Class 10 Maths

Formula & Methods Revision Booklet

2026–27 • 14 chapters • 28 worked examples • 56 practice questions

How to use this booklet

Read the method notes, cover the worked solution and try it yourself, then complete the chapter worksheet. Check the answer key only after writing your reasoning. Return to the full textbook for complete instruction and additional practice.

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Real Numbers

Start by writing each positive integer as a product of primes. The smallest exponent shared by two numbers gives the HCF; the largest exponent present gives the LCM.

Formulas and methods

Every integer greater than 1 has a prime factorisation unique apart from the order of its prime factors. The number 1 is neither prime nor composite.

For two positive integers a and b: HCF(a,b) × LCM(a,b) = ab. This product rule is not a general rule for three integers.

To prove irrationality, assume the number is p/q in lowest terms, square if needed, and show that p and q share a prime factor.

Worked examples

Find the HCF and LCM of 84 and 126.

$84 = 2^2 \times 3 \times 7$; $126 = 2 \times 3^2 \times 7$. Therefore HCF $= 2 \times 3 \times 7 = 42$ and LCM $= 2^2 \times 3^2 \times 7 = 252$. Check: $42 \times 252 = 84 \times 126 = 10584$.

Why is √3 irrational?

Suppose $\sqrt{3} = p/q$, with coprime integers p,q and $q \neq 0$. Then $p^2 = 3q^2$, so 3 divides p. Write $p = 3k$. This gives $q^2 = 3k^2$, so 3 also divides q. That contradicts coprimality; √3 is irrational.

Common mistake

Do not call every non-integer irrational: 7/4 is rational. In an irrationality proof, state that the fraction is in lowest terms.

Real Numbers — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Find the HCF and LCM of 36 and 60.

2. [Core] Two positive integers have HCF 8 and product 1536. Find their LCM.

3. [Core] Find the greatest number that divides 96 and 144 exactly.

4. [Challenge] Prove that $3 + 2\sqrt{5}$ is irrational, given that $\sqrt{5}$ is irrational.

Real Numbers — answers

1. Find the HCF and LCM of 36 and 60.

36 = $2^2 \times 3^2$ and 60 = $2^2 \times 3 \times 5$. HCF = 12; LCM = 180.

2. Two positive integers have HCF 8 and product 1536. Find their LCM.

LCM = 1536/8 = 192.

3. Find the greatest number that divides 96 and 144 exactly.

HCF(96,144) = 48.

4. Prove that $3 + 2\sqrt{5}$ is irrational, given that $\sqrt{5}$ is irrational.

If $3 + 2\sqrt{5} = r$ were rational, then $\sqrt{5} = (r - 3)/2$ would be rational, a contradiction.

Next step: explain one method aloud, then solve a question from your NCERT textbook without using this sheet.

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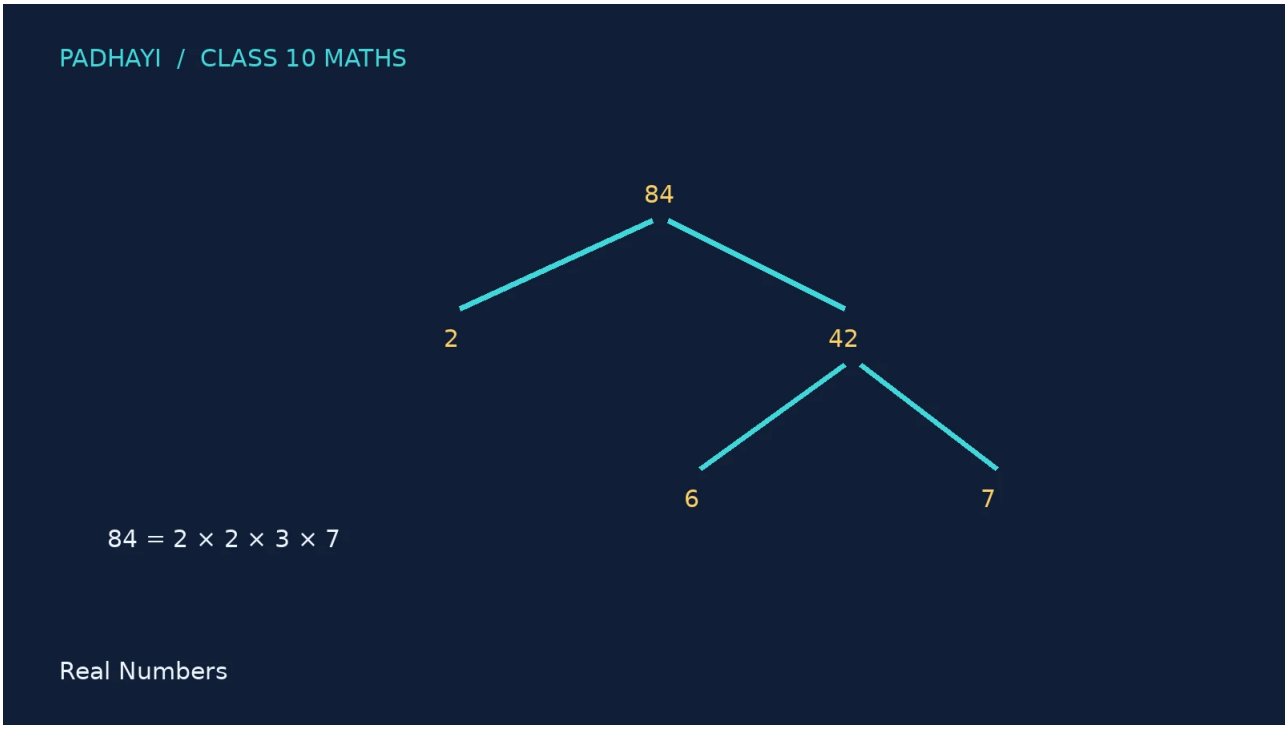

Schematic illustration; diagrams are not necessarily drawn to scale.

Polynomials

A zero is an input that makes the polynomial equal to zero. A graph meets the x-axis at its real zeros; the y-intercept is a different idea.

Formulas and methods

For $ax^2 + bx + c$, $a \neq 0$, zeros α and β satisfy $\alpha + \beta = -b/a$ and $\alpha\beta = c/a$.

A quadratic with zeros α and β can be written $k[x^2 - (\alpha + \beta)x + \alpha\beta]$, where $k \neq 0$.

If a quadratic has no real zero, its graph does not meet the x-axis.

Worked examples

Find and verify the zeros of $x^2 - 7x + 12$.

Factor as $(x - 3)(x - 4)$. The zeros are 3 and 4. Their sum is $7 = -(-7)/1$ and their product is $12 = 12/1$.

Construct a quadratic whose zeros are -2 and 5.

Their sum is 3 and product is -10. One polynomial is $x^2 - 3x - 10$. Multiplying this polynomial by any nonzero constant gives the same zeros.

Common mistake

The sum has a minus sign: $-b/a$. The product does not: c/a. Copy signed coefficients before substituting.

Polynomials — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Find the zeros of $x^2 - 9$.

2. [Core] State the sum and product of zeros of $2x^2 + 5x - 3$.

3. [Core] One zero of $x^2 - 6x + k$ is 2. Find k and the other zero.

4. [Challenge] Write a quadratic with zeros 1/2 and −3.

Polynomials — answers

1. Find the zeros of $x^2 - 9$.

$(x - 3)(x + 3) = 0$, so the zeros are 3 and -3.

2. State the sum and product of zeros of $2x^2 + 5x - 3$.

Sum = $-5/2$; product = $-3/2$.

3. One zero of $x^2 - 6x + k$ is 2. Find k and the other zero.

$4 - 12 + k = 0$ gives $k = 8$. The other zero is $6 - 2 = 4$.

4. Write a quadratic with zeros 1/2 and -3.

Sum = $-5/2$, product = $-3/2$. Multiplying the monic form by 2 gives $2x^2 + 5x - 3$.

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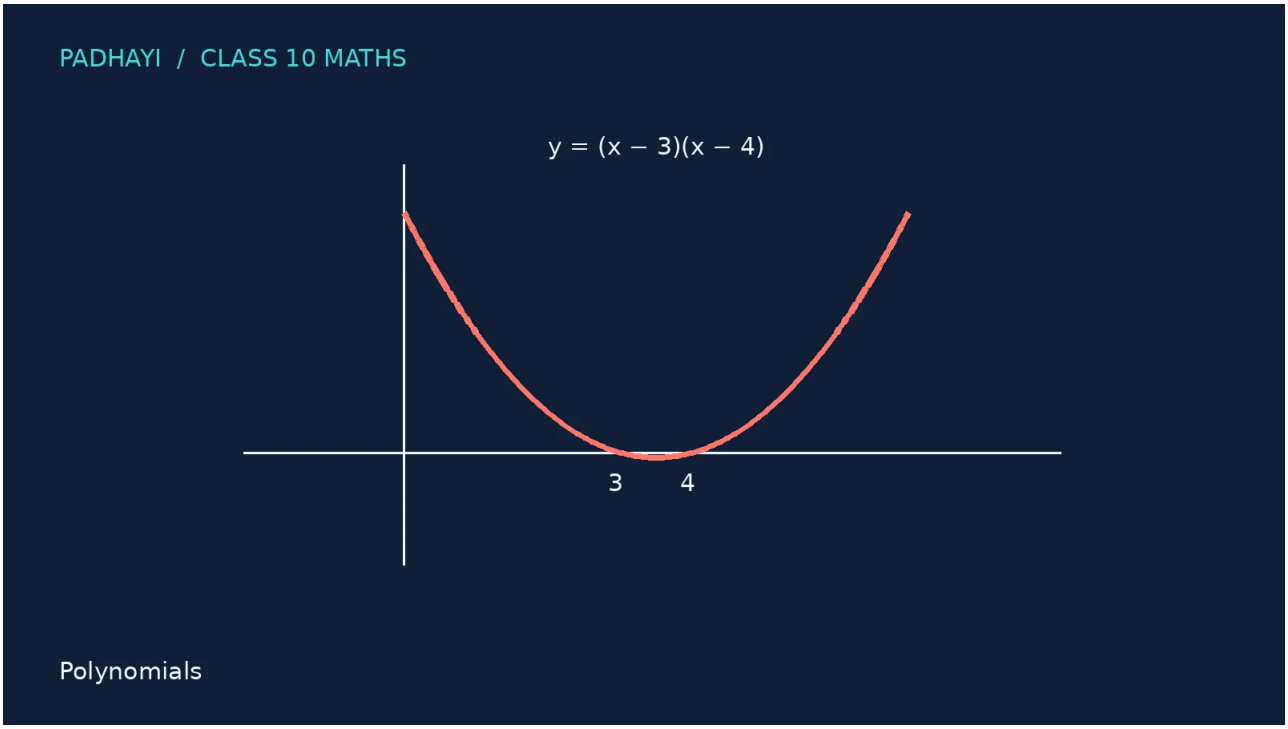

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Pair of Linear Equations in Two Variables

Define both unknowns with units before forming equations. Substitution works well when a coefficient is 1; elimination is often quicker when coefficients already match.

Formulas and methods

Write the equations as $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$.

If $a_1b_2 - a_2b_1 \neq 0$, there is one solution: the lines intersect.

For genuine lines with proportional a,b coefficients, proportional constants give coincident lines and infinitely many solutions; non-proportional constants give parallel lines and no solution. Ratio tests must not divide by zero.

Worked examples

Solve $2x + y = 11$ and $x - y = 1$.

Add the equations: $3x = 12$, so $x = 4$. Substitute into $x - y = 1$: $y = 3$. Check: $2(4) + 3 = 11$.

Two notebooks and three pens cost Rs 84. One notebook and one pen cost Rs 32. Find each price.

Let notebook price be n and pen price be p. Then $2n + 3p = 84$ and $n + p = 32$. Subtract twice the second equation from the first: $p = 20$. Thus $n = 12$. Check: $24 + 60 = 84$.

Common mistake

Multiply every term, including the constant, when eliminating. A contradiction such as $0 = 5$ means no solution; $0 = 0$ alone does not determine unique values.

Pair of Linear Equations in Two Variables — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Solve $x + y = 9$ and $x - y = 3$.

2. [Core] Solve $3x + 2y = 16$ and $x + y = 6$.

3. [Core] Classify $x + 2y = 5$ and $2x + 4y = 11$.

4. [Challenge] For which k do $2x + 3y = 7$ and $4x + 6y = k$ have infinitely many solutions?

Pair of Linear Equations in Two Variables — answers

1. Solve x + y = 9 and x − y = 3.

Add: 2x = 12. Thus x = 6, y = 3.

2. Solve 3x + 2y = 16 and x + y = 6.

Subtract twice the second equation: x = 4. Then y = 2.

3. Classify x + 2y = 5 and 2x + 4y = 11.

Doubling the first gives 2x + 4y = 10, inconsistent with 11. Parallel lines; no solution.

4. For which k do 2x + 3y = 7 and 4x + 6y = k have infinitely many solutions?

The second must be twice the first, including its constant: k = 14.

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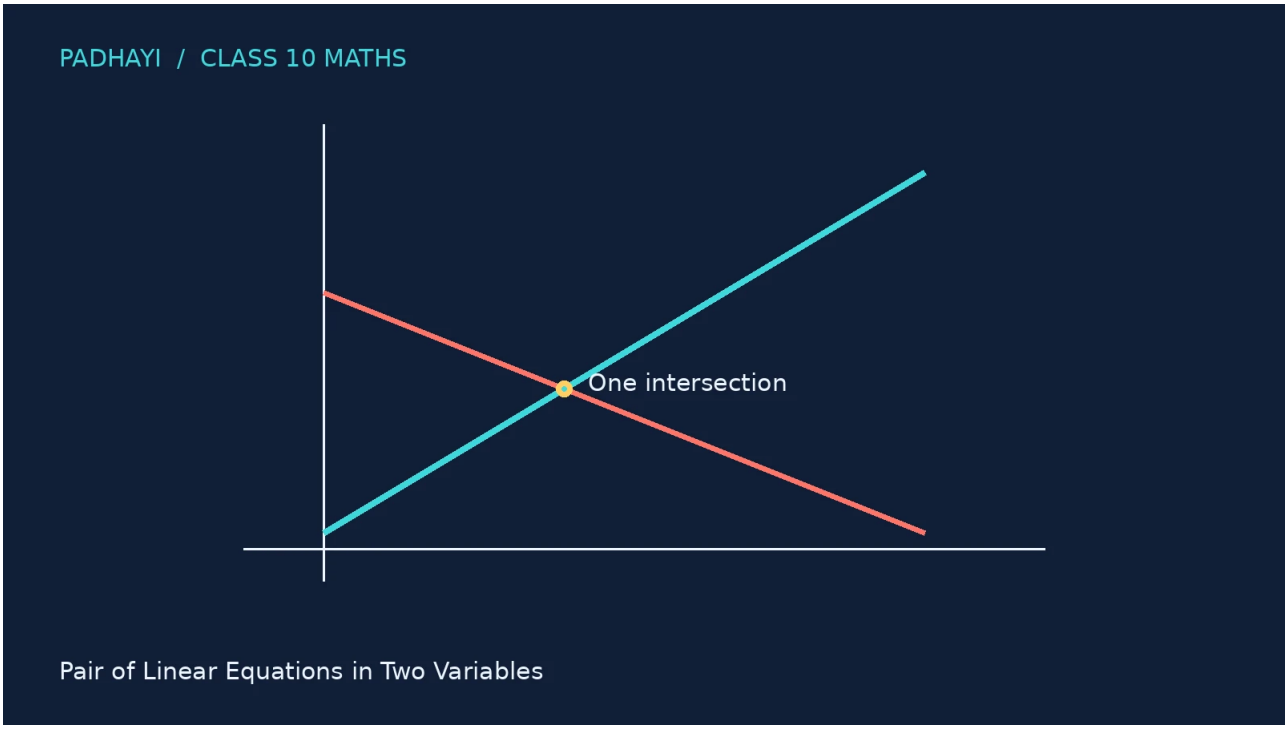

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Quadratic Equations

First move every term to one side. Try factorisation when the factors are clear; otherwise the quadratic formula works for any real coefficients with a nonzero leading coefficient.

Formulas and methods

Standard form: $ax^2 + bx + c = 0$, $a \neq 0$. Discriminant $D = b^2 - 4ac$.

For $D \geq 0$, $x = (-b \pm \sqrt{D})/(2a)$. The whole numerator is divided by 2a.

$D > 0$: two distinct real roots. $D = 0$: two equal real roots. $D < 0$: no real roots.

Worked examples

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

Split the middle term: $2x^2 - 6x - x + 3 = (2x - 1)(x - 3)$. Hence $x = 1/2$ or 3. Both make the original expression zero.

A rectangle has width x cm, length (x + 3) cm and area 40 cm². Find its dimensions.

$x(x + 3) = 40$ gives $x^2 + 3x - 40 = 0 = (x + 8)(x - 5)$. Roots are -8 and 5. A width must be positive, so width = 5 cm and length = 8 cm.

Common mistake

Use b with its sign. Keep both algebraic roots until the context justifies rejecting one. Negative dimensions are not valid.

Quadratic Equations — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Solve $x^2 - 5x + 6 = 0$.

2. [Core] How many real roots does $3x^2 + 2x + 1 = 0$ have?

3. [Core] Solve $x^2 + 4x + 1 = 0$.

4. [Challenge] Find k if $x^2 - 6x + k = 0$ has equal real roots.

Quadratic Equations — answers

1. Solve $x^2 - 5x + 6 = 0$.

$(x - 2)(x - 3) = 0$, so $x = 2$ or 3.

2. How many real roots does $3x^2 + 2x + 1 = 0$ have?

$D = 4 - 12 = -8$. No real roots.

3. Solve $x^2 + 4x + 1 = 0$.

$D = 12$. $x = (-4 \pm \sqrt{12})/2 = -2 \pm \sqrt{3}$.

4. Find k if $x^2 - 6x + k = 0$ has equal real roots.

$D = 36 - 4k = 0$, so $k = 9$. The repeated root is 3.

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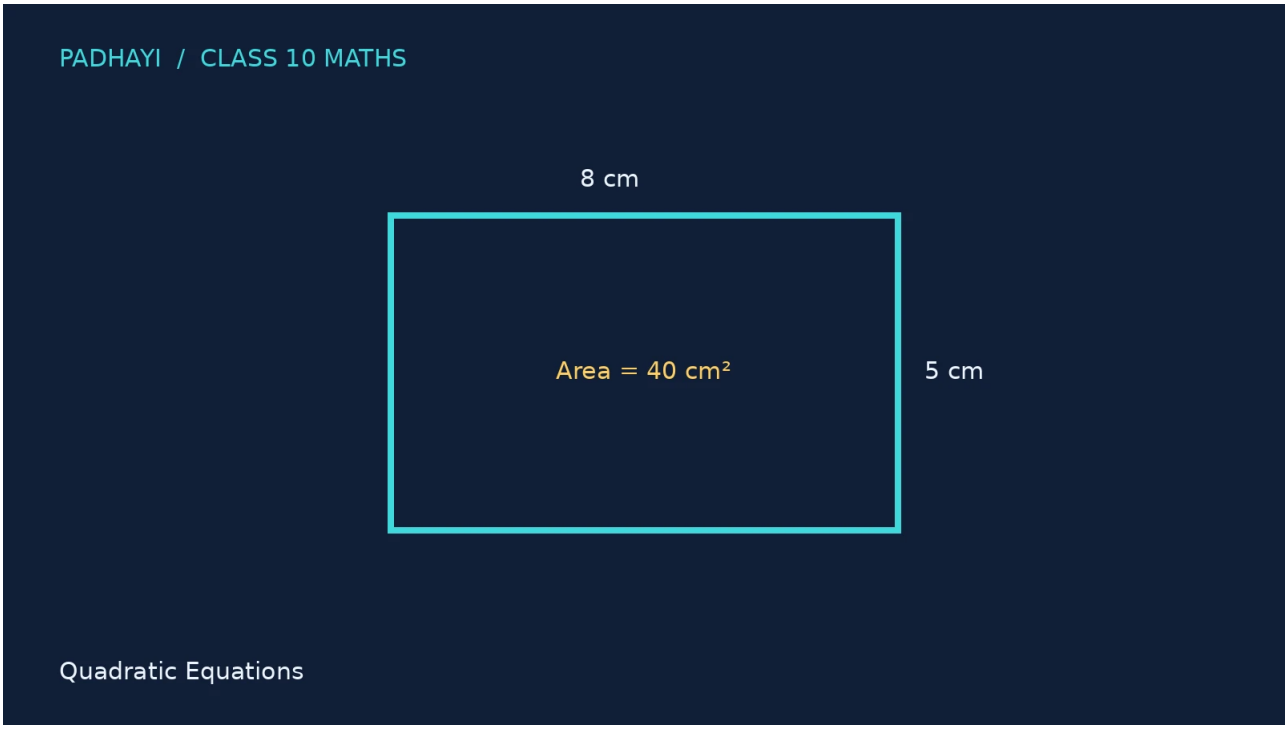

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Arithmetic Progressions

An arithmetic progression has a constant difference between consecutive terms. Decide whether the question asks for one term or a total before choosing a formula.

Formulas and methods

Common difference $d = a_2 - a_1$. The nth term is $a_n = a + (n - 1)d$, where n is a positive integer.

$S_n = n[2a + (n - 1)d]/2 = n(a + l)/2$, where l is the nth term.

Why the sum works: write the sum forwards and backwards. Each paired column is a + l; n such columns give $2S_n = n(a + l)$.

Worked examples

Find the 18th term of 7, 11, 15, ...

Here a = 7, d = 4. $a_{18} = 7 + 17 \times 4 = 75$. There are 17 jumps from the first term to the eighteenth.

Find the sum of the first 20 positive multiples of 3.

The AP is 3,6,...,60. $S_{20} = 20(3 + 60)/2 = 630$. This is a sum of 20 terms, not the 20th term, which is 60.

Common mistake

Use n − 1 jumps, not n. If solving for n produces a non-integer or non-positive value, that position is not a valid term number.

Arithmetic Progressions — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Find the common difference of 12, 8, 4, 0, ...

2. [Core] Find the 15th term when a = 2 and d = 5.

3. [Core] Find the sum 4 + 8 + ... + 80.

4. [Challenge] Is 100 a term of 7, 13, 19, ...?

Arithmetic Progressions — answers

1. Find the common difference of 12, 8, 4, 0, ...

d = 8 − 12 = −4.

2. Find the 15th term when a = 2 and d = 5.

a_{15} = 2 + 14 × 5 = 72.

3. Find the sum 4 + 8 + ... + 80.

n = 20. S_{20} = 20(4 + 80)/2 = 840.

4. Is 100 a term of 7, 13, 19, ...?

100 = 7 + 6(n − 1) gives n = 16.5. Since n is not an integer, 100 is not a term.

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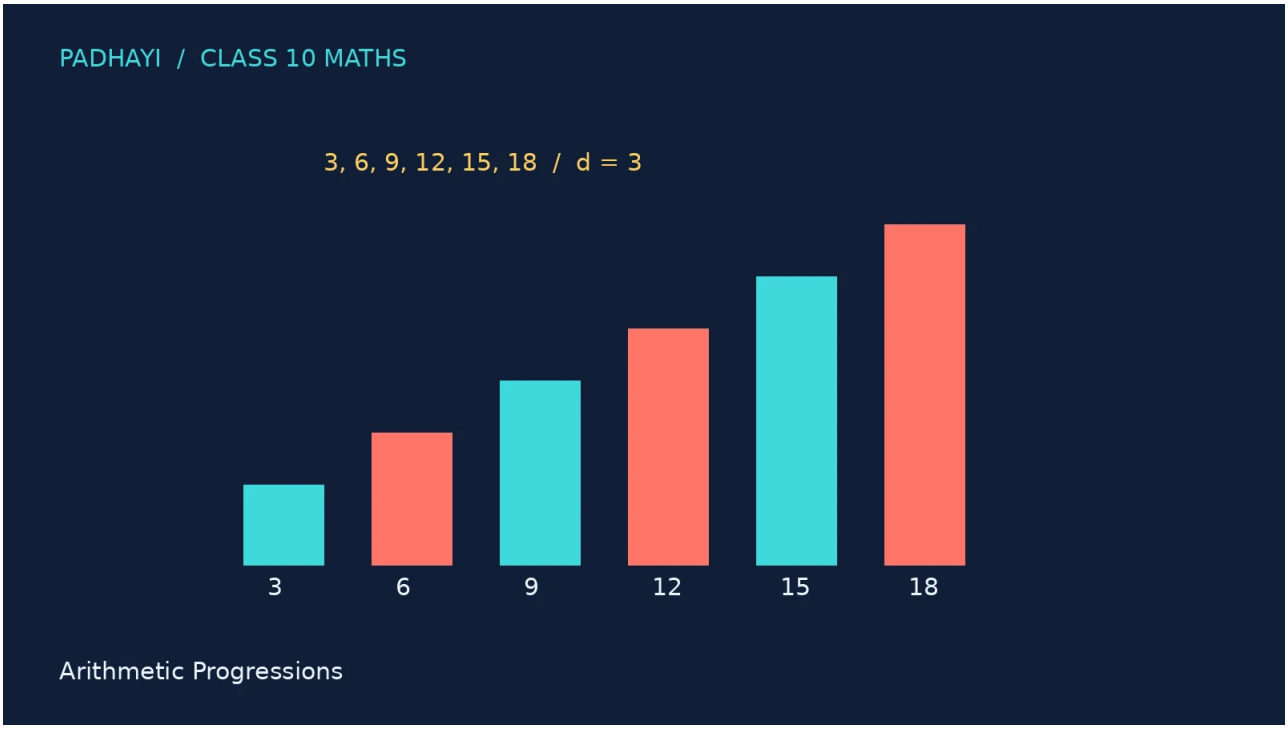

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Triangles

Write corresponding vertices in the same order. Similar triangles have the same shape, so corresponding side lengths have one common scale factor.

Formulas and methods

AA (or AAA) similarity: two corresponding equal angles suffice. SAS similarity: an included equal angle and proportional enclosing sides. SSS similarity: all three corresponding side pairs proportional.

Basic proportionality theorem (BPT): in triangle ABC, if D lies on AB, E on AC and DE ∥ BC, then AD/DB = AE/EC.

Converse BPT: if points on two sides divide those sides in the same ratio, their joining segment is parallel to the third side.

Worked examples

In triangle ABC, DE ∥ BC, AD = 3 cm, DB = 2 cm and AE = 4.5 cm. Find EC.

BPT gives 3/2 = 4.5/EC. Hence 3EC = 9 and EC = 3 cm. Notice that AD/DB compares parts, not a part with the whole side.

Explain the area proof of BPT.

Triangles ADE and BDE have the same altitude to AB, so area(ADE)/area(BDE) = AD/DB. Likewise area(ADE)/area(CDE) = AE/EC. Triangles BDE and CDE share base DE and lie between parallels DE and BC, so their areas are equal. Therefore AD/DB = AE/EC.

Common mistake

Similar does not mean congruent. Do not use SAS unless the equal angle lies between the two side pairs being compared.

Triangles — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Triangles ABC and PQR are similar in that order. Which side corresponds to AC?

2. [Core] Two similar triangles have corresponding sides 6 and 9 cm. A second side in the smaller triangle is 8 cm. Find its partner.

3. [Core] AD = 4, DB = 6, AE = 6, EC = 9. Are DE and BC parallel?

4. [Challenge] In triangle ABC, DE ∥ BC, AD/AB = 2/5 and BC = 15 cm. Find DE.

Triangles — answers

1. Triangles ABC and PQR are similar in that order. Which side corresponds to AC?

PR; correspondence is A ↔ P, B ↔ Q, C ↔ R.

2. Two similar triangles have corresponding sides 6 and 9 cm. A second side in the smaller triangle is 8 cm. Find its partner.

Scale factor = 9/6 = 3/2. Partner = 8 × 3/2 = 12 cm.

3. AD = 4, DB = 6, AE = 6, EC = 9. Are DE and BC parallel?

4/6 = 6/9 = 2/3. By converse BPT, DE ∥ BC.

4. In triangle ABC, DE ∥ BC, AD/AB = 2/5 and BC = 15 cm. Find DE.

Triangles ADE and ABC are similar. DE/BC = AD/AB = 2/5, so DE = 6 cm.

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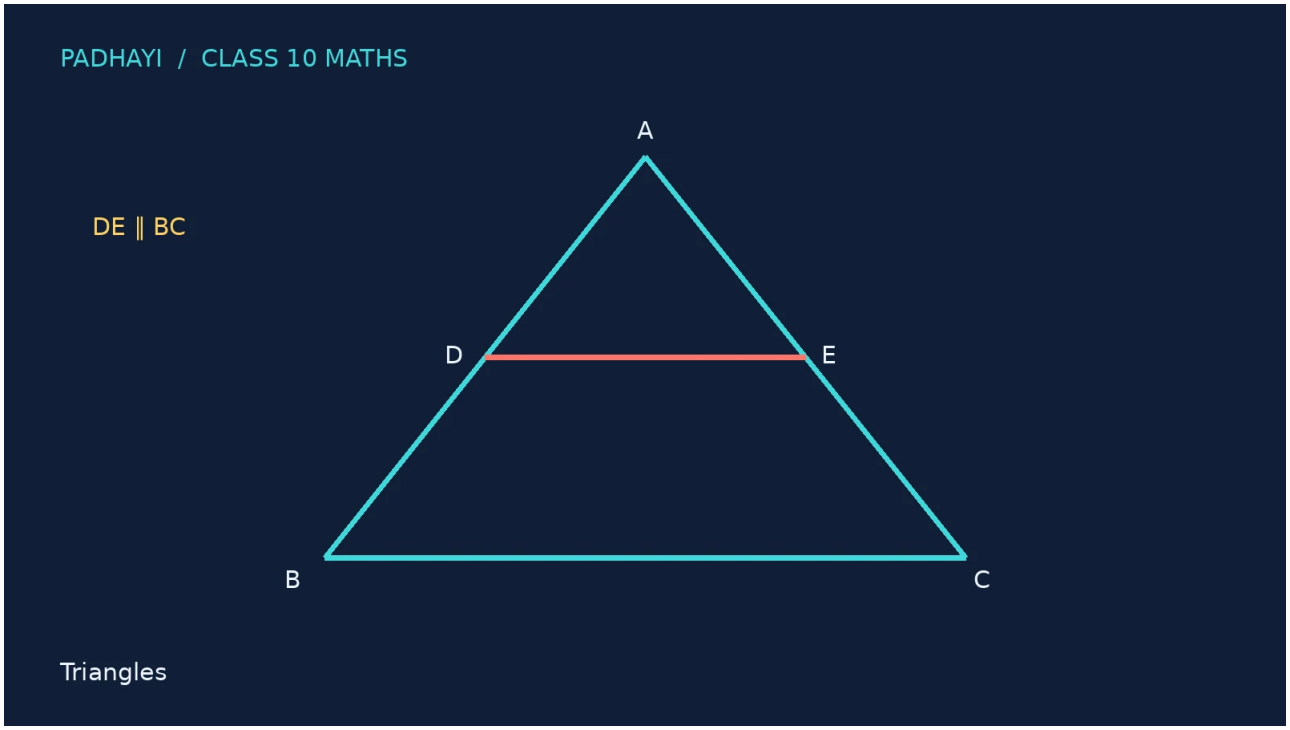

Schematic illustration; diagrams are not necessarily drawn to scale.

Coordinate Geometry

Sketch the points first to catch sign errors. A distance is never negative. The section formula here describes internal division of a line segment.

Formulas and methods

Distance AB = $\sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$. This follows from Pythagoras applied to the horizontal and vertical differences.

If AP:PB = m:n, P = $((mx_2 + nx_1)/(m+n), (my_2 + ny_1)/(m+n))$, with m,n positive.

Midpoint = $((x_1 + x_2)/2, (y_1 + y_2)/2)$, the special case m = n.

Worked examples

Find the distance between A(−2,3) and B(4,11).

Changes are 4 − (−2) = 6 and 11 − 3 = 8. Distance = √(36 + 64) = 10 units.

Find the point dividing A(1,2) and B(7,8) internally in the ratio 1:2.

AP:PB = 1:2. P = ((1×7 + 2×1)/3, (1×8 + 2×2)/3) = (3,4). It is closer to A, as the ratio predicts.

Common mistake

In the section formula, m multiplies the coordinates of B. Keep brackets around negative coordinates when subtracting.

Coordinate Geometry — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Find the midpoint of $(-4,2)$ and $(6,8)$.

2. [Core] Find the distance from $(0,0)$ to $(-5,12)$.

3. [Core] Divide $(2,-1)$ and $(8,5)$ internally in ratio 2:1.

4. [Challenge] A point on the x-axis is equidistant from $(2,3)$ and $(6,5)$. Find it.

Coordinate Geometry — answers

1. Find the midpoint of (−4,2) and (6,8).

((−4+6)/2,(2+8)/2) = (1,5).

2. Find the distance from (0,0) to (−5,12).

√(25+144) = 13 units.

3. Divide (2,−1) and (8,5) internally in ratio 2:1.

((2×8+2)/3,(2×5−1)/3) = (6,3).

4. A point on the x-axis is equidistant from (2,3) and (6,5). Find it.

Let it be (x,0). $(x-2)^2+9 = (x-6)^2+25$. Simplifying gives 8x = 48; point (6,0).

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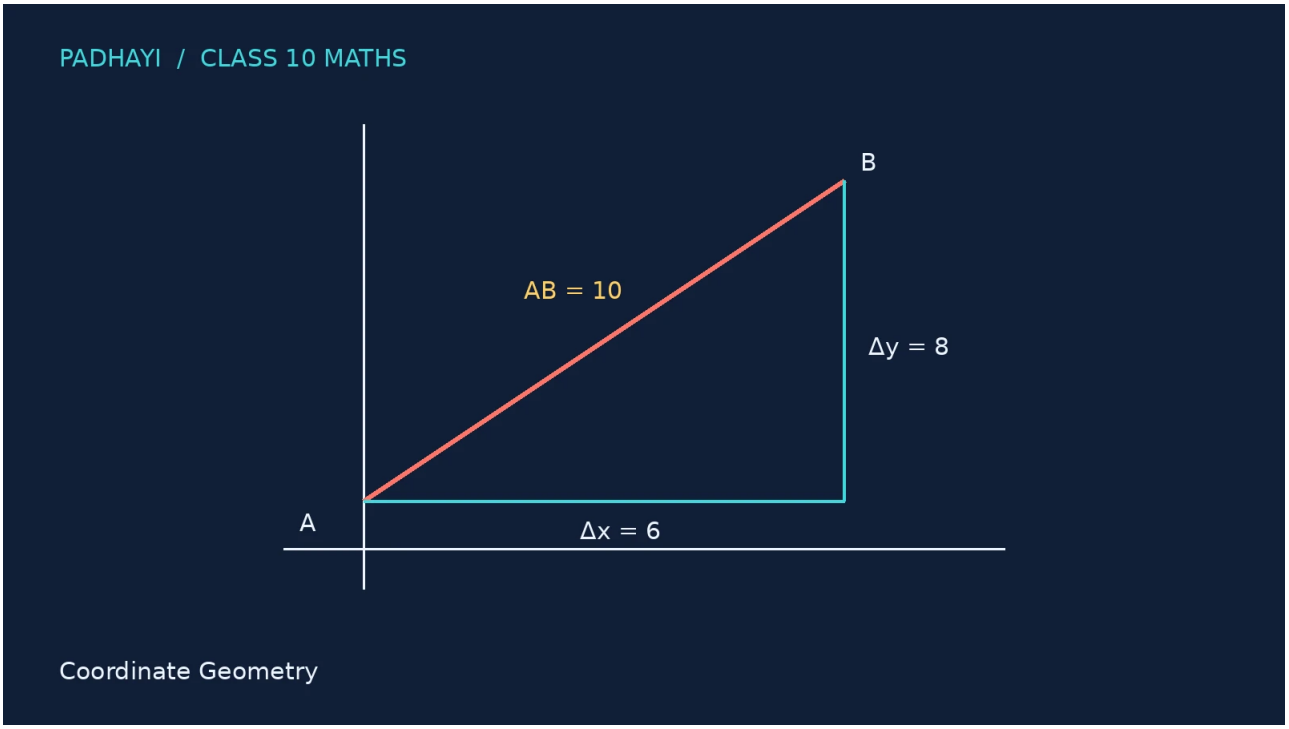

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Introduction to Trigonometry

Choose the reference angle before naming the opposite and adjacent sides. The hypotenuse is always opposite the right angle.

Formulas and methods

For an acute angle θ in a right triangle: sin θ = opposite/hypotenuse, cos θ = adjacent/hypotenuse, tan θ = opposite/adjacent.

cosec θ = 1/sin θ, sec θ = 1/cos θ, cot θ = 1/tan θ wherever the denominators are nonzero.

$\sin^2\theta + \cos^2\theta = 1$; $1 + \tan^2\theta = \sec^2\theta$; $1 + \cot^2\theta = \operatorname{cosec}^2\theta$, wherever defined.

Angles 0°,30°,45°,60°,90°: sin values 0,1/2,1/√2,√3/2,1; cos values 1,√3/2,1/√2,1/2,0; tan values 0,1/√3,1,√3,undefined.

Worked examples

If tan θ = 3/4 for an acute angle, find sin θ and cos θ.

Take opposite = 3k and adjacent = 4k, k > 0. Pythagoras gives hypotenuse = 5k. Hence sin θ = 3/5 and cos θ = 4/5.

Why does $\sin^2\theta + \cos^2\theta = 1$?

For opposite p, adjacent b and hypotenuse h, Pythagoras gives $p^2 + b^2 = h^2$. Divide by h^2: $(p/h)^2 + (b/h)^2 = 1$. Substitute the definitions of sine and cosine.

Common mistake

$\sin^2\theta$ means $(\sin\theta)^2$, not $\sin(\theta^2)$. Never cancel terms across addition. tan 90° is undefined, not zero.

Introduction to Trigonometry — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Evaluate $\sin 30° + \cos 60°$.

2. [Core] Find $\sec^2 45° - \tan^2 45°$.

3. [Core] For acute θ, $\sin \theta = 5/13$. Find $\cos \theta$.

4. [Challenge] Simplify $(1 - \cos^2 \theta)/\sin \theta$ where $\sin \theta \neq 0$.

Introduction to Trigonometry — answers

1. Evaluate sin 30° + cos 60°.

1/2 + 1/2 = 1.

2. Find $\sec^2 45° - \tan^2 45°$.

The identity $\sec^2 \theta - \tan^2 \theta = 1$ gives 1.

3. For acute θ, sin θ = 5/13. Find cos θ.

$\cos^2 \theta = 1 - 25/169 = 144/169$. Since θ is acute, cos θ = 12/13.

4. Simplify $(1 - \cos^2 \theta)/\sin \theta$ where $\sin \theta \neq 0$.

$1 - \cos^2 \theta = \sin^2 \theta$. Dividing by sin θ gives sin θ.

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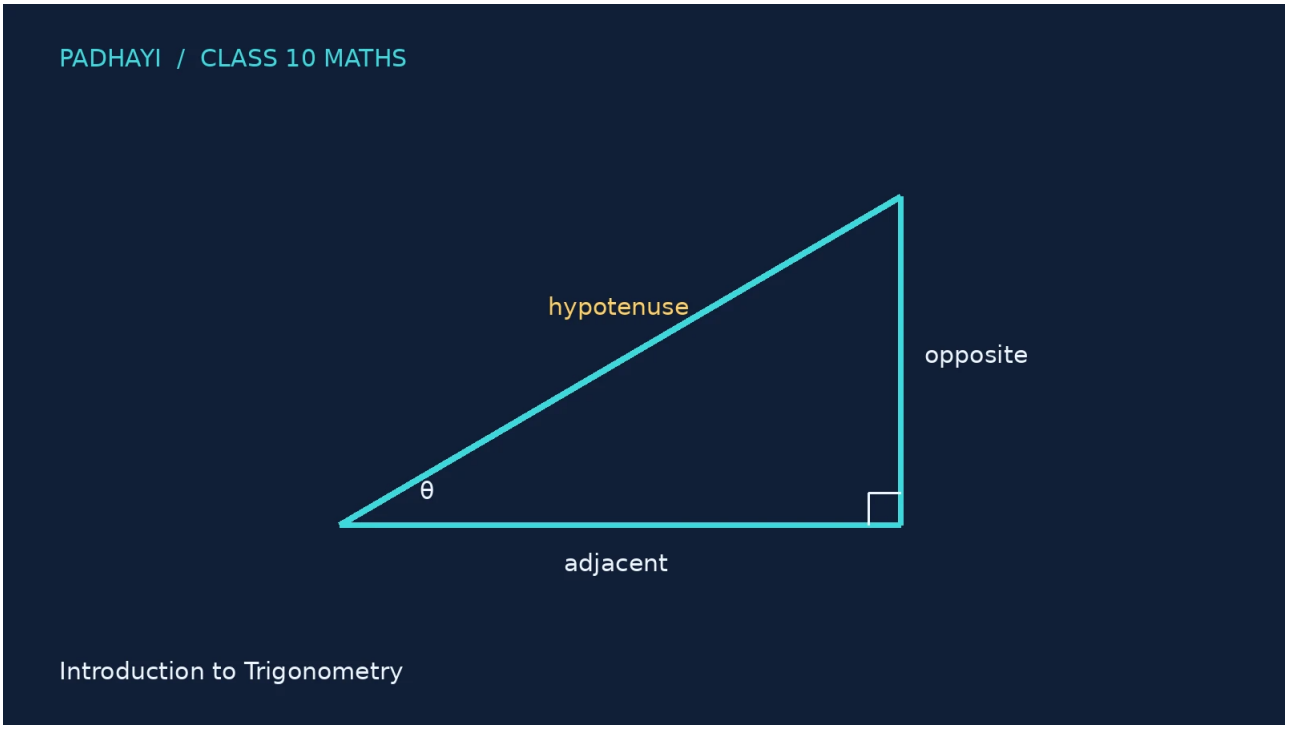

Schematic illustration; diagrams are not necessarily drawn to scale.

Some Applications of Trigonometry

Draw the horizontal ground, the vertical height and the line of sight before writing a ratio. State whether the observer is at ground level.

Formulas and methods

tan θ = vertical difference/horizontal distance for an angle θ measured from the horizontal.

Angle of elevation looks upward from a horizontal line. Angle of depression looks downward; parallel horizontals make the corresponding elevation angle equal.

If the observer has eye height e and tan θ = h/d, the object height is H = e + h, assuming level ground.

Worked examples

From a point 20 m from a tower base, its top has elevation 30°. Find the tower height, ignoring eye height.

tan 30° = h/20 = 1/√3. Thus h = 20/√3 = 20√3/3 m, approximately 11.55 m.

A tower has elevation 30° from a point. After moving 20 m toward it, the elevation is 60°. Find its height.

Let the nearer distance be x m and height h m. Then h = x√3 and h = (x+20)/√3. Thus 3x = x+20, so x = 10 and h = 10√3 m. Both points are on the same side of the base.

Common mistake

Do not confuse the sloping line of sight with the horizontal distance. Add eye height only when the question supplies or requires it.

Some Applications of Trigonometry — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] A pole is viewed at 45° from 12 m away on level ground. Ignore eye height. Find its height.

2. [Core] Find horizontal distance when a 15 m tower has elevation 60°.

3. [Core] An observer with eye height 1.6 m stands 10 m from a pole and sees its top at 45°. Find the pole height.

4. [Challenge] A 30 m tower casts a shadow of length $10\sqrt{3}$ m. Find the sun elevation.

Some Applications of Trigonometry — answers

1. A pole is viewed at 45° from 12 m away on level ground. Ignore eye height. Find its height.

tan 45° = h/12 = 1, so h = 12 m.

2. Find horizontal distance when a 15 m tower has elevation 60°.

d = 15/√3 = 5√3 m.

3. An observer with eye height 1.6 m stands 10 m from a pole and sees its top at 45°. Find the pole height.

Height above eye = 10 tan 45° = 10 m. Total = 11.6 m.

4. A 30 m tower casts a shadow of length 10√3 m. Find the sun elevation.

tan θ = 30/(10√3) = √3, so θ = 60°.

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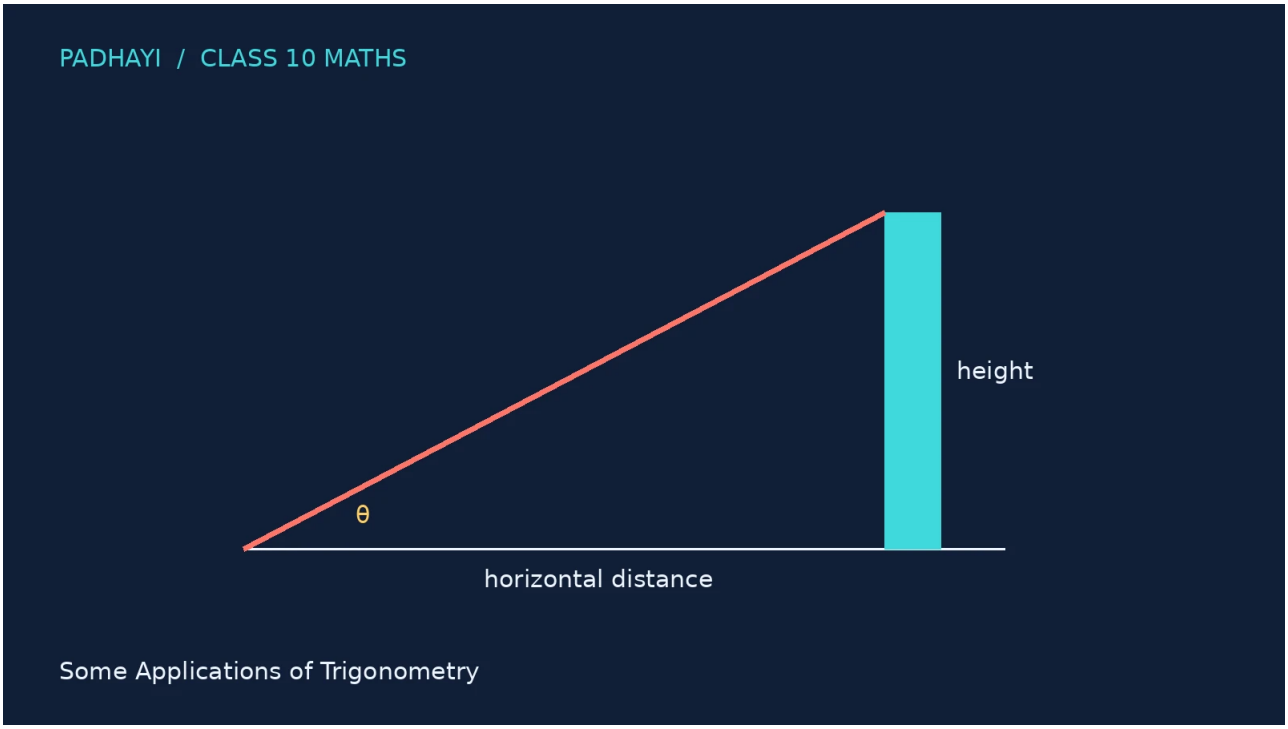

Schematic illustration; diagrams are not necessarily drawn to scale.

Circles

A tangent touches a circle at one point. Join the centre to that point immediately: the resulting right angle is often the key to the question.

Formulas and methods

The tangent at a point on a circle is perpendicular to the radius through that point.

The two tangent segments from the same external point have equal lengths: PA = PB.

If O is the centre, A a point of tangency and P an external point, $PA^2 = OP^2 - OA^2$.

Why the radius is perpendicular to the tangent: every other point Q on the tangent lies outside the circle, so OQ > r = OA. Thus OA is the shortest distance from O to the tangent line. The shortest distance from a point to a line is perpendicular.

Worked examples

A circle has radius 5 cm. An external point is 13 cm from its centre. Find a tangent length.

Join the centre O to tangent point A. OA ⊥ PA, so $PA = \sqrt{(13^2 - 5^2)} = \sqrt{144} = 12$ cm.

Prove that tangents PA and PB from P have equal lengths.

Join OA, OB and OP. Angles OAP and OBP are right angles, OA = OB (radii), and OP is common. The right triangles OAP and OBP are congruent by RHS. Therefore PA = PB.

Common mistake

Equal tangent lengths must come from the same external point and end at the points of contact. An arbitrary secant segment is not a tangent.

Circles — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] What angle does a tangent make with the radius at contact?

2. [Core] PA and PB are tangents from P. PA = 3x + 1 and PB = 5x − 7. Find x and their lengths.

3. [Core] A tangent is 24 cm long and the centre is 25 cm from the external point. Find the radius.

4. [Challenge] Two tangents PA and PB make angle APB = 70°. Find the non-reflex angle AOB.

Circles — answers

1. What angle does a tangent make with the radius at contact?

90°.

2. PA and PB are tangents from P. PA = 3x + 1 and PB = 5x − 7. Find x and their lengths.

3x+1 = 5x−7 gives x = 4. Each tangent is 13 units.

3. A tangent is 24 cm long and the centre is 25 cm from the external point. Find the radius.

$r^2 = 25^2 - 24^2 = 49$, so r = 7 cm.

4. Two tangents PA and PB make angle APB = 70°. Find the non-reflex angle AOB.

Quadrilateral OAPB has two right angles. Angle AOB = 360° − 90° − 90° − 70° = 110°.

Next step: explain one method aloud, then solve a question from your NCERT textbook without using this sheet.

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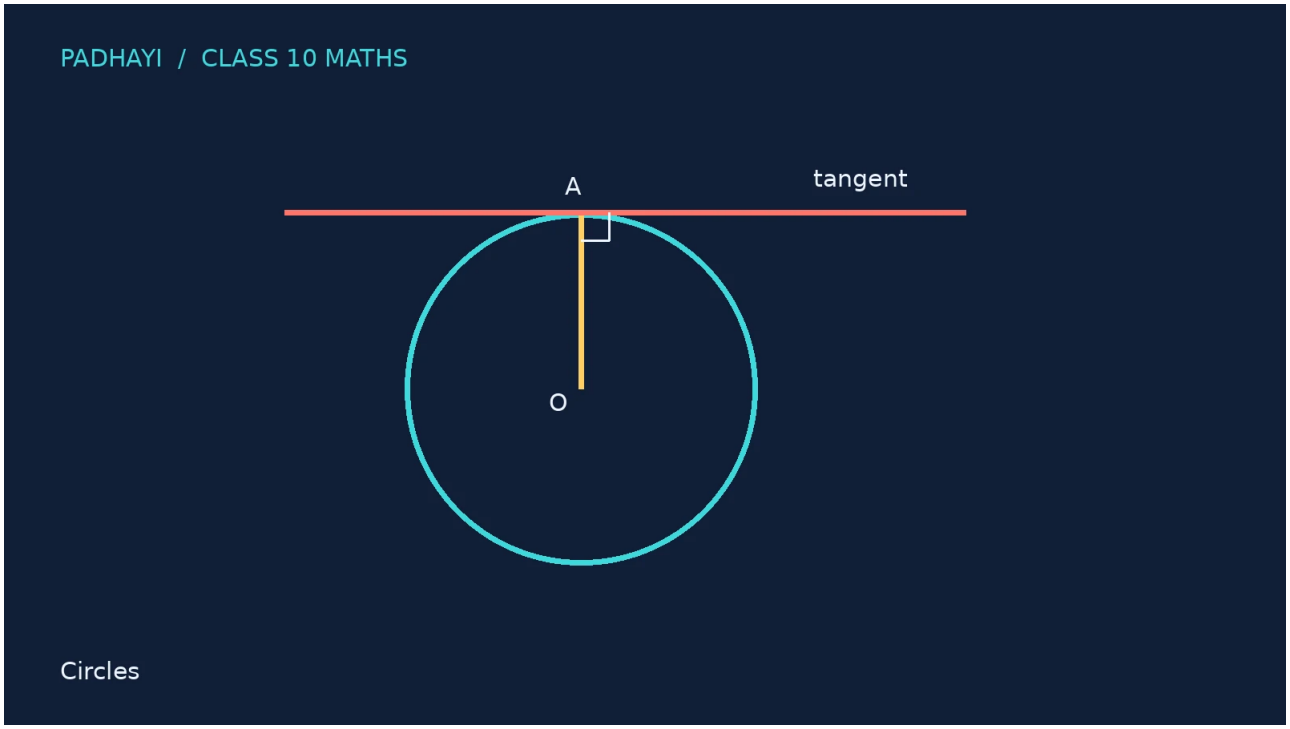

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Areas Related to Circles

Identify whether the shaded region is a sector, a segment or a combination. A sector includes two radii; a segment is bounded by a chord and its arc.

Formulas and methods

Circumference = $2\pi r$ and circle area = πr^2.

For a central angle θ in degrees: arc length = $(\theta/360)2\pi r$; sector area = $(\theta/360)\pi r^2$.

Minor segment area = corresponding minor sector area − area of the triangle formed by the two radii and chord. Sector perimeter = arc length + 2r.

For central angles 60°,90°,120°, the radius triangle areas are respectively $\sqrt{3}r^2/4$, $r^2/2$, $\sqrt{3}r^2/4$.

Worked examples

Find the area and perimeter of a 90° sector of radius 14 cm, using π = 22/7.

Area = $(1/4) \times (22/7) \times 196 = 154$ cm². Arc length = $(1/4) \times 2 \times (22/7) \times 14 = 22$ cm. Perimeter = 22 + 28 = 50 cm.

Find the minor segment area for radius 6 cm and central angle 60°.

Sector area = $(60/360)\pi \times 36 = 6\pi$ cm². The radius triangle is equilateral with side 6, so its area is $9\sqrt{3}$ cm². Segment area = $(6\pi - 9\sqrt{3})$ cm².

Common mistake

Arc length is not the complete sector perimeter. Use square units for area. Keep π exact unless a value or approximation is requested.

Areas Related to Circles — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Find a circle area for radius 7 cm using π = 22/7.

2. [Core] Find the arc length of a 60° sector of radius 21 cm using π = 22/7.

3. [Core] Find the area of a 120° sector of radius 9 cm.

4. [Challenge] Find the minor segment area of a circle of radius 10 cm cut off by a 90° central angle.

Areas Related to Circles — answers

1. Find a circle area for radius 7 cm using π = 22/7.

Area = (22/7) × 49 = 154 cm².

2. Find the arc length of a 60° sector of radius 21 cm using π = 22/7.

(1/6) × 2 × (22/7) × 21 = 22 cm.

3. Find the area of a 120° sector of radius 9 cm.

(1/3)π × 81 = 27π cm².

4. Find the minor segment area of a circle of radius 10 cm cut off by a 90° central angle.

Sector = 25π; triangle = (1/2)×10×10 = 50. Segment = (25π − 50) cm².

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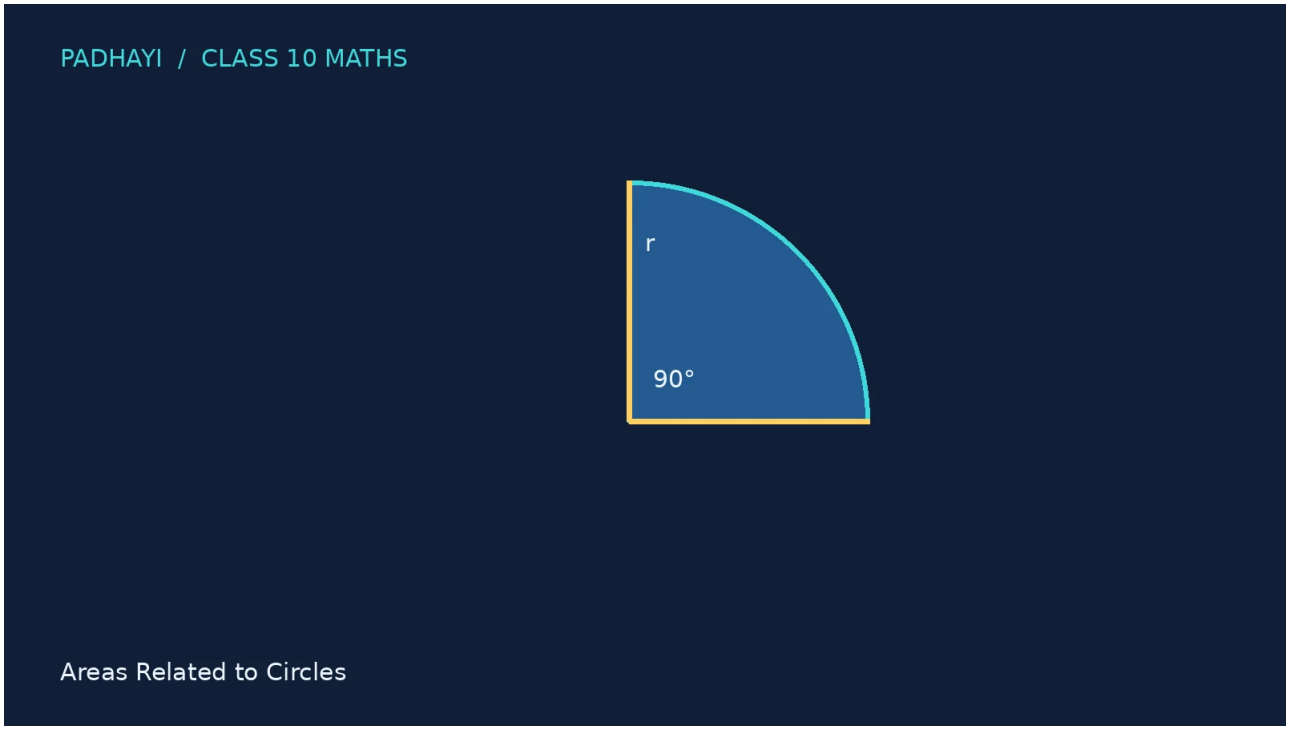

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Surface Areas and Volumes

Sketch the solid and mark the joined surfaces. Volumes add for joined solids; surface areas require counting only the exposed surfaces.

Formulas and methods

Cuboid: $V = lbh$; total surface area $= 2(lb + bh + hl)$. Cube: $V = a^3$; total surface area $= 6a^2$.

Cylinder: $V = \pi r^2 h$; curved area $= 2\pi rh$; total area $= 2\pi r(h+r)$.

Cone: $V = \pi r^2 h/3$; slant height $s = \sqrt{(r^2+h^2)}$; curved area $= \pi rs$; total area $= \pi r(s+r)$.

Sphere: $V = 4\pi r^3/3$; area $= 4\pi r^2$. Hemisphere: $V = 2\pi r^3/3$; curved area $= 2\pi r^2$; total area $= 3\pi r^2$.

Worked examples

A cone has radius 3 cm and height 4 cm. Find its curved area and volume.

Slant height $s = \sqrt{(9+16)} = 5$ cm. Curved area $= \pi \times 3 \times 5 = 15\pi$ cm^2. Volume $= \pi \times 9 \times 4/3 = 12\pi$ cm^3.

A hemisphere of radius 3 cm sits on a cylinder of the same radius and height 7 cm. Find the exposed area, including the bottom.

Count cylinder curved area, hemisphere curved area, and cylinder bottom. Area $= 2\pi \times 3 \times 7 + 2\pi \times 9 + \pi \times 9 = 69\pi$ cm^2. The shared circular face is internal and is not counted.

Common mistake

Cone surface area uses slant height, but volume uses perpendicular height. Convert all lengths to one unit before calculating.

Surface Areas and Volumes — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Find the volume of a cuboid 4 cm by 5 cm by 6 cm.

2. [Core] Find the total surface area of a hemisphere of radius 7 cm using $\pi = 22/7$.

3. [Core] A cylinder has radius 2 cm and height 9 cm. Find its volume.

4. [Challenge] A cone of radius 3 cm and height 4 cm is joined to a hemisphere of radius 3 cm. Find the combined volume.

Surface Areas and Volumes — answers

1. Find the volume of a cuboid 4 cm by 5 cm by 6 cm.

$4\times5\times6 = 120$ cm³.

2. Find the total surface area of a hemisphere of radius 7 cm using $\pi = 22/7$.

$3\pi r^2 = 3\times(22/7)\times49 = 462$ cm².

3. A cylinder has radius 2 cm and height 9 cm. Find its volume.

$\pi\times4\times9 = 36\pi$ cm³.

4. A cone of radius 3 cm and height 4 cm is joined to a hemisphere of radius 3 cm. Find the combined volume.

Cone volume = 12π; hemisphere volume = $(2/3)\pi\times27 = 18\pi$. Total = 30π cm³.

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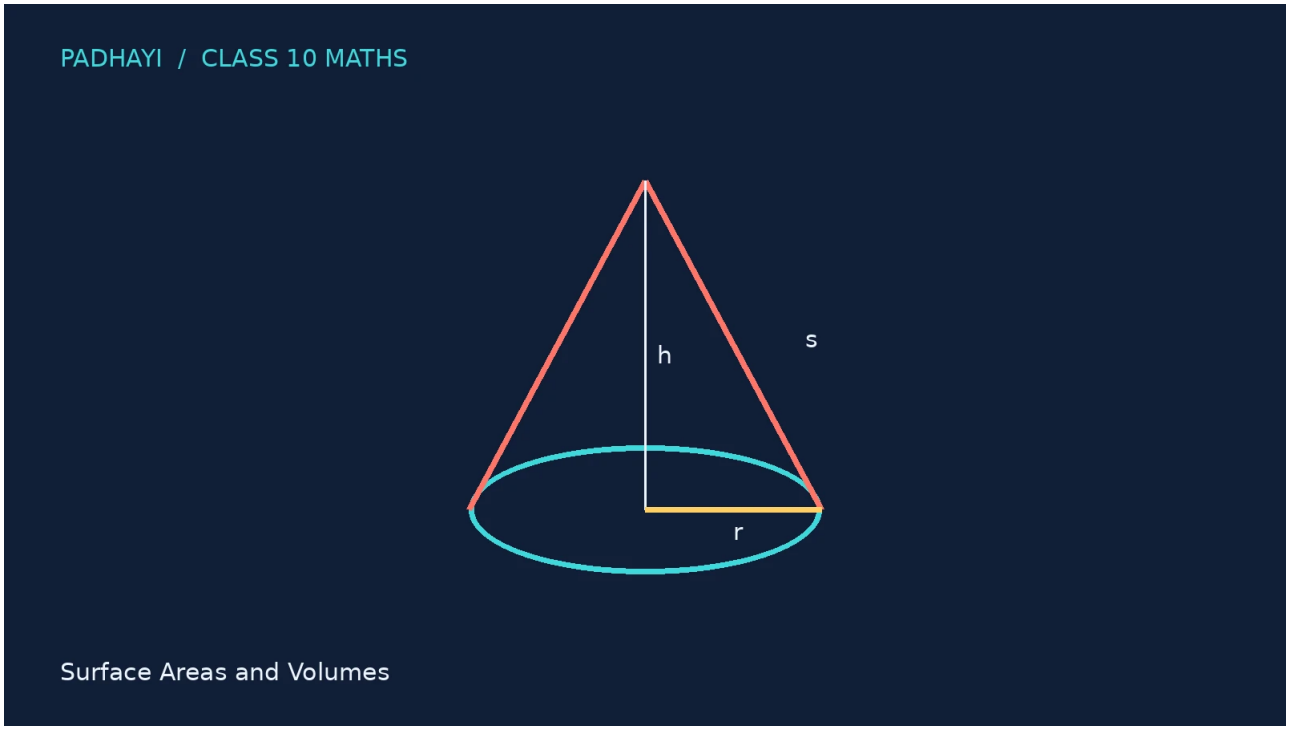

Schematic illustration; diagrams are not necessarily drawn to scale.

Statistics

Grouped data gives intervals rather than every original observation. Use class marks for the mean and cumulative frequency to locate the median class.

Formulas and methods

Class mark x_i = (lower limit + upper limit)/2. Direct mean = $\Sigma f_i x_i / \Sigma f_i$.

Assumed mean: mean = $a + \Sigma f_i d_i / \Sigma f_i$, where $d_i = x_i - a$. Step deviation: mean = $a + h\Sigma f_i u_i / \Sigma f_i$, $u_i = (x_i - a)/h$, using a convenient common h.

Median = $l + [(N/2 - cf)/f]h$. Here l is the lower boundary of the median class, cf the cumulative frequency before it, f its frequency and h its width.

Mode = $l + [(f_1 - f_0)/(2f_1 - f_0 - f_2)]h$. Here f_1 is the modal-class frequency, f_0 the previous frequency and f_2 the next; use appropriate continuous classes.

Worked examples

Find the mean for classes 0–10, 10–20, 20–30 with frequencies 2,5,3.

Class marks are 5,15,25. $\Sigma f = 10$ and $\Sigma fx = 2\times5 + 5\times15 + 3\times25 = 160$. Mean = 160/10 = 16.

Find median and mode for the same grouped data.

Cumulative frequencies are 2,7,10. N/2 = 5 lies in class 10–20. Median = $10 + [(5-2)/5]\times10 = 16$. Modal class is also 10–20: mode = $10 + [(5-2)/(10-2-3)]\times10 = 16$. These equal values are specific to this example.

Common mistake

cf in the median formula is the cumulative frequency before the median class. Do not use its upper boundary as l. Convert inclusive classes to continuous boundaries when needed.

Statistics — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] Find the class mark of 30–40.

2. [Core] Find mean for classes 0–10,10–20,20–30 with frequencies 3,4,3.

3. [Core] Find median for classes 0–10,10–20,20–30 with frequencies 4,8,8.

4. [Challenge] Find mode for classes 0–10,10–20,20–30 with frequencies 3,7,5.

Statistics — answers

1. Find the class mark of 30–40.

(30+40)/2 = 35.

2. Find mean for classes 0–10,10–20,20–30 with frequencies 3,4,3.

Σfx = 15+60+75 = 150; N = 10. Mean = 15.

3. Find median for classes 0–10,10–20,20–30 with frequencies 4,8,8.

N/2 = 10; median class 10–20. Median = 10 + [(10−4)/8]×10 = 17.5.

4. Find mode for classes 0–10,10–20,20–30 with frequencies 3,7,5.

Modal class 10–20. Mode = 10 + [(7−3)/(14−3−5)]×10 = 50/3, approximately 16.67.

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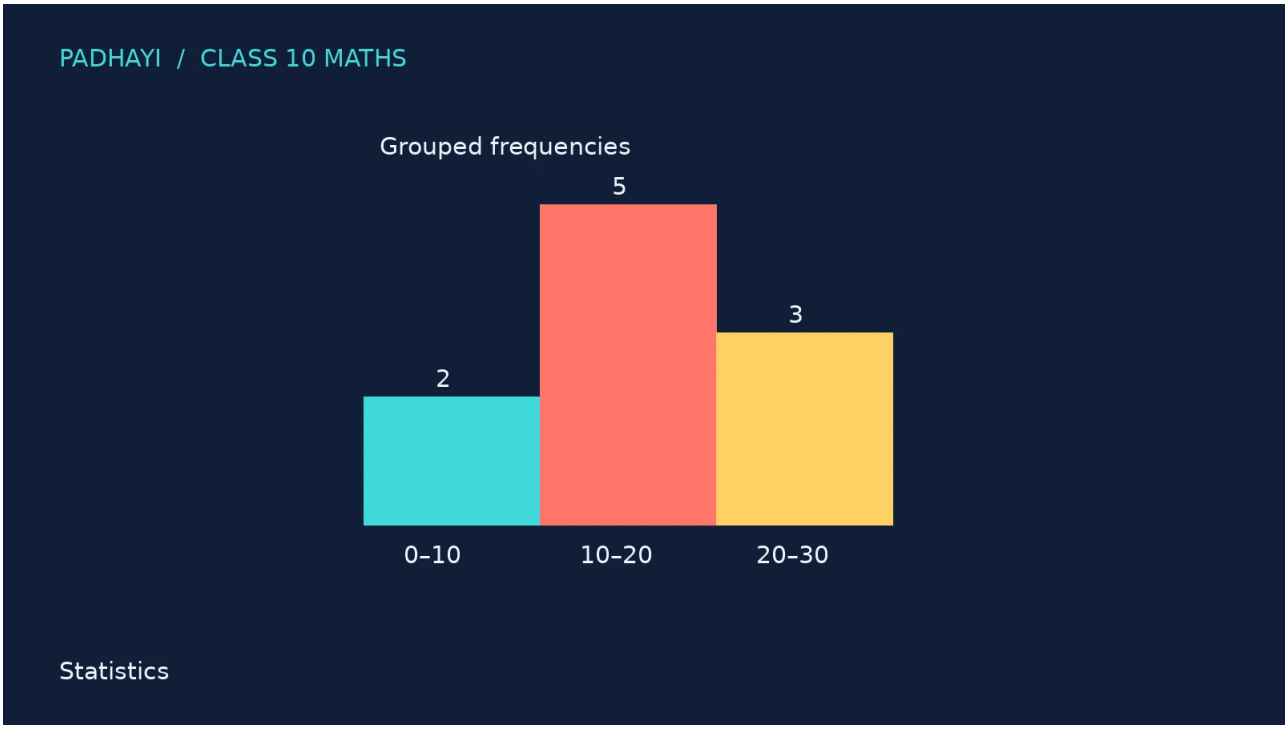

Schematic illustration; diagrams are not necessarily drawn to scale.

Probability

List the possible outcomes before counting favourable ones. The classical probability formula assumes that the elementary outcomes are equally likely.

Formulas and methods

P(E) = number of outcomes favourable to E / total number of equally likely outcomes.

$0 \le P(E) \le 1$. An impossible event has probability 0; a certain event has probability 1.

P(not E) = 1 − P(E). For two fair dice, use 36 ordered pairs, not 11 equally likely sums.

Worked examples

A fair die is rolled. Find the probability of a prime number.

The sample space is {1,2,3,4,5,6}. Prime outcomes are {2,3,5}; 1 is not prime. P = 3/6 = 1/2.

Two fair dice are rolled independently. Find the probability that their sum is 8.

Favourable ordered pairs are (2,6),(3,5),(4,4),(5,3),(6,2): 5 outcomes among 36 equally likely pairs. Probability = 5/36.

Common mistake

Count outcomes, not labels. A bag with repeated colours has one elementary outcome per equally likely individual ball; different colours need not be equally likely.

Probability — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] A fair coin is tossed once. Find P(head).

2. [Core] A bag contains 4 red and 6 blue identical-sized balls. One ball is selected at random. Find P(red).

3. [Core] A fair die is rolled. Find P(not getting 6).

4. [Challenge] Two fair coins are tossed independently. Find P(exactly one head).

Probability — answers

1. A fair coin is tossed once. Find P(head).

One favourable outcome among two: 1/2.

2. A bag contains 4 red and 6 blue identical-sized balls. One ball is selected at random. Find P(red).

4/(4+6) = 2/5, assuming each ball is equally likely to be selected.

3. A fair die is rolled. Find P(not getting 6).

1 − 1/6 = 5/6.

4. Two fair coins are tossed independently. Find P(exactly one head).

Equally likely outcomes HH,HT,TH,TT. HT and TH are favourable, so P = 2/4 = 1/2.

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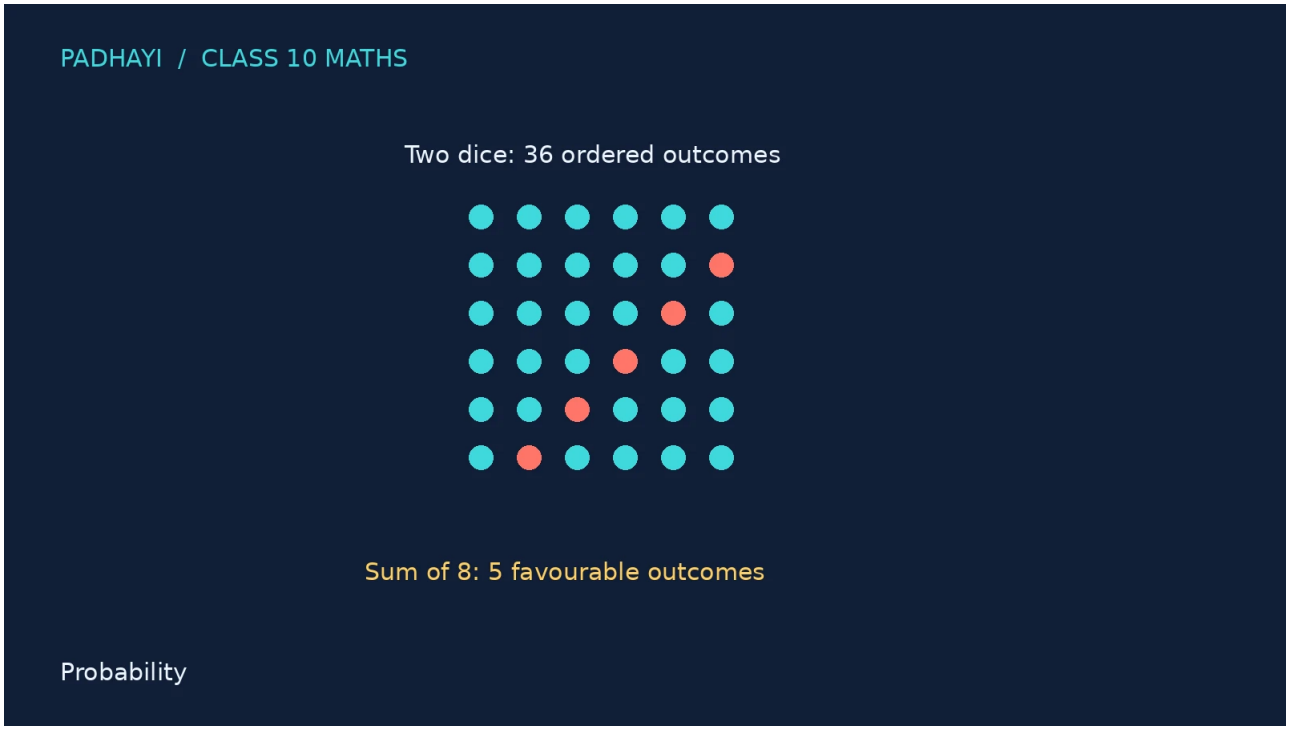

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