CBSE Class 10 Mathematics

Questions & Answers Practice Booklet for Board Exams

Standard (041) and Basic (241) | Extracted from the article "CBSE Class 10 Mathematics Model Questions and Answers for Board Exams"

How to use this booklet: *Attempt each question on paper first, then check the shaded answer. Model questions are* ***practice questions*** *written in board style; they are not predicted or guaranteed board questions. Confirm the latest syllabus and paper pattern on the official CBSE Academic website before the exam.*

Part 1: Important Questions with Answers

Real Numbers

Q1. Use Euclid's division algorithm to find the HCF of 96 and 404.

404 = 4 × 96 + 20; 96 = 4 × 20 + 16; 20 = 1 × 16 + 4; 16 = 4 × 4 + 0.
HCF = 4.

Q2. Find the HCF and LCM of 12, 15 and 21 using prime factorisation.

$12 = 2^2 \times 3$, $15 = 3 \times 5$, $21 = 3 \times 7$.
HCF = 3; LCM = $2^2 \times 3 \times 5 \times 7 = 420$.

Q3. Prove that √3 is irrational.

Suppose $\sqrt{3} = p/q$, where p and q are co-prime integers and $q \neq 0$. Squaring gives $3q^2 = p^2$, so 3 divides p^2, hence 3 divides p. Write $p = 3m$. Then $3q^2 = 9m^2$, so $q^2 = 3m^2$, and 3 divides q as well. Now p and q share the factor 3, contradicting co-primality. **So √3 is irrational.**

Polynomials

Q4. Find the zeroes of $x^2 - 5x + 6$ and verify the relationship with the coefficients.

$x^2 - 5x + 6 = (x - 2)(x - 3)$, so the zeroes are **2 and 3**. Sum = 5 = −(−5)/1 and product = 6 = 6/1. Verified.

Q5. Form a quadratic polynomial whose zeroes have sum −3 and product 2.

$x^2 -$ (sum)$x +$ product = **$x^2 + 3x + 2$.**

Q6. If α and β are the zeroes of $x^2 - 4x + 1$, find $\alpha^2 + \beta^2$.

$\alpha + \beta = 4$ and $\alpha\beta = 1$. $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 16 - 2 =$ **14.**

Pair of Linear Equations in Two Variables

Q7. Solve: $2x + 3y = 11$ and $2x - 4y = -24$.

Subtract the second from the first: $7y = 35$, so $y = 5$. Then $2x = 11 - 15 = -4$, so $x = -2$. **(x, y) = (−2, 5).**

Q8. For what value of k does the system $kx + 3y = k - 3$, $12x + ky = k$ have infinitely many solutions?

Need $k/12 = 3/k = (k - 3)/k$. From $k/12 = 3/k$, $k^2 = 36$, so $k = \pm 6$. From $3/k = (k - 3)/k$, $k - 3 = 3$, so $k = 6$. **$k = 6$.**

Quadratic Equations

Q9. Solve $2x^2 - 7x + 3 = 0$ by factorisation.

$2x^2 - 6x - x + 3 = 2x(x - 3) - 1(x - 3) = (2x - 1)(x - 3)$. **$x = 1/2$ or $x = 3$.**

Q10. Find the values of k for which $2x^2 + kx + 3 = 0$ has equal roots.

Discriminant must be zero: $k^2 - 4(2)(3) = 0$, so $k^2 = 24$ and **$k = \pm 2\sqrt{6}$.**

Q11. The product of two consecutive positive integers is 306. Find them.

$n(n + 1) = 306$ gives $n^2 + n - 306 = 0$, or $(n + 18)(n - 17) = 0$. Since n is positive, $n = 17$. **The integers are 17 and 18.**

Arithmetic Progressions

Q12. Find the 10th term of the AP 2, 7, 12, ...

$a = 2$, $d = 5$. $a_{10} = 2 + 9 \times 5 =$ **47.**

Q13. Which term of the AP 3, 8, 13, ... is 78?

$3 + (n - 1) \times 5 = 78$, so $n - 1 = 15$ and **$n = 16$.**

Q14. Find the sum of the first 20 terms of 1, 4, 7, ...

$S_{20} = (20/2)[2(1) + 19(3)] = 10 \times 59 =$ **590.**

Coordinate Geometry

Q15. Find the distance between $(-5, 7)$ and $(-1, 3)$.

$\sqrt{[(-1 + 5)^2 + (3 - 7)^2]} = \sqrt{(16 + 16)} =$ **$4\sqrt{2}$ units.**

Q16. Find the point that divides the line segment joining $(4, -3)$ and $(8, 5)$ internally in the ratio 3 : 1.

$x = (3 \times 8 + 1 \times 4)/4 = 7$; $y = (3 \times 5 + 1 \times (-3))/4 = 3$. **The point is (7, 3).**

Triangles and Circles

Q17. The sides of two similar triangles are in the ratio 3 : 5. What is the ratio of their areas?

The ratio of areas equals the square of the ratio of corresponding sides: **9 : 25.**

Q18. A point is 13 cm from the centre of a circle of radius 5 cm. Find the length of the tangent from the point.

A tangent is perpendicular to the radius at the point of contact, so length = $\sqrt{(13^2 - 5^2)} = \sqrt{144} =$ **12 cm.**

Trigonometry and Its Applications

Q19. Prove that $(1 - \cos\theta)/(1 + \cos\theta) = (\operatorname{cosec}\theta - \cot\theta)^2$.

RHS = $(1/\sin\theta - \cos\theta/\sin\theta)^2 = (1 - \cos\theta)^2/\sin^2\theta = (1 - \cos\theta)^2 / [(1 - \cos\theta)(1 + \cos\theta)] = (1 - \cos\theta)/(1 + \cos\theta)$ = LHS. **Proved.**

Q20. A 10 m ladder makes an angle of 60° with the ground. How high up the wall does it reach?

Height = $10 \sin 60° = 10 \times (\sqrt{3}/2) =$ **$5\sqrt{3}$ m** (about 8.66 m).

Mensuration, Statistics and Probability

Q21. Find the curved surface area of a cylinder of radius 7 cm and height 10 cm.

$2\pi rh = 2 \times (22/7) \times 7 \times 10 =$ **440 cm².**

Q22. Two dice are thrown together. What is the probability that the sum is 8?

Favourable outcomes: (2,6), (3,5), (4,4), (5,3), (6,2), i.e. 5 out of 36. **P = 5/36.**

Q23. If the median of a distribution is 25 and the mean is 24, find the mode.

Mode = 3 × Median − 2 × Mean = 75 − 48 = **27.**

Part 2: Previous Year Questions

Wording should be cross-checked against the official question papers while revising.

PYQ 1 (CBSE 2024, Mathematics Standard, Set 30/1/1, 1 mark). If the sum of the zeroes of the polynomial $p(x) = 2x^2 - k\sqrt{2}\,x + 1$ is $\sqrt{2}$, then the value of k is: (a) $\sqrt{2}$ (b) 2 (c) $2\sqrt{2}$ (d) 1/2.

Sum of zeroes = $-(-k\sqrt{2})/2 = k\sqrt{2}/2$. Setting this equal to $\sqrt{2}$ gives k = 2. **Answer: (b).**

PYQ 2 (CBSE 2024, 2 marks). Prove that $5 - 2\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is irrational.

Assume $5 - 2\sqrt{3} = r$, a rational number. Then $2\sqrt{3} = 5 - r$, so $\sqrt{3} = (5 - r)/2$. The right side is rational, but $\sqrt{3}$ is irrational. This contradiction shows that **$5 - 2\sqrt{3}$ is irrational.**

PYQ 3 (CBSE 2018, 3 marks). Given that $\sqrt{2}$ is irrational, prove that $5 + 3\sqrt{2}$ is an irrational number.

Assume $5 + 3\sqrt{2} = r$, a rational number. Then $\sqrt{2} = (r - 5)/3$, which is rational, contradicting the given fact. Hence **$5 + 3\sqrt{2}$ is irrational.**

Part 3: Competency-Based Questions

Case Study 1: The School Garden (Arithmetic Progression)

A school is planting saplings in rows along its new playground. The first row has 4 saplings, and every following row has 2 more saplings than the one before. In all, there are 10 rows.
(i) How many saplings are in the 10th row? (1 mark)
(ii) What is the total number of saplings planted in the 10 rows? (1 mark)
(iii) Which row will have 30 saplings if the pattern is continued? Show your working. (2 marks)

The numbers 4, 6, 8, ... form an AP with $a = 4$ and $d = 2$.
(i) $a_{10} = 4 + 9 \times 2 =$ **22 saplings.**
(ii) $S_{10} = (10/2)[2 \times 4 + 9 \times 2] = 5 \times 26 =$ **130 saplings.**
(iii) $4 + (n - 1) \times 2 = 30$, so $n - 1 = 13$ and **n = 14.** The 14th row will have 30 saplings.

Case Study 2: The Tower and the Student (Heights and Distances)

Ananya stands on level ground and looks up at the top of a 30 m tall tower. From her first position, the angle of elevation is 60°. She then walks directly away from the tower until the angle of elevation becomes 45°. (Use $\sqrt{3} = 1.73$.)
(i) How far is Ananya's first position from the foot of the tower? (1 mark)
(ii) How far is her second position from the foot of the tower? (1 mark)
(iii) How far did she walk between the two positions? (2 marks)

Let the tower be AB = 30 m, with the first position at C and the second at D.
(i) $\tan 60° = 30/BC$, so $BC = 30/\sqrt{3} = 10\sqrt{3} = 10 \times 1.73 =$ **17.3 m.**
(ii) $\tan 45° = 30/BD = 1$, so $BD =$ **30 m.**
(iii) Distance walked $= BD - BC = 30 - 17.3 =$ **12.7 m.**

Assertion-Reason Questions

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

AR 1. *Assertion:* If the HCF of two numbers is 5 and their LCM is 150, their product is 750. *Reason:* The product of two numbers equals the product of their HCF and LCM.

(A). $5 \times 150 = 750$, so the assertion is true, and the reason is the standard result that explains it.

AR 2. *Assertion:* The quadratic equation $x^2 + x + 1 = 0$ has no real roots. *Reason:* A quadratic equation has no real roots when its discriminant is negative.

(A). The discriminant is $1^2 - 4(1)(1) = -3$, which is negative, so there are no real roots. The reason correctly explains the assertion.

Part 4: Model Questions (Practice Only) with Answer Explanations

These are practice questions in board style, written for revision. They are not predicted or guaranteed board questions.

Section A style (1 mark)

M1. After how many decimal places does the decimal expansion of 7/80 terminate?

> $80 = 2^4 \times 5$, so the fraction terminates. Written out, 7/80 = 0.0875, which has **4 decimal places.** (The highest power of 2 or 5 in the denominator tells you the number of places.)

M2. A bag contains 5 red, 8 white and 4 green balls. One ball is drawn at random. What is the probability that it is not red?

> Total balls = 5 + 8 + 4 = 17. Balls that are not red = 12. **P = 12/17.**

Section B style (2 marks)

M3. Solve for x and y: $3x - 5y = -1$ and $x - y = -1$.

> From $x - y = -1$, $x = y - 1$. Substituting: $3(y - 1) - 5y = -1$, so $-2y - 3 = -1$, giving $y = -1$. Then $x = -2$. Check: $3(-2) - 5(-1) = -6 + 5 = -1$ ✓. **(x, y) = (−2, −1).**

M4. If the sum of the first n terms of an AP is $3n^2 + 5n$, find the first term and the common difference.

> First term $a = S_1 = 3 + 5 = 8$. $S_2 = 12 + 10 = 22$, so the second term = 22 − 8 = 14. Common difference d = 14 − 8 = 6. **a = 8, d = 6.** (Check: $a_n = S_n - S_{n-1} = 6n + 2$, which gives $a_1 = 8$.)

Section C style (3 marks)

M5. In a trapezium ABCD with AB ∥ DC, the diagonals AC and BD meet at O. Prove that AO/BO = CO/DO.

> In triangles AOB and COD: ∠AOB = ∠COD (vertically opposite angles) and ∠OAB = ∠OCD (alternate angles, since AB ∥ DC). So ΔAOB ~ ΔCOD by AA similarity. Corresponding sides are proportional, so AO/CO = BO/DO, which rearranges to **AO/BO = CO/DO.**

M6. Prove that $(\sin\theta - 2\sin^3\theta)/(2\cos^3\theta - \cos\theta) = \tan\theta$.

> Numerator: $\sin\theta(1 - 2\sin^2\theta)$. Denominator: $\cos\theta(2\cos^2\theta - 1)$. Since $1 - 2\sin^2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1$, the brackets are equal and cancel. What remains is $\sin\theta/\cos\theta$ = **tan θ.** Proved.

M7. If one zero of $x^2 - 5x + k$ is twice the other, find the value of k.

> Let the zeroes be α and 2α. Sum: $3\alpha = 5$, so $\alpha = 5/3$. Product: $2\alpha^2 = 2 \times 25/9$ = **50/9,** which is k.

Section D style (5 marks)

M8. A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.

Let the speed be x km/h. Then $360/x - 360/(x + 5) = 1$. Simplifying: $360 \times 5 = x(x + 5)$, so $x^2 + 5x - 1800 = 0$. Factorising: $(x + 45)(x - 40) = 0$. Speed cannot be negative, so **x = 40 km/h.** Check: 360/40 = 9 hours and 360/45 = 8 hours, which is 1 hour less ✓.

M9. A metallic sphere of radius 4.2 cm is melted and recast into a cylinder of radius 6 cm. Find the height of the cylinder.

Volume of sphere = volume of cylinder. $(4/3)\pi(4.2)^3 = \pi(6)^2 h$. So $h = (4 \times 4.2^3)/(3 \times 36) = (4 \times 74.088)/108 =$ **2.744 cm.**