2 + 3x + m$ is 2, then the value of m is
   (a) 10 (b) – 10 (c) – 7 (d) – 2
4. The value of k for which the lines $(k + 1)x + 3ky + 15 = 0$ and $5x + ky + 5 = 0$ are coincident is
   (a) 14 (b) – 14 (c) – 2 (d) None of these
5. The point on the x – axis which is equidistant from (- 4, 0) and (10, 0) is
   (a) (7,0) (b) (5,0) (c) (0,0) (d) (3,0)
6. In an AP if a = 1, a_n = 20 and S_n = 399, then n is
   (a) 19 (b) 21 (c) 38 (d) 42

7. Given that $\sin\theta = \frac{a}{b}$, then $tan\theta$ is

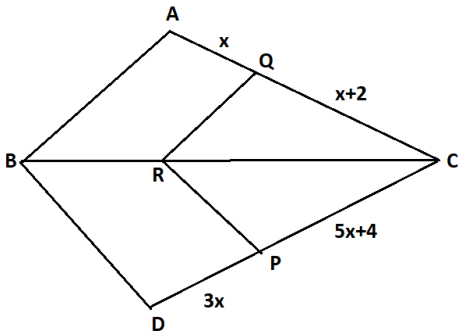
(a) $\frac{b}{\sqrt{b^2-a^2}}$ (b) $\frac{\sqrt{b^2-a^2}}{b}$ (c) $\frac{a}{\sqrt{b^2-a^2}}$ (d) $\frac{\sqrt{b^2-a^2}}{a}$

8. $(cosec\,\theta - \sin\,\theta)\,(\sec\,\theta - \cos\,\theta)\,(\tan\,\theta + \cot\,\theta)$ is equal to

(a) 0 (b)1 (c) – 1 (d) None of these

9. In the given figure QR // AB, RP // BD. If CQ = x + 2, QA = x, CP = 5x + 4 and PD = 3x then the value of x is

(a) 1
(b) 6
(c) 3
(d) 9



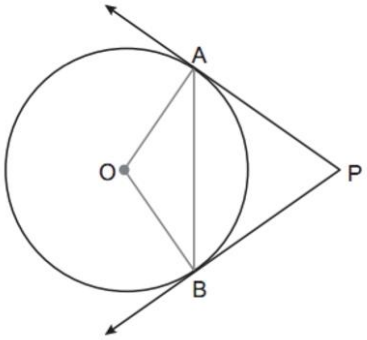
10. In Δ LMN and Δ PQR, ∠L = ∠P, ∠N = ∠R and MN = 2 QR. Then the two triangles are

(a) Congruent but not similar (b)Similar but not congruent

(c)Neither similar nor congruent (d)Congruent as well as similar

11. In the figure given below PA and PB are two tangents to the circle with center O such that ∠APB = 50^0 then ∠PAB is equal to

(a) 35^0
(b) 65^0
(c) 40^0
(d) 70^0



12. Three cows are tethered with 7m long rope at the three corners of a triangular field having sides 20m, 28 m and 32m. The total area of the plot that is grazed by the cows is

(a) 77 m^2 (b) 539 m^2 (c) 38.5 m^2 (d)None of these

13. A solid is hemispherical at the bottom and conical (of same radius) above it. If the curved surface areas of two parts are equal, then the ratio of its radius and the slant height of the conical part is

(a) 1:4 (b) 4:1 (c) 2:1 (d)1:2

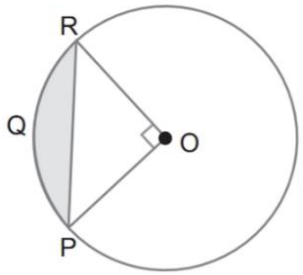
14. The mode of the distribution

class interval	0 – 20	20 – 40	40 – 60	60 – 80
Frequency	15	6	18	10

is

(a) 54 (b) 52 (c) 50 (d) 53

15. Observe the figure drawn below:



What is the area of the segment PQR, if the radius of the circle is 7 cm?

(a) 14 cm^2 (b) 17.3 cm^2 (c) 28 cm^2 (d) 91 cm^2

16. A solid spherical ball fit exactly inside the cubical box of side 2a. The volume of the ball is

(a) $\frac{16}{3}\ \pi a^3$ (b) $\frac{1}{6}\ \pi a^3$ (c) $\frac{32}{3}\ \pi a^3$ (d) $\frac{4}{3}\ \pi a^3$

17. A bag contains 3 red, 5 black and 7 white balls. A ball is drawn from the bag at random. The probability that the ball drawn is not black is

(a) $\frac{1}{3}$ (b) $\frac{9}{15}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$

18. What is the value of $\frac{3-sin^2 60^0}{\tan 30^0 tan 60^0}$

(a) $2\frac{1}{4}$ (b) $3\frac{1}{4}$ (c) $2\frac{3}{4}$ (d) $3\frac{3}{4}$

Direction for questions 19 & 20: In question numbers 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.

19. Assertion (A): $\sqrt{7}$ is an irrational number.
Reason (R): A square root of a prime number is always an irrational number.

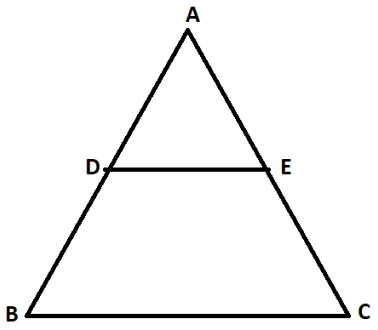
(a) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

(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.

20. Assertion (A): If D is a point on side QR of ΔPQR such that PD $\perp$ QR, then $\Delta PQD \sim \Delta RPD$.
Reason (R): In the figure given below, if $\angle D = \angle C$ then $\Delta ADE \sim \Delta ACB$.



(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.

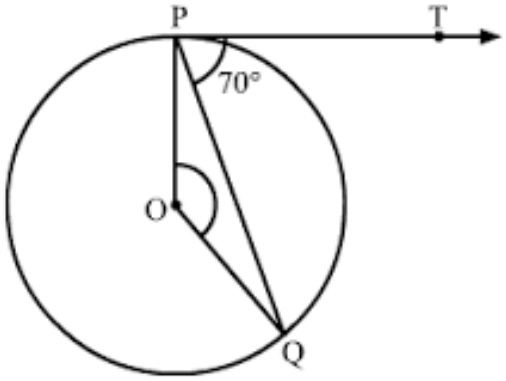
SECTION B

Section B consist of 5 questions of 2 marks each

21. Represent the following situation algebraically
A railway half ticket costs half the full fare but reservation charges are the same on a half ticket as on a full ticket. One reserved first-class ticket from Delhi to Trivandrum central costs ₹ 2125. Also, one reserved first-class ticket and one reserved half first class ticket from Delhi to Trivandrum central costs ₹ 3200. We have to find the full fare from Delhi to Trivandrum central and also the reservation charges for a ticket.

22. M and N are points on the sides PQ and PR respectively of a $\triangle PQR$, such that PM = 4 cm, QM = 4.5cm, PN = 4 cm, NR = 4.5 cm. Show that $\angle PMN = \angle PQR$

23. If PT is a tangent to a circle with center O and PQ is a chord of the circle such that ∠QPT = 70°, then find the measure of ∠POQ.



24. The circumference of a circle is 22 cm. Calculate the area of its quadrant

OR

The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.

25. Show that $2\ (cos^2\ 45°\ +\ tan^2 60°)\ -6\ (sin^2 45°\ -\ tan^2 30°)\ =\ 6.$

OR

Prove the trigonometric identity $\frac{\sin\theta+cos\theta}{\sin\theta-cos\theta}+\frac{sin\theta-cos\theta}{sin\theta+\cos\theta}=\frac{2}{1-2cos^2\theta}$

SECTION C

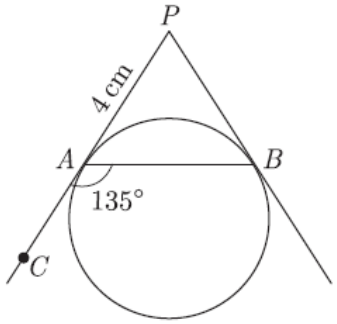
Section C consist of 6 questions of 3 marks each

26. Prove that $(3 - \sqrt{5})$ is irrational.
27. If α and β are the zeroes of the quadratic polynomial $f(x) = 2x^2 - 5x + 7$, find a polynomial whose zeros are 2α and 2β.
28. Solve graphically: 2x + 3y = 2; x – 2y = 8. Also shade the region bounded by these lines and x axis.

OR

5 pencils and 7 pens together cost ₹195 while 7 pencils and 5 pens together cost ₹153. Find the cost of each one of the pencils and the pen.

29. Prove that $\frac{cosA}{1-tanA} + \frac{sinA}{1-\cot A} = sinA + \cos A$
30. In the given figure, *PA* and *PB* are tangents drawn to a circle from an external point *P* such that *PA* = 4 cm and $\angle BAC = 135^o$. Find the length of chord *AB*.



OR

Prove that the tangents drawn at the ends of a diameter of a circle are parallel.

31. From a pack of 52 playing cards, Jacks, Queens and Kings of red color are removed. From the remaining, a card is drawn at random. Find the probability that drawn card is

    (i) a black king

    (ii) a card of red color,

    (iii) a card of black color.

SECTION D

Section D consist of 4 questions of 5 marks each

32. Write all the values of p for which the quadratic equation $x^2 + px + 16 = 0$ has equal roots. Find the roots of the equation so obtained.

OR

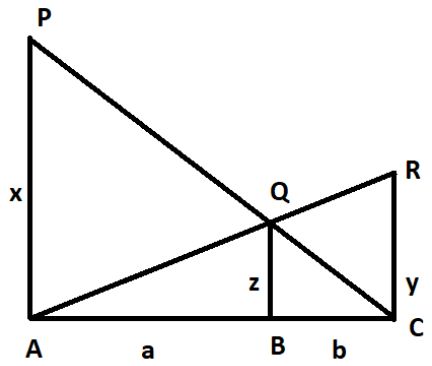
To fill a swimming pool two pipes are used. If the pipe of larger diameter used for 4 hours and the pipe of smaller diameter for 9 hours, only half of the pool can be filled. Find, how long it would take for each pipe to fill the pool separately, if the pipe of smaller diameter takes 10 hours more than the pipe of larger diameter to fill the pool?

33. A solid is in the form of a right circular cone mounted on a hemisphere. The radius of the hemisphere is 2.1 cm and the height of the solid is 6.1 cm. The solid is placed in a cylindrical tub full of water in such a way that the whole solid is submerged in water. If the radius of the cylinder is 5 cm and its height is 9.8 cm, find the volume of water left in the tub.

34. Prove that if a line is drawn parallel to one side of a triangle intersecting the other two sides in distinct points, then the other two sides are divided in the same ratio. Using the above theorem prove that a line through the point of intersection of the diagonals and parallel to one of the parallel sides of the trapezium divides the non-parallel sides in the same ratio.

OR

In the given figure PA, QB and RC are perpendicular to AC.



If AB =a, BC = b, PA = x, QB = z and RC = y then prove that $\frac{1}{z} = \frac{1}{x} + \frac{1}{y}$.

35. Find the value of *x* and *y*, if the median for the following data is 31.

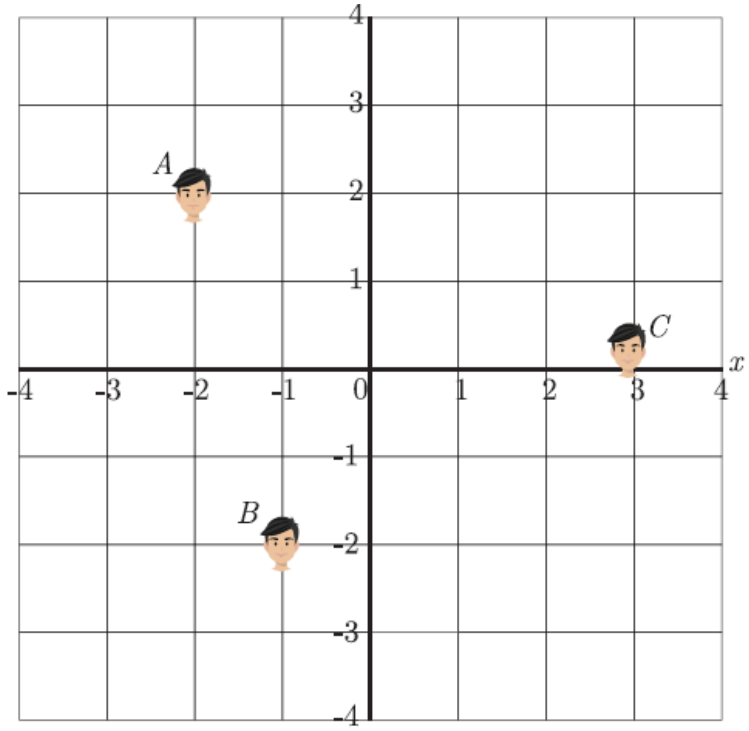
Class interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	Total
Frequency	5	*x*	6	*y*	6	5	40

SECTION E

Section E consist of 3 case studies of 4 marks each

36. Ajay, Bhigu and Colin have been best friends since childhood. They always want to sit in a row in the classroom. But the teacher doesn't allow them and rotates the seats row-wise every day. Bhigu is very good at maths, and he does distance calculation every day. He

considers the center of class as origin and marks their position on a paper in a co-ordinate system. One day Bhigu make the following diagram of their seating position



i. What is the distance of point *A* from origin?

ii. What is the distance between *A* and *B?*

iii. A point *D* lies on the line segment between points *A* and B such that $AD : DB = 4 : 3$. What are the the coordinates of point *D?*

OR

Check ΔAOB is an isosceles, equilateral, or scalene triangle.

37. Hardik repays his loan of ₹ 1,32,000, by paying every month. Starting with the first instalment of ₹1,500. He increases the instalment by ₹ 200 every year month.

Based on the above information answer the following questions.

i. If the amount paid in successive installment form an AP, then write its first term and common difference.

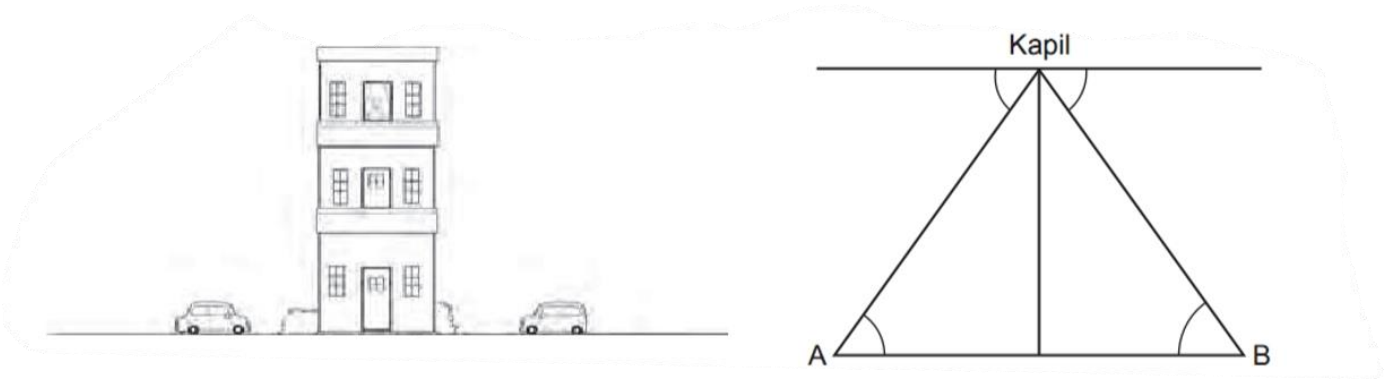
ii. Find the amount paid by Hardik in 15^{th} installment.

iii. In which installment will he pay ₹ 5500.

OR

Write the value of k for which the terms 11,2k+1,3k – 1 form an AP.

38. Kapil is standing on the balcony of his house. He observes two cars, one on either side (say A and B)



i. At an instant the angle of depression of the two cars were found to be 30^0 and 60^0 respectively. If the height at which he is standing is 3 m, then find the distance between the two cars.

ii. As the first car approaches towards the building, state whether the angle of depression will increase or decrease.

iii. If the ratio of the height of a tower and the length of its shadow is $\sqrt{3}: 1$, then find the angle of elevation of the sun.

OR

iii) If the height of a building and the distance of the point of observation from its foot, both are increased by 10%, then check whether the angle of elevation is increased by 10% or remains unchanged.