

# CBSE EXAMINATION PAPER-2023

## MATHEMATICS

(Solved)

Time allowed : 3 hours

Maximum Marks : 87

### General Instructions :

Read the following instructions carefully and follow them :

- i. This question paper contains **43 questions**. All questions are **compulsory**.
- ii. This question paper is divided into **5 sections**.
- iii. **Section A** – questions number **1 to 19** are multiple choice questions Each question carries **1 marks**.
- iv. **Section B** – questions number **20 to 26** are very short answer Each question carries **2 marks**.
- v. **Section C** – questions number **27 to 34** are short answer Each question carries **3 marks**.
- vi. **Section D** – questions number **35 to 37** are case based questions
- vii. **Section E** – questions number **38 to 43** are long answer Each question carries **5 marks**.
- viii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.
- ix. Use of calculator is NOT allowed.

## Section A

**Question 1.** The ratio of HCF to LCM of the least composite number and the least prime number is:

[1 Marks]

(A) 1:2

(B) 2:1

(C) 1:1

(D) 1:3

**Question 2.** The roots of the equation  $x^2 + 3x - 10 = 0$  are:

[1 Marks]

(A) 2, -5

(B) -2, 5

(C) 2, 5

(D) -2, -5

**Question 3.**

The next term of the A.P. :  $\sqrt{6}, \sqrt{24}, \sqrt{54}$  is:

[1 Marks]

(A)  $\sqrt{60}$

(B)  $\sqrt{96}$

(C)  $\sqrt{72}$

(D)  $\sqrt{216}$

**Question 4.**

The distance of the point  $(-1, 7)$  from x-axis is:

[1 Marks]

(A) 7

(B) -1

(C) 6

(D)  $\sqrt{50}$

**Question 5.** What is the area of a semi-circle of diameter 'd'?

[1 Marks]

(A)  $\frac{1}{4} \pi d^2$

(B)  $\frac{1}{16} \pi d^2$

(C)  $\frac{1}{8} \pi d^2$

(D)  $\frac{1}{2} \pi d^2$

**Question 6.** The empirical relation between the mode, median and mean of a distribution is:

[1 Marks]

(A) Mode = 3 Mean – 2 Median

(B) Mode = 3 Median – 2 Mean

(C) Mode = 2 Mean – 3 Median

(D) Mode = 2 Median – 3 Mean

**Question 7.**

The pair of linear equations  $2x = 5y + 6$  and  $15y = 6x - 18$  represents two lines which are:

[1 Marks]

(A) parallel

(B) intersecting

(C) coincident

(D) either intersecting or parallel

**Question 8.** If  $\alpha, \beta$  are zeroes of the polynomial  $x^2 - 1$ , then value of  $(\alpha + \beta)$  is:

[1 Marks]

(A) 1

(B) 2

(C) -1

(D) 0

**Question 9.**

If a pole 6 m high casts a shadow  $2\sqrt{3}$  m long on the ground, then sun's elevation is:

[1 Marks]

(A)  $60^\circ$

(B)  $45^\circ$

(C)  $90^\circ$

(D)  $30^\circ$

**Question 10.**

$\sec \theta$  when expressed in terms of  $\cot \theta$ , is equal to:

[1 Marks]

(A)  $\sqrt{1-\cot^2\theta} / \cot \theta$

(B)  $\sqrt{1 + \cot^2 \theta}$

(C)  $1+ \cot^2\theta / \cot \theta$

(D)  $\sqrt{1 + \cot^2 \theta} / \cot \theta$

**Question 11.**

In the given figure,  $\triangle ABC \sim \triangle QPR$ . If  $AC = 6$  cm,  $BC = 5$  cm,  $QR = 3$  cm and  $PR = x$ ; then the value of  $x$  is:

[1 Marks]

(A) 10 cm

(B) 2.5 cm

(C) 3.6 cm

(D) 3.2 cm

**Question 12.**

The distance of the point  $(-6, 8)$  from origin is:

[1 Marks]

(A) 6

(B) -6

(C) 8

(D) 10

**Question 13.**

In the given figure, PQ is a tangent to the circle with centre O. If  $\angle OPQ = x$ ,  $\angle POQ = y$ , then  $x + y$  is:

[1 Marks]

(A)  $60^\circ$

(B)  $90^\circ$

(C)  $45^\circ$

(D)  $180^\circ$

**Question 14.**

In the given figure, TA is a tangent to the circle with centre O such that  $OT = 4$  cm,  $\angle OTA = 30^\circ$ , then length of TA is :

[1 Marks]

(A)  $2\sqrt{2}$  cm

(B) 2 cm

(C)  $2\sqrt{3}$  cm

(D)  $\sqrt{3}$  cm

**Question 15.**

In  $\triangle ABC$ ,  $PQ \parallel BC$ . If  $PB = 6$  cm,  $AP = 4$  cm,  $AQ = 8$  cm, find the length of AC.

[1 Marks]

(A) 6 cm

(B) 14 cm

(C) 20 cm

(D) 12 cm

**Question 16.**

If  $\alpha, \beta$  are the zeroes of the polynomial  $p(x) = 4x^2 - 3x - 7$ , then  $(1/\alpha + 1/\beta)$  is equal to:

[1 Marks]

(A)  $-7/3$

(B)  $7/3$

(C)  $-3/7$

(D)  $3/7$

**Question 17.** A card is drawn at random from a well-shuffled pack of 52 cards. The probability that the card drawn is not an ace is:

[1 Marks]

(A)  $1/13$

(B)  $9/13$

(C)  $12/13$

(D)  $4/13$

**Question 18.**

Assertion (A) : The probability that a leap year has 53 Sundays is  $2/7$ .

Reason (R) : The probability that a non-leap year has 53 Sundays is  $5/7$ .

[1 Marks]

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

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

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

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

**Question 19.**

Assertion (A) : a, b, c are in AP. if and only if  $2b=a+c$ .

Reason (R) : The sum of first n odd natural numbers is  $n^2$ .

[1 Marks]

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

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

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

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

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**Section B**

**Question 20.** Two numbers are in the ratio 2 : 3 and their LCM is 180. What is the HCF of these numbers?

[2 Marks]

**Question 21.** If one zero of the polynomial  $p(x) = 6x^2 + 37x - (k - 2)$  is reciprocal of the other, then find the value of k.

[2 Marks]

**Question 22.** Find the sum and product of the roots of the quadratic equation  $2x^2 - 9x + 4 = 0$ .

[2 Marks]

**Question 23.** Find the discriminant of the quadratic equation  $4x^2 - 5 = 0$  and hence comment on the nature of roots of the equation.

[2 Marks]

**Question 24.** If a fair coin is tossed twice, find the probability of getting 'atmost one head'.

[2 Marks]

**Question 25.**

Evaluate  $5 \cos^2 60^\circ + 4 \sec^2 30^\circ - \tan^2 45^\circ / \sin^2 30^\circ + \cos^2 30^\circ$ .

[2 Marks]

**Question 26.** If A and B are acute angles such that  $\sin(A - B) = 0$  and  $2 \cos(A + B) - 1 = 0$ , then find angles A and B.

[2 Marks]

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## Section C

**Question 27.** How many terms are there in an A.P. whose first and fifth terms are  $-14$  and  $2$ , respectively, and the last term is  $62$ ?

[3 Marks]

**Question 28.** Which term of the A.P. :  $65, 61, 57, 53, \dots$  is the first negative term?

[3 Marks]

**Question 29.**

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

[3 Marks]

**Question 30.** Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line segment joining the points of contact at the centre.

[3 Marks]

**Question 31.**

Prove that:  $\sin A - 2 \sin^3 A / 2 \cos^3 A - \cos A = \tan A$

[3 Marks]

**Question 32.** Prove that  $\sec A (1 - \sin A)(\sec A + \tan A) = 1$ .

[3 Marks]

**Question 33.** Two concentric circles are of radii  $5$  cm and  $3$  cm. Find the length of the chord of the larger circle which touches the smaller circle.

[3 Marks]

**Question 34.** Find the value of 'p' for which the quadratic equation  $px(x - 2) + 6 = 0$  has two equal real roots.

[3 Marks]

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## Section D

### Question 35.

Two schools 'P' and 'Q' decided to award prizes to their students for two games of Hockey ₹  $x$  per student and Cricket ₹  $y$  per student. School 'P' decided to award a total of ₹ 9,500 for the two games to 5 and 4 students respectively; while school 'Q' decided to award ₹ 7,370 for the two games to 4 and 3 students respectively.

Based on the above information, answer the following questions :

(1)

What is the prize amount for hockey?

[2 Marks]

(2) Represent the following information algebraically (in terms of  $x$  and  $y$ ).

[1 Marks]

(3) What will be the total prize amount if there are 2 students each from two games?

[1 Marks]

(4)

Prize amount on which game is more and by how much?

[2 Marks]

### Question 36.

Jagdish has a field which is in the shape of a right angled triangle AQC. He wants to leave a space in the form of a square PQRS inside the field for growing wheat and the remaining for growing vegetables (as shown in the figure). In the field, there is a pole marked as O.

Based on the above information, answer the following questions :

(1) Taking O as origin, coordinates of P are  $(-200, 0)$  and of Q are  $(200, 0)$ . PQRS being a square, what are the coordinates of R and S?

[1 Marks]

(2)

What is the area of square PQRS?

[2 Marks]

(3) If S divides CA in the ratio  $K:1$ , what is the value of K, where point A is  $(200, 800)$ ?

[1 Marks]

(4)

What is the length of diagonal PR in square PQRS?

[2 Marks]

#### Question 37.

Governing council of a local public development authority of Dehradun decided to build an adventurous playground on the top of a hill, which will have adequate space for parking. After survey, it was decided to build rectangular playground, with a semi-circular area allotted for parking at one end of the playground. The length and breadth of the rectangular playground are 14 units and 7 units, respectively. There are two quadrants of radius 2 units on one side for special seats.

Based on the above information, answer the following questions :

(1) What is the total perimeter of the parking area?

[1 Marks]

(2)

What is the total area of parking and the two quadrants?

[2 Marks]

(3) Find the cost of fencing the playground and parking area at the rate of ₹ 2 per unit.

[1 Marks]

(4)

What is the ratio of area of playground to area of parking area?

[2 Marks]

## Section E

**Question 38.** A straight highway leads to the foot of a tower. A man standing on the top of the 75 m high tower observes two cars at angles of depression of  $30^\circ$  and  $60^\circ$ , which are approaching the foot of the tower. If one car is exactly behind the other on the same side of the tower, find the distance between the two cars. (Use  $\sqrt{3} = 1.73$ )

[5 Marks]

**Question 39.** From the top of a 7 m high building, the angle of elevation of the top of a cable tower is  $60^\circ$  and the angle of depression of its foot is  $30^\circ$ . Determine the height of the tower.

[5 Marks]

**Question 40.**

D is a point on the side BC of a triangle ABC such that  $\angle ADC = \angle BAC$ . Prove that  $CA^2 = CB \cdot CD$

[5 Marks]

**Question 41.**

If AD and PM are medians of triangles ABC and PQR respectively where  $\triangle ABC \sim \triangle PQR$ , prove that  $AB/PQ = AD/PM$ .

[5 Marks]

**Question 42.** A student was asked to make a model shaped like a cylinder with two cones attached to its ends by using a thin aluminium sheet. The diameter of the model is 3 cm and its total length is 12 cm. If each cone has a height of 2 cm, find the volume of air contained in the model.

[5 Marks]

**Question 43.**

The monthly expenditure on milk in 200 families of a Housing Society is given below:

Find the value of  $x$  and also, find the median and mean expenditure on milk.

[5 Marks]

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