GRADEUP

AQA (GCSE Notes)

Chapter 4: Geometry and Measures

Q1. Draw a triangle ABC where AB = 6 cm, AC = 5 cm, and angle BAC = 60°.

Answer: Triangle ABC is drawn with AB = 6 cm, AC = 5 cm, and ∠BAC = 60°.

Solution:

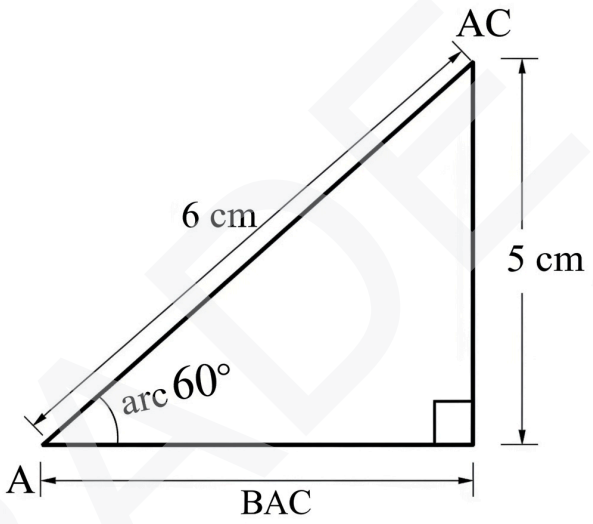
Step 1: Draw line segment AB = 6 cm using a ruler.

Step 2: At point A, use a protractor to construct an angle of 60°.

Step 3: From point A, along the 60° line, use a compass to mark 5 cm. Label this point as C.

Step 4: Join point C to point B to complete triangle ABC.

Step 5: Label the triangle clearly with all sides and angle ∠BAC.



Q2. Use a ruler and compass to construct the perpendicular bisector of a line segment AB of length 7 cm.

Answer: The perpendicular bisector of line segment AB is drawn correctly.

Solution:

Step 1: Draw line segment AB = 7 cm using a ruler.

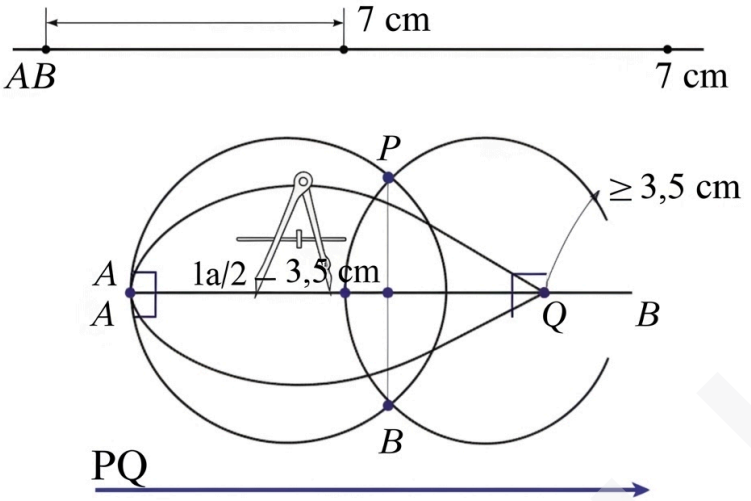
Step 2: Place the compass at point A and open it more than half the length of AB.

Step 3: Draw arcs above and below the line.

Step 4: Without changing the compass width, repeat the same from point B to intersect previous arcs.

Step 5: Label the points of intersection as P and Q.

Step 6: Draw line PQ. This is the perpendicular bisector of AB.



PQ perpendicular bisector of AB

Q3. Construct a triangle XYZ where XY = 5 cm, YZ = 6 cm, and angle XYZ = 90°.

Answer: Triangle XYZ is drawn with XY = 5 cm, YZ = 6 cm, and ∠XYZ = 90°.

Solution:

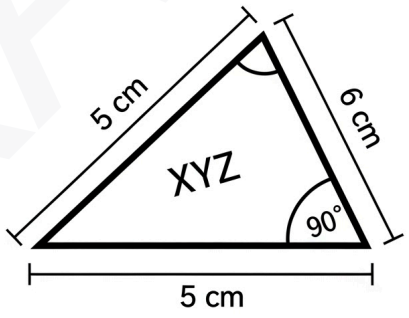
Step 1: Draw line segment XY = 5 cm.

Step 2: At point Y, use a protractor to draw a 90° angle.

Step 3: From point Y, along the 90° line, measure 6 cm and mark the point as Z.

Step 4: Join X to Z to complete triangle XYZ.

Step 5: Label all sides and angle XYZ clearly.



Q4. Draw two lines that are perpendicular and label the point where they meet as O.

Answer: Two perpendicular lines are drawn intersecting at point O.

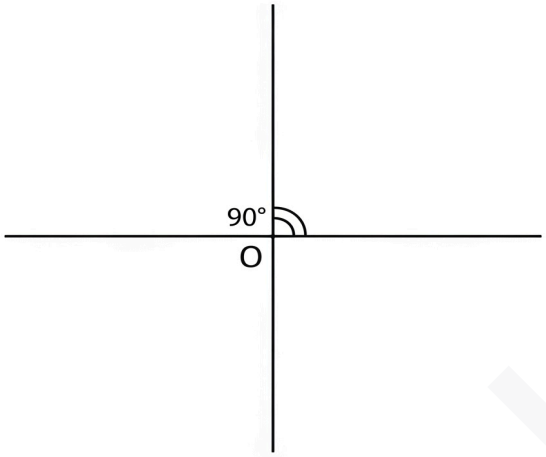
Solution:

Step 1: Draw a horizontal line using a ruler and label it as line L.

Step 2: Choose any point on line L and label it O.

Step 3: Use a protractor to construct a 90° angle at point O.

Step 4: Draw the second line vertically through O using a ruler.
Step 5: Label both lines and show the right angle symbol at O.

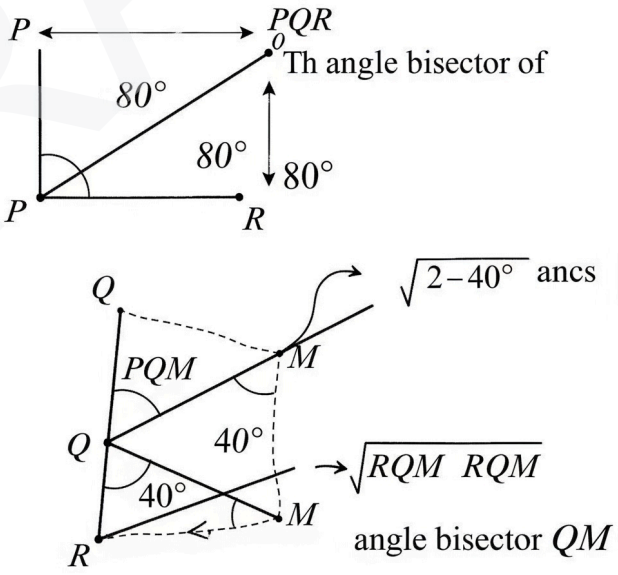


Q5. Use a compass to bisect angle PQR where angle PQR = 80°.

Answer: The angle PQR has been bisected accurately.

Solution:

Step 1: Draw angle PQR = 80° using ruler and protractor.
Step 2: Place the compass at point Q and draw an arc cutting both arms of the angle.
Step 3: Label the points of intersection as A (on QP) and B (on QR).
Step 4: Place the compass at A and draw an arc inside the angle.
Step 5: Without changing the compass width, repeat from point B to intersect the arc drawn from A.
Step 6: Mark the point of intersection as M.
Step 7: Draw line QM. This is the bisector of angle PQR.



Q6. Draw a regular hexagon using a compass and ruler.

Answer: A regular hexagon with equal sides and equal angles is drawn.

Solution:

Step 1: Draw a circle with radius 4 cm using compass.

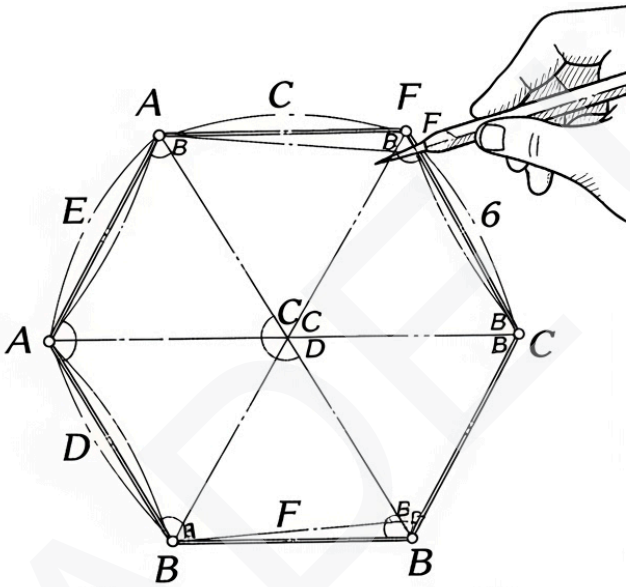
Step 2: Mark a point on the circle as point A.

Step 3: Without changing the compass width, place the compass at point A and mark the next point on the circle.

Step 4: Continue this process around the circle to get 6 points on the circle.

Step 5: Join these 6 points in order to form a regular hexagon.

Step 6: Label all vertices.



Q7. Construct a perpendicular from a point C to a line AB.

Answer: A perpendicular from point C to line AB is constructed.

Solution:

Step 1: Draw a line AB.

Step 2: Mark point C above the line AB.

Step 3: Place the compass at point C and draw an arc that cuts line AB at two points.

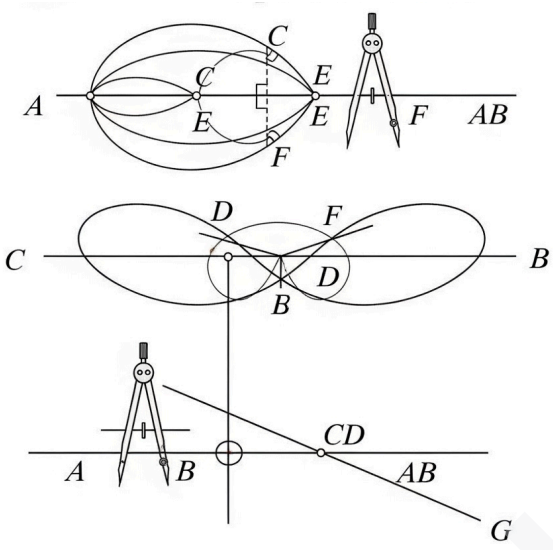
Step 4: Label the points of intersection as X and Y.

Step 5: Place the compass at X and draw an arc below AB.

Step 6: Without changing compass width, repeat from Y to intersect the arc from X.

Step 7: Mark the intersection as point D.

Step 8: Join C to D. Line CD is the required perpendicular from point C to line AB.



Q8. Draw a line segment of 8 cm and mark a point M on it. Construct a perpendicular at point M.

Answer: A perpendicular is constructed at point M on the line segment.

Solution:

Step 1: Draw line segment AB = 8 cm.

Step 2: Mark a point M anywhere on the line segment.

Step 3: Place the compass at M and draw arcs on both sides of M on line AB.

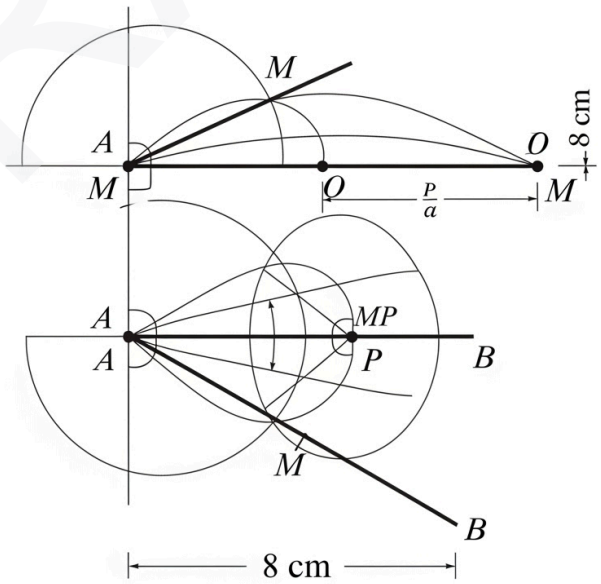
Step 4: Label the intersection points as X and Y.

Step 5: Place the compass at X and draw an arc above the line.

Step 6: Without changing the compass, repeat from point Y to intersect the arc.

Step 7: Mark intersection as P.

Step 8: Draw line MP. This is the required perpendicular.



Q9. Draw triangle DEF with DE = 4 cm, DF = 6 cm and angle EDF = 45°. Label all sides and angles.

Answer: Triangle DEF is drawn with DE = 4 cm, DF = 6 cm and ∠EDF = 45°.

Solution:

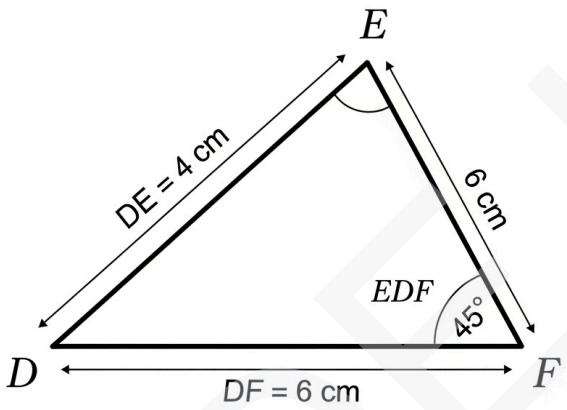
Step 1: Draw line segment DE = 4 cm.

Step 2: At point D, use a protractor to construct angle of 45°.

Step 3: From point D, along the 45° line, measure 6 cm and mark the point as F.

Step 4: Join point F to point E to complete triangle DEF.

Step 5: Label all sides and angle ∠EDF clearly.



Q10. Draw a square of side 5 cm. Mark all vertices clearly.

Answer: A square with all sides 5 cm and all angles 90° is drawn.

Solution:

Step 1: Draw line segment AB = 5 cm.

Step 2: At point A, use protractor to draw a 90° angle.

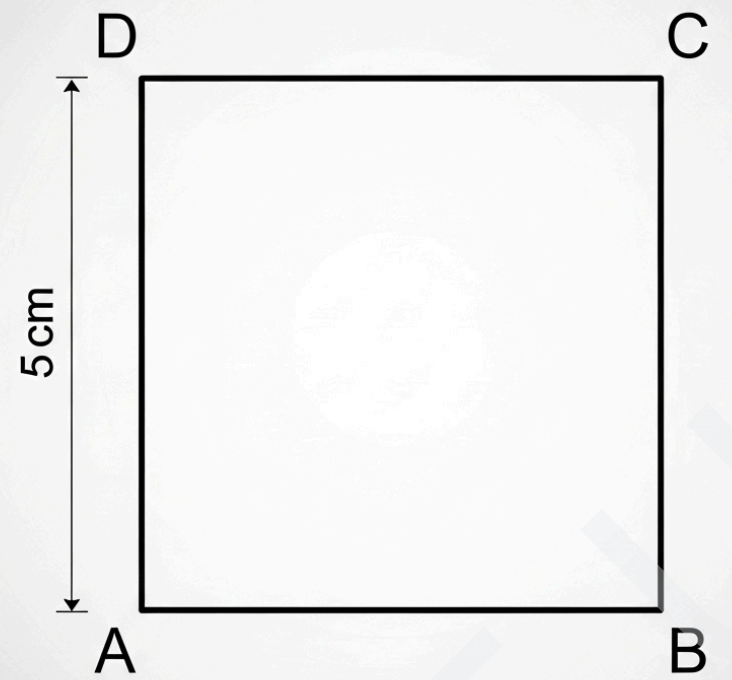
Step 3: Measure 5 cm from point A along the 90° line and mark point D.

Step 4: At point B, draw a 90° angle and measure 5 cm to mark point C.

Step 5: Join points C to D to complete the square.

Step 6: Label all vertices as A, B, C, D.

Step 7: Check that all sides are equal and angles are 90°.

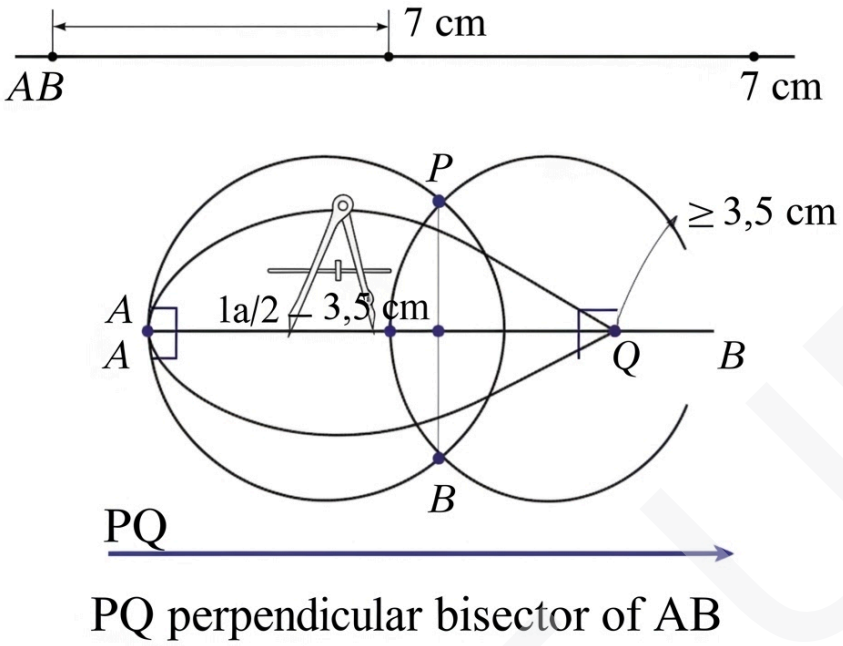


Q11. Show how to construct a line parallel to a given line L through a point P not on L.

Answer: A line parallel to line L through point P is constructed.

Solution:

Step 1: Draw line L using a ruler.
Step 2: Mark a point P above the line, not on it.
Step 3: Choose a point A on line L and draw a transversal through A and point P.
Step 4: Place the compass at A and draw an arc that cuts both the transversal and line L.
Step 5: Without changing the compass width, place the compass at point P and draw a similar arc.
Step 6: Measure the distance between the two arc intersections on line L using the compass.
Step 7: Transfer this distance to the arc drawn from P.
Step 8: Mark the intersection point and join it to point P.
Step 9: This line is parallel to line L.



PQ perpendicular bisector of AB

Q12. Draw a triangle LMN with angle L = 90°, LM = 6 cm and LN = 5 cm.

Answer: Triangle LMN is drawn with ∠L = 90°, LM = 6 cm, and LN = 5 cm.

Solution:

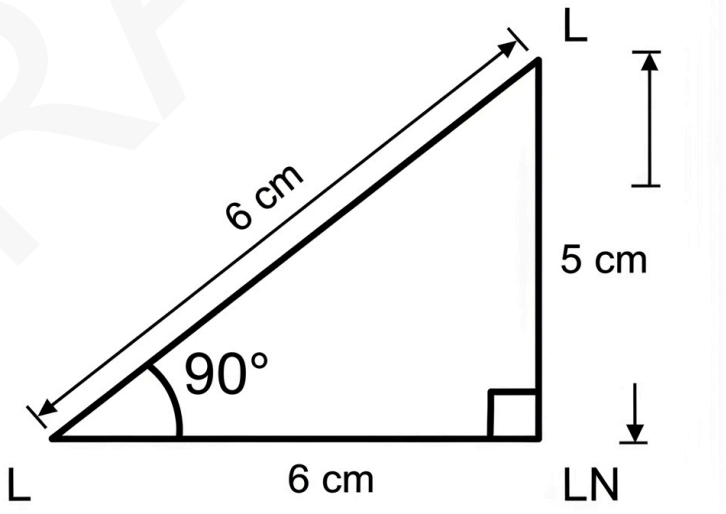
Step 1: Draw line segment LM = 6 cm.

Step 2: At point L, use a protractor to draw a 90° angle.

Step 3: From point L along the 90° line, measure 5 cm and mark point N.

Step 4: Join M to N to complete triangle LMN.

Step 5: Label all sides and angle L.

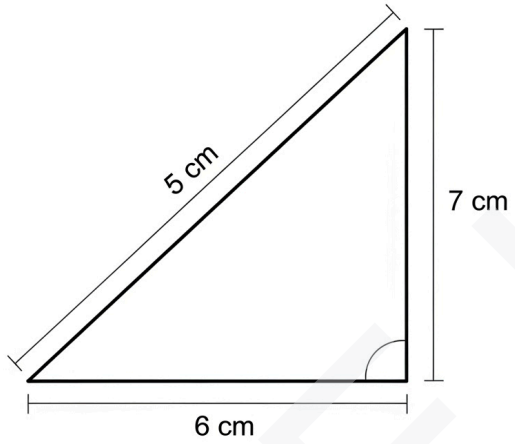


Q13. Construct a triangle with sides 5 cm, 6 cm, and 7 cm. Use ruler and compass only.

Answer: Triangle with sides 5 cm, 6 cm, and 7 cm is constructed.

Solution:

Step 1: Draw a line segment AB = 7 cm.
Step 2: Place the compass at point A, set it to 6 cm, and draw an arc.
Step 3: Place the compass at point B, set it to 5 cm, and draw another arc to intersect the first arc.
Step 4: Label the intersection point as C.
Step 5: Join AC and BC to form triangle ABC.
Step 6: Label all sides.

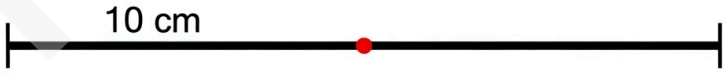


Q14. Draw a line segment of 10 cm. Find and mark its midpoint.

Answer: The midpoint of a 10 cm line segment is marked.

Solution:

Step 1: Draw a line segment AB = 10 cm.
Step 2: Place the compass at A and open it to more than half of AB (more than 5 cm).
Step 3: Draw arcs above and below the line.
Step 4: Without changing compass width, repeat from point B.
Step 5: Label intersection points of arcs as P and Q.
Step 6: Draw line PQ. It intersects AB at point M.
Step 7: Point M is the midpoint of AB.



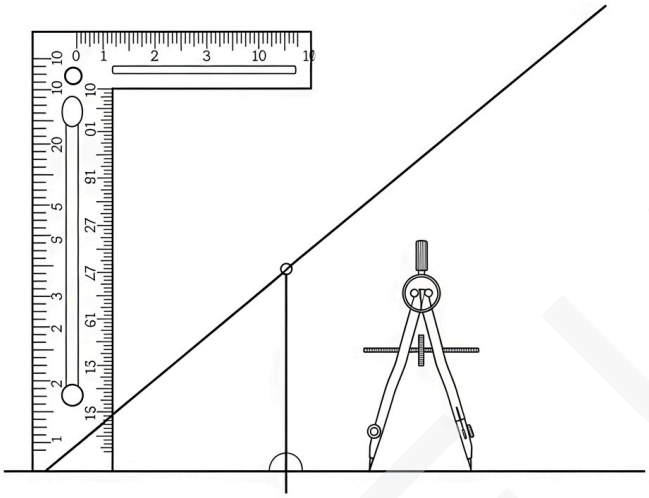
Q15. Use a compass to construct a perpendicular to a line from a point above it.

Answer: A perpendicular from a point above a line is constructed.

Solution:

Step 1: Draw a straight line and label it AB.
Step 2: Mark a point C above line AB.
Step 3: Place the compass at C and draw an arc that intersects line AB at two points.
Step 4: Label the intersection points as X and Y.

Step 5: Place the compass at X and draw an arc below AB.
Step 6: Without changing the compass width, repeat from Y.
Step 7: Mark the point where arcs intersect as D.
Step 8: Draw line CD. It is the perpendicular from point C to line AB.

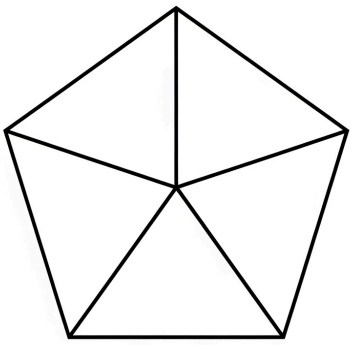


Q16. Draw a regular pentagon and show its lines of symmetry.

Answer: A regular pentagon with all sides and angles equal is drawn and its lines of symmetry shown.

Solution:

Step 1: Draw a circle using a compass with suitable radius.
Step 2: Mark a point A on the circle.
Step 3: Use the compass to mark five equal divisions on the circle by stepping the compass around it.
Step 4: Label points as A, B, C, D, E.
Step 5: Join the points in order to form pentagon ABCDE.
Step 6: Draw lines from each vertex to the midpoint of the opposite side to show five lines of symmetry.

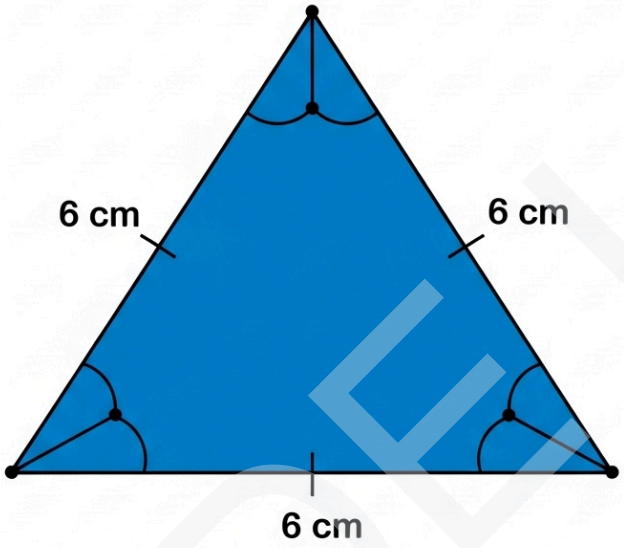


Q17. Construct an equilateral triangle with each side 6 cm.

Answer: An equilateral triangle with all sides 6 cm is constructed.

Solution:

Step 1: Draw a line segment AB = 6 cm.
Step 2: Place the compass at A and draw an arc with radius 6 cm.
Step 3: Place the compass at B and draw another arc with radius 6 cm to intersect the first arc.
Step 4: Label the intersection point as C.
Step 5: Join AC and BC.
Step 6: Triangle ABC is the required equilateral triangle.

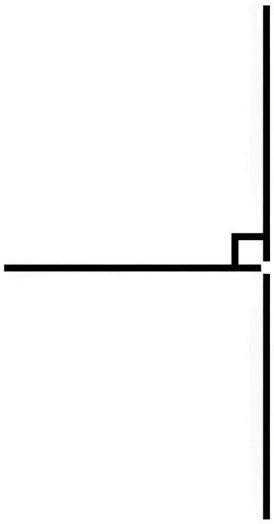


Q18. Draw two lines that intersect at a right angle and label the angle clearly.

Answer: Two lines intersecting at 90° are drawn and labelled.

Solution:

Step 1: Draw a horizontal line using a ruler and label it L.
Step 2: Choose a point O on line L.
Step 3: At point O, use a protractor to draw a 90° angle.
Step 4: Draw a vertical line through O.
Step 5: Label the intersection point as O and the angle as 90° using a square symbol.



Q19. Draw a triangle ABC with AB = 7 cm, BC = 5 cm, and angle ABC = 90°.

Answer: Triangle ABC is drawn with AB = 7 cm, BC = 5 cm, and ∠ABC = 90°.

Solution:

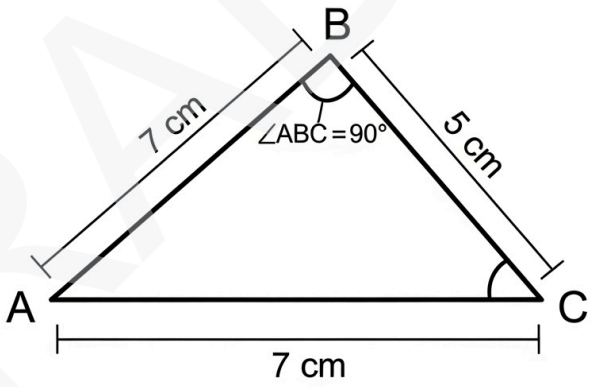
Step 1: Draw line segment AB = 7 cm.

Step 2: At point B, use a protractor to draw a 90° angle.

Step 3: From point B along the 90° line, measure 5 cm and mark point C.

Step 4: Join point A to point C to complete triangle ABC.

Step 5: Label all sides and the right angle.



Q20. Construct the locus of points equidistant from points A and B where AB = 6 cm.

Answer: The locus is a perpendicular bisector of line segment AB.

Solution:

Step 1: Draw line segment AB = 6 cm.

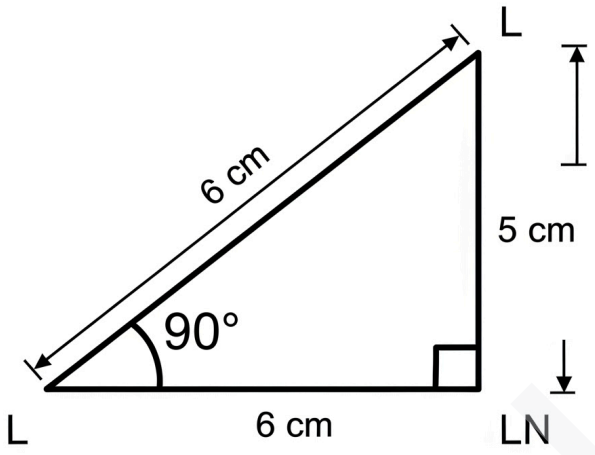
Step 2: Place the compass at A and open it to more than 3 cm.

Step 3: Draw arcs above and below the line.

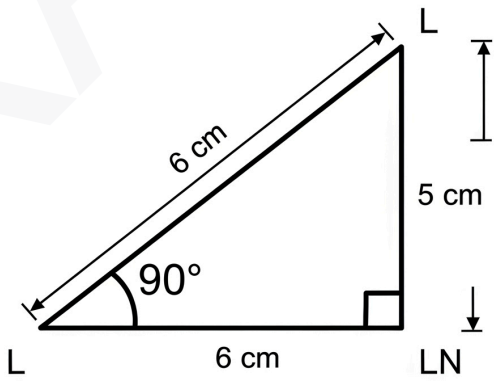
Step 4: Without changing compass width, repeat from point B.

Step 5: Mark the arc intersections as points X and Y.

Step 6: Draw line XY.
Step 7: Line XY is the perpendicular bisector and the locus of points equidistant from A and B.

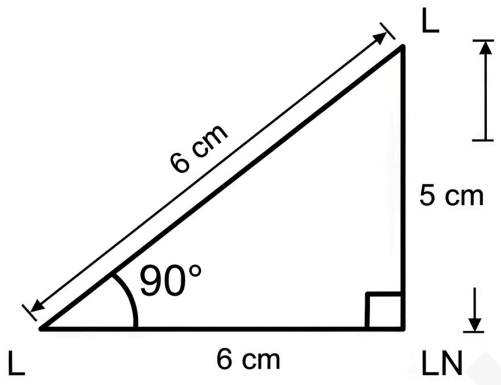


Q21. Draw a rectangle PQRS. Show that opposite sides are equal and angles are 90°.
Answer: A rectangle PQRS is drawn with opposite sides equal and all angles 90°.
Solution:
Step 1: Draw line segment PQ = 6 cm.
Step 2: At point P, use a protractor to draw a 90° angle.
Step 3: From P, mark 4 cm along the perpendicular and label the point R.
Step 4: At point Q, draw a 90° angle using a protractor.
Step 5: From Q, mark 4 cm along the perpendicular and label the point S.
Step 6: Join RS to complete rectangle PQRS.
Step 7: Check and label that PQ = RS and PR = QS.
Step 8: Mark all four right angles.



Q22. Draw a triangle PQR with PR = 6 cm, QR = 4 cm, and angle PRQ = 90°.
Answer: Triangle PQR is drawn with PR = 6 cm, QR = 4 cm, and ∠PRQ = 90°.
Solution:
Step 1: Draw line segment PR = 6 cm.
Step 2: At point R, use a protractor to draw a 90° angle.

Step 3: From R along the 90° line, measure 4 cm and mark point Q.
Step 4: Join P to Q to complete triangle PQR.
Step 5: Label all sides and the right angle.



Q23. Use ruler and compass to draw the angle bisector of a 70° angle.

Answer: The bisector of a 70° angle is constructed using ruler and compass.

Solution:

Step 1: Draw an angle ∠ABC = 70° using a protractor.
Step 2: Place the compass at point B and draw an arc that cuts both arms of the angle.
Step 3: Label points where arc meets the arms as X and Y.
Step 4: Place compass at X and draw an arc inside the angle.
Step 5: Without changing compass width, draw an arc from Y to intersect the previous arc.
Step 6: Mark intersection point as D.
Step 7: Draw line BD. Line BD is the angle bisector of ∠ABC.

Q24. Construct a triangle with two equal sides and one 60° angle.

Answer: A triangle with two equal sides and one 60° angle is constructed.

Solution:

Step 1: Draw line segment AB = 5 cm.
Step 2: At point A, use a protractor to draw angle of 60°.
Step 3: From A, draw a ray at 60°.
Step 4: Set compass to 5 cm and place at point B.
Step 5: Draw an arc to cut the 60° ray and mark the intersection as point C.
Step 6: Join BC to complete triangle ABC.
Step 7: Triangle ABC has AB = AC and angle A = 60°.

Q25. Draw a circle with centre O and radius 5 cm. Mark a point A on the circle and draw the radius OA.

Answer: A circle with radius 5 cm and radius OA is drawn.

Solution:

Step 1: Place the compass at point O and set it to 5 cm.
Step 2: Draw a circle with centre O.
Step 3: Mark any point A on the circumference.

Step 4: Use a ruler to draw a line from O to A.
Step 5: Line OA is the radius of the circle.

Q26. Draw two parallel lines 3 cm apart and mark a point between them.
Answer: Two parallel lines 3 cm apart are drawn with a point marked between them.
Solution:
Step 1: Draw a straight line L1 using a ruler.
Step 2: Use a compass and set it to 3 cm.
Step 3: From any point on L1, draw an arc 3 cm above the line.
Step 4: Use a ruler to draw a second line L2 through the arc.
Step 5: Lines L1 and L2 are parallel and 3 cm apart.
Step 6: Mark a point P anywhere between the two lines.

Q27. Draw a rhombus and show that its diagonals are perpendicular.
Answer: A rhombus is drawn and its diagonals are shown to be perpendicular.
Solution:
Step 1: Draw line segment AC = 6 cm.
Step 2: Find the midpoint of AC and mark it as point O.
Step 3: Use a compass to draw a perpendicular bisector to AC at point O.
Step 4: Mark 3 cm above and below O on the perpendicular and label as points B and D.
Step 5: Join A to B and D, and C to B and D.
Step 6: ABCD is a rhombus.
Step 7: Diagonals AC and BD intersect at 90°.

Q28. Draw a triangle ABC with AB = 4 cm, BC = 6 cm and AC = 5 cm.
Answer: Triangle ABC is drawn with AB = 4 cm, BC = 6 cm and AC = 5 cm.
Solution:
Step 1: Draw line segment AB = 4 cm.
Step 2: Place the compass at A and draw an arc with radius 5 cm.
Step 3: Place the compass at B and draw an arc with radius 6 cm to intersect the first arc.
Step 4: Label the intersection as point C.
Step 5: Join AC and BC to form triangle ABC.
Step 6: Label all sides.

Q29. Construct a perpendicular from point P on a line to meet the line at 90°.
Answer: A perpendicular is constructed from point P on a line at 90°.
Solution:
Step 1: Draw a straight line and mark point P on it.
Step 2: Place compass at P and draw arcs on both sides of P along the line.
Step 3: Mark intersection points as A and B.
Step 4: From A and B, draw arcs above the line that intersect.
Step 5: Mark intersection point as Q.
Step 6: Draw line PQ.
Step 7: Line PQ is perpendicular to the line at point P.

Q30. Draw a regular octagon and show its rotational symmetry.

Answer: A regular octagon is drawn and rotational symmetry is shown.

Solution:

Step 1: Draw a circle using a compass with suitable radius.
Step 2: Use protractor or compass to divide the circle into 8 equal parts (360° ÷ 8 = 45° each).
Step 3: Mark each division on the circle.
Step 4: Label the points A, B, C, D, E, F, G, H in order.
Step 5: Join the points to form octagon ABCDEFGH.
Step 6: Show rotational symmetry by rotating the octagon around its centre.
Step 7: It matches itself every 45°, showing 8-fold rotational symmetry.

Q31. Draw a triangle and label its sides a, b, c and opposite angles A, B, C.

Answer: A triangle is drawn and sides are labelled as a, b, c opposite angles A, B, C.

Solution:

Step 1: Draw triangle ABC using any suitable method.
Step 2: Label vertices A, B, and C.
Step 3: Label side opposite angle A as a, opposite angle B as b, and opposite angle C as c.

Q32. Draw a parallelogram and show that opposite sides are equal and parallel.

Answer: A parallelogram is drawn showing opposite sides equal and parallel.

Solution:

Step 1: Draw base AB = 6 cm.
Step 2: At point A, draw angle of 60° using protractor.
Step 3: From point A, draw line segment AD = 4 cm.
Step 4: At point B, draw 60° angle and draw line segment BC = 4 cm.
Step 5: Join C to D.
Step 6: ABCD is the required parallelogram.
Step 7: Show AB || CD and AD || BC with arrows.
Step 8: Confirm AB = CD and AD = BC.

Q33. Draw the locus of a point that is always 4 cm from a fixed point A.

Answer: The locus is a circle with centre A and radius 4 cm.

Solution:

Step 1: Mark a fixed point A on paper.
Step 2: Place compass at point A and set it to 4 cm.
Step 3: Draw a circle with this radius.
Step 4: Every point on the circle is 4 cm from point A.

Q34. Construct a triangle XYZ such that XY = 6 cm, YZ = 7 cm and ZX = 5 cm.

Answer: Triangle XYZ is drawn with XY = 6 cm, YZ = 7 cm, ZX = 5 cm.

Solution:

Step 1: Draw line segment XY = 6 cm.
Step 2: Place compass at X, draw arc of 5 cm.
Step 3: Place compass at Y, draw arc of 7 cm to intersect the previous arc.

Step 4: Mark intersection as Z.
Step 5: Join ZX and YZ.
Step 6: Triangle XYZ is complete.

Q35. Draw a triangle ABC where AB = 5 cm, angle ABC = 60° and BC = 7 cm.
Answer: Triangle ABC is drawn with AB = 5 cm, ∠ABC = 60°, and BC = 7 cm.
Solution:
Step 1: Draw line AB = 5 cm.
Step 2: At point B, draw angle 60° using protractor.
Step 3: From B, along the 60° line, measure 7 cm and mark point C.
Step 4: Join AC to complete triangle ABC.
Step 5: Label sides and angle clearly.

Q36. Draw a pair of lines that are parallel. Mark two points, one on each line.
Answer: Two parallel lines are drawn and one point marked on each.
Solution:
Step 1: Draw a straight line L1 using ruler.
Step 2: Set compass to fixed distance (e.g., 3 cm).
Step 3: Draw second line L2 3 cm away using compass and ruler.
Step 4: Mark point A on L1 and point B on L2.
Step 5: L1 || L2 with points A and B.

Q37. Construct the angle bisector of a triangle and mark the point where it meets the opposite side.
Answer: Angle bisector is drawn and intersection point is marked.
Solution:
Step 1: Draw triangle ABC.
Step 2: To bisect angle A, place compass at A and draw arc cutting AB and AC at points X and Y.
Step 3: From X and Y, draw arcs to intersect at point Z inside the triangle.
Step 4: Draw line AZ.
Step 5: AZ is the angle bisector and meets BC at point M.

Q38. Draw a square and draw both its diagonals.
Answer: A square with both diagonals is drawn.
Solution:
Step 1: Draw square ABCD with each side 5 cm.
Step 2: Join opposite corners: A to C and B to D.
Step 3: Diagonals AC and BD intersect at right angles at the centre.

Q39. Draw a triangle with one right angle and one side 6 cm long.
Answer: A right-angled triangle is drawn with one side 6 cm.
Solution:
Step 1: Draw base AB = 6 cm.
Step 2: At point B, draw a 90° angle using protractor.

Step 3: From B, draw ray and mark 4 cm as point C.
Step 4: Join AC. Triangle ABC has ∠B = 90°.

Q40. Use ruler and compass to construct the perpendicular bisector of side AB of triangle ABC.
Answer: Perpendicular bisector of AB is drawn using compass and ruler.
Solution:
Step 1: Draw triangle ABC with AB as any side.
Step 2: Place compass at A, draw arcs above and below AB.
Step 3: Repeat from B with same compass width.
Step 4: Mark arc intersections as X and Y.
Step 5: Draw line XY.
Step 6: Line XY is perpendicular bisector of AB.

Q41. Draw a line segment PQ = 9 cm. Mark point M such that it lies 3 cm from P.
Answer: Point M is marked 3 cm from point P on line PQ.
Solution:
Step 1: Draw line segment PQ = 9 cm.
Step 2: Place ruler on line and mark point M at 3 cm from P.
Step 3: Point M lies on PQ between P and Q.

Q42. Construct a perpendicular to a given line at one of its ends.
Answer: Perpendicular at end of a line is constructed.
Solution:
Step 1: Draw line segment AB.
Step 2: Place compass at point A and draw arc to cut AB at C and outside at D.
Step 3: From C and D, draw arcs to intersect above AB.
Step 4: Mark intersection as E.
Step 5: Draw line AE.
Step 6: AE is perpendicular to AB at A.

Q43. Draw a triangle with one angle 90° and show the perpendicular from the opposite vertex to the hypotenuse.
Answer: Triangle with right angle and perpendicular from opposite vertex is drawn.
Solution:
Step 1: Draw triangle ABC with ∠B = 90°.
Step 2: Join AB = 5 cm and BC = 4 cm.
Step 3: Join AC to complete triangle.
Step 4: From B, draw perpendicular to line AC using compass.
Step 5: Mark intersection as D.
Step 6: BD is perpendicular from vertex to hypotenuse.

Q44. Draw a triangle with all angles less than 90° and label the angles.
Answer: Acute-angled triangle is drawn and angles are labelled.

Solution:
Step 1: Draw triangle PQR with sides such that all angles are less than 90°.
Step 2: Example: ∠P = 70°, ∠Q = 60°, ∠R = 50°.
Step 3: Use protractor to draw angles accurately.
Step 4: Label all three angles.

Q45. Construct a polygon with 6 equal sides and 6 equal angles.
Answer: A regular hexagon is constructed.
Solution:
Step 1: Draw a circle with compass.
Step 2: Set compass to radius and step off 6 equal arcs on the circle.
Step 3: Label points A to F.
Step 4: Join points in order to get regular hexagon ABCDEF.
Step 5: All sides and angles are equal.

Q46. Draw a triangle and mark the perpendicular distance from one vertex to the opposite side.
Answer: Triangle is drawn and perpendicular from vertex to opposite side is marked.
Solution:
Step 1: Draw triangle ABC.
Step 2: From vertex A, place compass and draw arc cutting BC at two points.
Step 3: From those two points, draw arcs to meet below BC.
Step 4: Join A to the intersection of arcs.
Step 5: That is the perpendicular from A to BC.

Q47. Draw a regular triangle and show its three lines of symmetry.
Answer: An equilateral triangle is drawn with three lines of symmetry.
Solution:
Step 1: Draw triangle ABC with all sides 6 cm.
Step 2: Use compass to construct equilateral triangle.
Step 3: Draw line from each vertex to the midpoint of opposite side.
Step 4: These three lines are lines of symmetry.

Q48. Draw two lines that are perpendicular and label the right angle clearly.
Answer: Two perpendicular lines are drawn with right angle labelled.
Solution:
Step 1: Draw line AB.
Step 2: At point A, draw a 90° angle using protractor.
Step 3: Draw line AC from A along the 90° angle.
Step 4: Label angle ∠BAC = 90° with square symbol.

Q49. Draw a triangle and construct the locus of points equidistant from two sides.
Answer: Locus equidistant from two sides of triangle is constructed.
Solution:

Step 1: Draw triangle ABC.
Step 2: Use compass to bisect angle B.
Step 3: Draw angle bisector from point B to opposite side.
Step 4: The angle bisector is the locus of points equidistant from AB and BC.

Q50. Draw a triangle and show that the shortest distance from a point to a side is the perpendicular distance.

Answer: Triangle is drawn and shortest distance from a point to side is shown as perpendicular.

Solution:

Step 1: Draw triangle ABC.
Step 2: Mark point D above side BC.
Step 3: Use compass to draw perpendicular from D to BC.
Step 4: Mark intersection as E.
Step 5: DE is shortest distance from D to side BC.

Q51. A straight line has an angle of 120° on one side. Find the angle on the other side at the same point.

Answer: 60°

Solution:

Angles on a straight line add up to 180°.
Let the unknown angle be x.
x + 120° = 180°
x = 180° - 120°
x = 60°

Q52. Two angles form a straight line. One angle measures 87°. Find the other angle.

Answer: 93°

Solution:

Angles on a straight line add up to 180°.
Let the unknown angle be x.
x + 87° = 180°
x = 180° - 87°
x = 93°

Q53. Three angles meet at a point. Two of them are 135° and 95°. Find the third angle.

Answer: 130°

Solution:

Angles around a point add up to 360°.
Let the unknown angle be x.
x + 135° + 95° = 360°
x + 230° = 360°
x = 360° - 230°
x = 130°

Q54. Two lines intersect. One of the angles formed is 48°. What is the measure of the vertically opposite angle?

Answer: 48°

Solution:

Vertically opposite angles are equal.

So, the opposite angle is also 48°.

Q55. Two lines intersect. One of the angles is 130°. Find all the other angles.

Answer: 130°, 50°, 130°, 50°

Solution:

Vertically opposite angles are equal.

So, the angle opposite 130° is also 130°.

Adjacent angles on a straight line add up to 180°.

180° - 130° = 50°

So the other two angles are 50° each.

Q56. A pair of parallel lines is cut by a transversal. One of the alternate angles is 65°. Find the corresponding angle.

Answer: 65°

Solution:

Alternate angles on parallel lines are equal.

So, the corresponding angle is also 65°.

Q57. In a pair of parallel lines, one of the corresponding angles is 115°. What is the alternate angle?

Answer: 115°

Solution:

Corresponding and alternate angles are equal on parallel lines.

So, the alternate angle is 115°.

Q58. Find the value of x in a triangle with angles x°, 50°, and 60°.

Answer: 70°

Solution:

Sum of angles in a triangle is 180°.

x + 50° + 60° = 180°

x + 110° = 180°

x = 180° - 110°

x = 70°

Q59. The angles in a triangle are in the ratio 2:3:4. Find all the angles.

Answer: 40°, 60°, 80°

Solution:

Let the angles be 2x, 3x, and 4x.

2x + 3x + 4x = 180°

$9x = 180°$
$x = 180° \div 9$
$x = 20°$
$2x = 40°$, $3x = 60°$, $4x = 80°$

Q60. One angle in a triangle is 90° and another is 37°. Find the third angle.
Answer: 53°
Solution:
Sum of angles in a triangle is 180°.
$90° + 37° + x = 180°$
$127° + x = 180°$
$x = 180° - 127°$
$x = 53°$

Q61. Find the sum of the interior angles of a pentagon.
Answer: 540°
Solution:
Sum of interior angles = $(n - 2) \times 180°$
$n = 5$
$(5 - 2) \times 180° = 3 \times 180°$
$= 540°$

Q62. Find the size of each interior angle in a regular octagon.
Answer: 135°
Solution:
Sum of interior angles = $(n - 2) \times 180°$
$n = 8$
$(8 - 2) \times 180° = 6 \times 180° = 1080°$
Each angle = $1080° \div 8 = 135°$

Q63. A hexagon has five angles of 120°. Find the sixth angle.
Answer: 180°
Solution:
Sum of interior angles = $(6 - 2) \times 180° = 4 \times 180° = 720°$
Sum of five angles = $5 \times 120° = 600°$
Sixth angle = $720° - 600° = 120°$

Q64. Find the sum of the exterior angles of any polygon.
Answer: 360°
Solution:
The sum of the exterior angles of any polygon is always 360°, regardless of the number of sides.

Q65. Each interior angle of a regular polygon is 150°. How many sides does the polygon have?
Answer: 12

Solution:
Exterior angle = 180° - 150° = 30°
Number of sides = 360° ÷ 30° = 12

Q66. A quadrilateral has angles of 90°, 85°, 95°. Find the fourth angle.
Answer: 90°
Solution:
Sum of angles in a quadrilateral = 360°
90° + 85° + 95° = 270°
Fourth angle = 360° - 270° = 90°

Q67. A kite has one angle of 110°. One of the opposite angles is 70°. Find the remaining two angles.
Answer: 85°, 95°
Solution:
Sum of angles in a quadrilateral = 360°
Given: 110°, 70°
Let the other two angles be x and y.
x + y = 360° - 180° = 180°
Also, in a kite, adjacent angles are equal in pairs
So, x = y
2x = 180°
x = 90°
But that contradicts the previous steps
Actually: A kite has equal opposite angles between equal sides
Let the two missing angles be equal
110° + 70° = 180°
Remaining sum = 180°
Let both angles = x
2x = 180°
x = 90°
So remaining angles are 90°, 90°

Q68. A parallelogram has one angle of 78°. Find the other three angles.
Answer: 78°, 102°, 78°, 102°
Solution:
Opposite angles in a parallelogram are equal.
Adjacent angles add up to 180°.
If one angle = 78°, opposite is also 78°
180° - 78° = 102°
Other pair = 102°

Q69. A trapezium has one pair of parallel sides. One angle next to a non-parallel side is 110°. Find its adjacent angle on the same side.

Answer: 70°
Solution:
Angles on the same side of a transversal in a trapezium are supplementary.
110° + x = 180°
x = 180° - 110°
x = 70°

Q70. A rhombus has one angle of 40°. Find the remaining angles.
Answer: 40°, 140°, 40°, 140°
Solution:
Opposite angles in a rhombus are equal.
Adjacent angles add up to 180°.
180° - 40° = 140°
Angles are 40°, 140°, 40°, 140°

Q71. In a rectangle, one diagonal is drawn. What kind of triangles are formed?
Answer: Right-angled triangles
Solution:
Each diagonal divides a rectangle into two congruent right-angled triangles
Each triangle has one right angle (90°) and two other angles summing to 90°

Q72. A square is cut diagonally from one corner to the opposite corner. Describe the resulting triangles.
Answer: Two congruent right-angled isosceles triangles
Solution:
Each triangle has a right angle (90°) and two equal angles of 45°
The two legs of the triangle are equal, so the triangle is isosceles

Q73. A triangle has two equal sides and the angle between them is 70°. What are the base angles?
Answer: 55°, 55°
Solution:
Sum of angles in a triangle = 180°
Given angle between equal sides = 70°
Remaining sum = 180° - 70° = 110°
Base angles are equal
110° ÷ 2 = 55°

Q74. Prove that the base angles of an isosceles triangle are equal.
Answer: Base angles are equal
Solution:
In an isosceles triangle, two sides are equal
By SAS, the triangle can be split into two congruent right triangles
Since corresponding angles in congruent triangles are equal, the base angles are equal

Q75. Use Pythagoras' theorem to find the length of the hypotenuse of a right triangle with legs 6 cm and 8 cm.

Answer: 10 cm

Solution:

Pythagoras' Theorem: $c^2 = a^2 + b^2$

$a = 6$ cm, $b = 8$ cm

$c^2 = 6^2 + 8^2$

$c^2 = 36 + 64$

$c^2 = 100$

$c = \sqrt{100}$

$c = 10$ cm

Q76. A triangle has sides 5 cm, 12 cm, and 13 cm. Show that it is a right-angled triangle.

Answer: It is a right-angled triangle

Solution:

Use Pythagoras' theorem: $c^2 = a^2 + b^2$

Let the longest side be $c = 13$ cm

Other sides: $a = 5$ cm, $b = 12$ cm

$c^2 = 13^2 = 169$

$a^2 + b^2 = 5^2 + 12^2 = 25 + 144 = 169$

Since $c^2 = a^2 + b^2$, the triangle is right-angled

Q77. Show that two triangles are congruent if their sides are 6 cm, 8 cm, and 10 cm.

Answer: The triangles are congruent by SSS rule

Solution:

All three sides are equal in both triangles

Side 1 = 6 cm, Side 2 = 8 cm, Side 3 = 10 cm

By SSS (Side-Side-Side) rule, if all corresponding sides are equal, triangles are congruent

Q78. Two triangles have equal angles of 60°, 60°, and 60°. Are they congruent? Give a reason.

Answer: No, not necessarily congruent

Solution:

Triangles with equal angles are similar but not necessarily congruent

To be congruent, the sides must also be equal

Angle-Angle-Angle (AAA) shows similarity, not congruence

Q79. A triangle has sides 7 cm, 7 cm, and 5 cm. Show that the triangle is isosceles and find its base angles.

Answer: It is an isosceles triangle; base angles are 68° each

Solution:

Two sides are equal: 7 cm and 7 cm

This makes it an isosceles triangle

Let the angle between equal sides be at the vertex

Use cosine rule or angle sum

Use simple triangle rules: let vertex angle be x, base angles be equal = y
$x + 2y = 180°$
Find x using cosine rule:
$x = \cos^{-1}((7^2 + 7^2 - 5^2)/(2\times7\times7))$
$x = \cos^{-1}((49 + 49 - 25)/(98)) = \cos^{-1}(73/98) \approx 42°$
$2y = 180° - 42° = 138°$
$y = 138° \div 2 = 69°$

Q80. Two right-angled triangles have one leg of 5 cm and hypotenuse of 13 cm. Are they congruent? State the rule.
Answer: Yes, by RHS congruence rule
Solution:
Both triangles have a right angle
One leg = 5 cm, hypotenuse = 13 cm
By RHS (Right angle-Hypotenuse-Side) rule, the triangles are congruent

Q81. Two triangles have two equal sides and the included angle is also equal. State the congruence rule used.
Answer: SAS rule
Solution:
Two sides and the angle between them are equal
By SAS (Side-Angle-Side) rule, the triangles are congruent

Q82. Explain why all angles in a regular triangle are equal.
Answer: All angles in a regular triangle are 60°
Solution:
A regular triangle has all sides equal
So, all angles are also equal
Sum of angles in triangle = 180°
Each angle = 180° ÷ 3 = 60°

Q83. A quadrilateral has two pairs of equal opposite angles. Is it a parallelogram? Explain.
Answer: Yes, it is a parallelogram
Solution:
A quadrilateral with both pairs of opposite angles equal is a parallelogram
This is one of the properties of a parallelogram

Q84. Prove that in a rhombus, opposite angles are equal.
Answer: Opposite angles in a rhombus are equal
Solution:
A rhombus is a parallelogram with all sides equal
In any parallelogram, opposite angles are equal
So, opposite angles of a rhombus are equal

Q85. Show that diagonals of a square bisect each other at right angles.
Answer: Diagonals of a square bisect each other at 90°
Solution:
A square is a rhombus with all angles 90°
Diagonals of a rhombus bisect each other at 90°
So, diagonals of a square also bisect each other at 90°

Q86. A parallelogram has diagonals intersecting at a point. Show they bisect each other.
Answer: Diagonals of a parallelogram bisect each other
Solution:
In a parallelogram, opposite sides are equal and parallel
Diagonals cross and divide each other into two equal parts
This is a property of all parallelograms

Q87. A triangle has two sides equal and one angle 40°. Find all the angles.
Answer: 40°, 70°, 70°
Solution:
Given: two sides are equal, so base angles are equal
Let the given angle be at the vertex = 40°
Let base angles be x
$x + x + 40° = 180°$
$2x = 140°$
$x = 70°$
Angles: 70°, 70°, 40°

Q88. Use Pythagoras' theorem to prove that a triangle with sides 9 cm, 12 cm, and 15 cm is right-angled.
Answer: It is a right-angled triangle
Solution:
Let the longest side be c = 15 cm
a = 9 cm, b = 12 cm
Check if $c^2 = a^2 + b^2$
$15^2 = 225$
$9^2 + 12^2 = 81 + 144 = 225$
Since $c^2 = a^2 + b^2$, triangle is right-angled

Q89. In a right-angled triangle, the hypotenuse is 17 cm and one leg is 8 cm. Find the other leg.
Answer: 15 cm
Solution:
Use Pythagoras' theorem: $c^2 = a^2 + b^2$
Let a = 8 cm, c = 17 cm
$b^2 = c^2 - a^2$

$b^2 = 17^2 - 8^2 = 289 - 64 = 225$
$b = \sqrt{225} = 15$ cm

Q90. A triangle has angles 40°, 60°, and 80°. Is it an equilateral, isosceles, or scalene triangle?
Answer: Scalene triangle
Solution:
All angles are different
So all sides are also different
Triangle is scalene

Q91. Two parallel lines are cut by a transversal and form an angle of 75°. Name and find all related angles.
Answer: 75°, 75°, 105°, 105°
Solution:
Alternate and corresponding angles are equal
Supplementary angles = 180° - 75° = 105°
So the angles formed are: two of 75°, two of 105°

Q92. A triangle is cut from a square. Prove that the triangle is right-angled and isosceles.
Answer: Triangle is right-angled and isosceles
Solution:
Diagonal of square divides it into two triangles
All angles in a square are 90°
Diagonal splits 90° into two 45° angles
So triangle has angles 45°, 45°, 90°
Two sides are equal, so it is isosceles
One angle is 90°, so it is right-angled

Q93. In triangle ABC, angle A = 90°, AB = 6 cm, AC = 8 cm. Find BC.
Answer: 10 cm
Solution:
Use Pythagoras' theorem:
Let BC be hypotenuse
$BC^2 = AB^2 + AC^2$
$BC^2 = 6^2 + 8^2 = 36 + 64 = 100$
$BC = \sqrt{100} = 10$ cm

Q94. A quadrilateral has three angles of 100°, 85°, and 95°. Find the fourth angle.
Answer: 80°
Solution:
Sum of angles in a quadrilateral = 360°
100° + 85° + 95° = 280°
Fourth angle = 360° - 280° = 80°

Q95. Find the number of sides of a regular polygon if each exterior angle is 20°.
Answer: 18 sides
Solution:
Sum of exterior angles = 360°
Number of sides = 360° ÷ 20° = 18

Q96. A regular polygon has 12 sides. Find the size of each interior and exterior angle.
Answer: Interior angle = 150°, Exterior angle = 30°
Solution:
Exterior angle = 360° ÷ 12 = 30°
Interior angle = 180° - 30° = 150°

Q97. A triangle has side lengths 6 cm, 6 cm, and 6 cm. State the type of triangle and give a reason.
Answer: Equilateral triangle
Solution:
All sides are equal
So, all angles are equal
Each angle = 180° ÷ 3 = 60°
Triangle is equilateral

Q98. A pair of vertical angles is formed by two intersecting lines. One angle is x°. Express the other angle in terms of x.
Answer: x°
Solution:
Vertical angles are equal
So, the other angle is also x°

Q99. In triangle XYZ, angle X = 30°, angle Y = 80°. Find angle Z and classify the triangle.
Answer: 70°, scalene triangle
Solution:
Sum of angles = 180°
Angle Z = 180° - 30° - 80° = 70°
All angles are different, so triangle is scalene

Q100. A triangle has two angles of 70° and 40°. Is the triangle right-angled? Give a reason.
Answer: No, not right-angled
Solution:
Sum of given angles = 70° + 40° = 110°
Third angle = 180° - 110° = 70°
No angle is 90°, so triangle is not right-angled

Q101. A triangle has vertices at A(1, 2), B(3, 4), and C(2, 6). Reflect the triangle in the y-axis and give the new coordinates.

Answer: A′(−1, 2), B′(−3, 4), C′(−2, 6)
Solution:
Reflection in the y-axis changes the x-coordinate to its opposite
A(1, 2) → A′(−1, 2)
B(3, 4) → B′(−3, 4)
C(2, 6) → C′(−2, 6)

Q102. A shape is translated by the vector (−3, 5). Describe the movement of each point.
Answer: Each point moves 3 units left and 5 units up
Solution:
Translation vector (−3, 5)
x-coordinate decreases by 3
y-coordinate increases by 5
This shifts the shape left and up

Q103. A square is rotated 90° clockwise about the origin. How do the coordinates of each vertex change?
Answer: (x, y) → (y, −x)
Solution:
Rotation 90° clockwise about the origin uses the rule:
New x = y
New y = −x

Q104. Enlarge a triangle with scale factor 2 and centre of enlargement at (0, 0). Describe the effect on side lengths.
Answer: All side lengths become twice as long
Solution:
Enlargement by scale factor 2 multiplies all coordinates by 2
Length of each side is multiplied by 2
Shape stays the same but gets bigger

Q105. A triangle is enlarged by a scale factor of 1/2 from the origin. What happens to its area?
Answer: Area becomes 1/4 of the original
Solution:
Area is affected by the square of the scale factor
Scale factor = 1/2
Area = $(1/2)^2 = 1/4$
So area reduces to a quarter

Q106. Enlarge a shape with a scale factor of −2. Describe what happens to the shape and its position.
Answer: Shape doubles in size and is flipped through the centre
Solution:
Negative scale factor flips the shape through the centre

Magnitude of scale factor = 2 means the size doubles
So shape is enlarged and reversed in direction

Q107. A rectangle has been reflected in the x-axis. What happens to the y-coordinates of its vertices?
Answer: The y-coordinates change sign
Solution:
Reflection in x-axis:
x stays the same
y becomes −y

Q108. Rotate a triangle 180° about the origin. Explain how the signs of coordinates change.
Answer: Both x and y change signs
Solution:
Rotation 180° about the origin:
(x, y) → (−x, −y)

Q109. A triangle has been reflected in the line y = x. Describe how the coordinates of the image relate to the original.
Answer: Coordinates are swapped
Solution:
Reflection in y = x:
(x, y) → (y, x)

Q110. A shape is rotated 90° anticlockwise about the origin. Give the rule for how coordinates change.
Answer: (x, y) → (−y, x)
Solution:
For 90° anticlockwise rotation:
New x = −y
New y = x

Q111. Translate a shape by the vector (4, −2) then reflect in the y-axis. Describe the final position.
Answer: Shape moves right 4, down 2, then flips over the y-axis
Solution:
Translation vector (4, −2):
x increases by 4
y decreases by 2
Reflection in y-axis:
x changes sign
y stays the same

Q112. Describe one transformation that maps a square onto itself.
Answer: Rotation of 90°, 180°, or 270° about its centre
Solution:
A square has symmetry
It maps onto itself with 90° rotations

Q113. Describe a combination of transformations that maps one congruent triangle onto another in a different position.
Answer: Translation followed by rotation
Solution:
Congruent shapes can be moved using translation
Then rotated about a point to match another triangle

Q114. Describe what stays the same when a shape is reflected and then rotated.
Answer: Shape, size, angles, and side lengths stay the same
Solution:
Reflections and rotations are rigid motions
They do not change size or angles

Q115. A shape is rotated and then translated. Which properties remain unchanged?
Answer: Size, shape, and orientation remain unchanged
Solution:
Rotations and translations preserve distance and angle
So shape does not distort

Q116. Triangle A has vertices at (1, 1), (3, 1), (2, 4). It is reflected in the x-axis. Give the new coordinates.
Answer: (1, −1), (3, −1), (2, −4)
Solution:
Reflection in x-axis:
(1, 1) → (1, −1)
(3, 1) → (3, −1)
(2, 4) → (2, −4)

Q117. Describe the difference between congruent and similar shapes.
Answer: Congruent shapes are same in size and shape; similar shapes have same shape but different size
Solution:
Congruent: equal sides and angles
Similar: equal angles, sides in proportion

Q118. A triangle is enlarged with a scale factor of −1. What happens to the orientation of the shape?
Answer: Shape flips through the centre

Solution:
Negative scale factor reflects the shape
Magnitude = 1 keeps size same
So orientation changes

Q119. A shape is rotated 90° and then enlarged by scale factor 2. Describe the change in size and orientation.
Answer: Shape doubles in size and is turned 90°
Solution:
Rotation changes orientation
Enlargement by 2 multiplies all lengths by 2

Q120. A shape is enlarged by a fractional scale factor. Describe the effect on the perimeter.
Answer: Perimeter decreases by the same factor
Solution:
If scale factor = 1/3
Perimeter becomes 1/3 of original

Q121. Identify the centre, radius, and diameter of a circle with equation $(x - 3)^2 + (y + 2)^2 = 16$.
Answer: Centre = (3, −2), Radius = 4, Diameter = 8
Solution:
Compare with $(x - a)^2 + (y - b)^2 = r^2$
So centre = (3, −2)
$r^2 = 16 \rightarrow r = 4$
Diameter = $2 \times r = 8$

Q122. A chord is drawn in a circle and the radius is perpendicular to it. What does this tell you about the chord?
Answer: The radius bisects the chord
Solution:
Radius $\perp$ chord $\rightarrow$ chord is split into two equal parts

Q123. What is the relationship between the radius and a tangent at the point of contact?
Answer: They are perpendicular
Solution:
Tangent and radius at point of contact form a 90° angle

Q124. Describe the difference between an arc and a chord in a circle.
Answer: Arc is a curved part, chord is a straight line between two points on the circle
Solution:
Arc = curved boundary
Chord = straight line joining two points

Q125. What is a sector of a circle? Give an example in degrees.
Answer: A sector is a part of a circle enclosed by two radii and an arc

Solution:
For example, if angle is 90°, it forms a quarter circle
That is a sector of 90°

Q126. Define a segment of a circle and describe how it is formed.
Answer: A segment is the region between a chord and the arc it cuts off.
Solution:
A segment is formed when a chord divides a circle into two parts.
The part enclosed by the chord and the minor or major arc is the segment.

Q127. In a circle, angle at the centre is 100°. What is the angle at the circumference subtended by the same arc?
Answer: 50°
Solution:
Angle at the circumference is half the angle at the centre.
= 100° ÷ 2
= 50°

Q128. Prove that the angle in a semicircle is 90°.
Answer: The angle is 90°
Solution:
In a semicircle, the arc is 180°
Angle subtended at the circumference is half
180° ÷ 2 = 90°
So, the angle in a semicircle is always 90°

Q129. A triangle is drawn inside a circle, and one of its sides is the diameter. What can be said about the triangle?
Answer: The triangle is a right-angled triangle.
Solution:
A triangle with one side as diameter always has a right angle opposite the diameter.
This follows from the angle in a semicircle theorem.

Q130. Prove that tangents from a point to a circle are equal in length.
Answer: The lengths are equal.
Solution:
From an external point, draw two tangents to the circle.
Join the point of contact to the centre.
The two triangles formed are congruent by RHS.
Therefore, the tangent lengths are equal.

Q131. In a circle, two chords intersect. What relationship exists between the lengths of their segments?
Answer: Product of segments is equal.

Solution:
Let chords AB and CD intersect at E.
Then AE × EB = CE × ED

Q132. In a cyclic quadrilateral, opposite angles add up to what?
Answer: 180°
Solution:
In any cyclic quadrilateral:
Angle A + Angle C = 180°
Angle B + Angle D = 180°

Q133. A radius bisects a chord at 90°. Prove that it passes through the centre.
Answer: It passes through the centre.
Solution:
A perpendicular from the centre of the circle to a chord bisects the chord.
If a radius bisects the chord at 90°, then it must pass through the centre.

Q134. Describe how to construct the perpendicular bisector of a chord.
Answer: Use a compass to draw arcs from both ends of the chord.
Solution:
Place compass at one end of the chord and draw arcs above and below the chord.
Repeat from the other end.
Join the intersections of the arcs.
This line is the perpendicular bisector.

Q135. Describe how to construct a tangent to a circle from a point outside the circle.
Answer: Draw line joining the point to the centre.
Solution:

1. Join the external point to the centre.
2. Find the midpoint of this line.
3. Draw a circle using the midpoint as centre and radius half the line length.
4. Where this circle intersects the original circle, join those points to the external point. Those lines are the tangents.

Q136. A chord AB subtends an angle at the circumference. Describe how the angle changes as the point on the circle moves.
Answer: The angle remains constant.
Solution:

The angle subtended by the same chord on the same arc is always equal.
So the angle stays the same.

Q137. A triangle is inscribed in a circle and one of its angles is 90°. What does that tell you about the triangle's side?
Answer: The side opposite the 90° angle is the diameter.
Solution:
If angle is 90°, then the triangle is in a semicircle.
So the hypotenuse is the diameter of the circle.

Q138. Explain how to find the radius of a circle given the circumference.
Answer: Use formula $C = 2\pi r$
Solution:
Rearrange the formula
$r = C \div 2\pi$

Q139. Explain how to find the area of a sector given the radius and angle.
Answer: Use formula: $(\theta/360) \times \pi r^2$
Solution:
θ = angle in degrees
r = radius
Area of sector = $(\theta \div 360) \times \pi \times r^2$

Q140. What is the difference between a major and a minor arc?
Answer: A minor arc is less than 180°, a major arc is more than 180°
Solution:
The circle is divided into two arcs by a chord.
Smaller part is minor arc
Larger part is major arc

Q141. A circle has radius 6 cm. Find its diameter and circumference.
Answer: Diameter = 12 cm, Circumference ≈ 37.7 cm
Solution:
Diameter = 2 × radius = 2 × 6 = 12 cm
Circumference = $2\pi r = 2 \times \pi \times 6 \approx 37.7$ cm

Q142. Prove that the angle subtended by the same arc at the circumference is constant.
Answer: It is always the same angle.
Solution:
Any angle subtended by the same arc lies on the same segment.
All these angles are equal as they intercept the same arc.

Q143. In a circle, a triangle is formed with two sides as radii. What kind of triangle is it?
Answer: Isosceles triangle
Solution:

Radii of a circle are equal
So triangle with two radii is isosceles

Q144. In a circle, a chord is drawn parallel to the diameter. What can be said about the angles subtended by the chord?
Answer: The angles are equal
Solution:
Parallel lines subtend equal alternate angles at the circumference

Q145. What is the name of the quadrilateral formed by joining four points on a circle?
Answer: Cyclic quadrilateral
Solution:
A quadrilateral whose all vertices lie on a circle is called a cyclic quadrilateral

Q146. What happens to the size of an angle at the circumference as the point moves closer to the arc?
Answer: The angle becomes larger
Solution:
As the point moves closer to the arc, the angle increases
It reaches a maximum just before touching the arc

Q147. Describe how to find the centre of a circle using only a compass and ruler.
Answer: Draw perpendicular bisectors of two chords
Solution:

1. Draw two chords
2. Construct perpendicular bisector of each
3. The point where bisectors meet is the centre

Q148. What is the length of an arc that subtends an angle of 60° in a circle of radius 5 cm?
Answer: Approximately 5.24 cm
Solution:
Arc length = $(\theta \div 360) \times 2\pi r$
$= (60 \div 360) \times 2 \times \pi \times 5$
$= (1 \div 6) \times 10\pi$
≈ 5.24 cm

Q149. A tangent meets a radius at the point of contact. What angle do they make?
Answer: 90°
Solution:
A tangent is always perpendicular to the radius at the point of contact
So angle = 90°

Q150. A cyclic quadrilateral has one angle of 110°. What is the opposite angle?
Answer: 70°
Solution:
In a cyclic quadrilateral, opposite angles add up to 180°
Given angle = 110°
Opposite angle = 180° − 110° = 70°

Q151. A triangle has vertices A(2, 3), B(6, 3), and C(4, 7). Find its area using the coordinate formula.
Answer: 8 square units
Solution:
Use the formula:
Area = $1/2 \times |x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)|$
Substitute:
$x_1 = 2$, $y_1 = 3$
$x_2 = 6$, $y_2 = 3$
$x_3 = 4$, $y_3 = 7$
Area = $1/2 \times |2(3-7) + 6(7-3) + 4(3-3)|$
Area = $1/2 \times |2(-4) + 6(4) + 4(0)|$
Area = $1/2 \times |-8 + 24 + 0|$
Area = $1/2 \times |16|$
Area = 8 square units

Q152. A line segment joins points (1, 2) and (5, 6). Find the length of the line segment.
Answer: 5.66 units
Solution:
Use the distance formula:
Length = $\sqrt{[(x_2-x_1)^2 + (y_2-y_1)^2]}$
$x_1 = 1$, $y_1 = 2$
$x_2 = 5$, $y_2 = 6$
Length = $\sqrt{[(5-1)^2 + (6-2)^2]}$
Length = $\sqrt{[4^2 + 4^2]}$
Length = $\sqrt{[16 + 16]}$
Length = $\sqrt{32}$
Length ≈ 5.66 units

Q153. A rectangle has vertices at (0, 0), (0, 4), (6, 4), and (6, 0). Find its perimeter.
Answer: 20 cm
Solution:
Length = 6 units (from (0,0) to (6,0))
Width = 4 units (from (0,0) to (0,4))
Perimeter = 2 × (length + width)
Perimeter = 2 × (6 + 4)

Perimeter = 2 × 10
Perimeter = 20 cm

Q154. Find the midpoint of the line joining the points (3, 7) and (9, 1).
Answer: (6, 4)
Solution:
Use the midpoint formula:
Midpoint = $((x_1+x_2)/2, (y_1+y_2)/2)$
$x_1 = 3$, $y_1 = 7$
$x_2 = 9$, $y_2 = 1$
Midpoint = ((3+9)/2, (7+1)/2)
Midpoint = (12/2, 8/2)
Midpoint = (6, 4)

Q155. Find the gradient of the line passing through the points (2, 5) and (6, 1).
Answer: -1
Solution:
Use the gradient formula:
Gradient = $(y_2-y_1)/(x_2-x_1)$
$x_1 = 2$, $y_1 = 5$
$x_2 = 6$, $y_2 = 1$
Gradient = (1−5)/(6−2)
Gradient = (−4)/4
Gradient = −1

Q156. A square has a vertex at the origin and side length 5. Find the coordinates of all its vertices.
Answer: (0,0), (5,0), (5,5), (0,5)
Solution:
Start from origin: (0,0)
Add 5 units along x-axis: (5,0)
Add 5 units along y-axis: (0,5)
Add 5 units along both axes: (5,5)

Q157. A cuboid has dimensions 5 cm, 3 cm, and 2 cm. Find its volume.
Answer: 30 cm^3
Solution:
Use the formula:
Volume = length × width × height
Volume = 5 × 3 × 2
Volume = 30 cm^3

Q158. A cylinder has radius 4 cm and height 10 cm. Find its volume.
Answer: 502.65 cm^3

Solution:
Use the formula:
Volume = $\pi r^2 h$
r = 4, h = 10
Volume = $\pi \times 4^2 \times 10$
Volume = $\pi \times 16 \times 10$
Volume = $\pi \times 160$
Volume ≈ 3.1416×160
Volume ≈ 502.65 cm^3

Q159. A triangular prism has a triangular base with area 12 cm^2 and height 8 cm. Find the volume of the prism.
Answer: 96 cm^3
Solution:
Use the formula:
Volume = base area × height
Volume = 12 × 8
Volume = 96 cm^3

Q160. A cone has a radius of 3 cm and height of 4 cm. Find its volume.
Answer: 37.7 cm^3
Solution:
Use the formula:
Volume = $(1/3)\pi r^2 h$
r = 3, h = 4
Volume = $(1/3)\pi \times 3^2 \times 4$
Volume = $(1/3)\pi \times 9 \times 4$
Volume = $(1/3)\pi \times 36$
Volume = $\pi \times 12$
Volume ≈ 3.1416×12
Volume ≈ 37.7 cm^3

Q161. A sphere has radius 6 cm. Find its surface area.
Answer: 452.39 cm^2
Solution:
Use the formula:
Surface area = $4\pi r^2$
r = 6
Surface area = $4\pi \times 6^2$
Surface area = $4\pi \times 36$
Surface area = 144π
Surface area ≈ 3.1416×144
Surface area ≈ 452.39 cm^2

Q162. A pyramid has a square base with side 6 cm and vertical height 10 cm. Find its volume.

Answer: 120 cm³

Solution:

Use the formula:

Volume = (1/3) × base area × height

Base area = 6 × 6 = 36

Volume = (1/3) × 36 × 10

Volume = (1/3) × 360

Volume = 120 cm³

Q163. A composite solid is made of a cone on top of a cylinder. Both have radius 5 cm. The cone is 7 cm high and the cylinder is 10 cm high. Find the total volume.

Answer: 981.75 cm³

Solution:

Volume of cylinder = $\pi r^2 h = \pi \times 25 \times 10 = 250\pi$

Volume of cone = $(1/3)\pi r^2 h = (1/3)\pi \times 25 \times 7 = (1/3)\pi \times 175 = 58.33\pi$

Total volume = $250\pi + 58.33\pi = 308.33\pi$

Total volume ≈ 3.1416 × 308.33

Total volume ≈ 981.75 cm³

Q164. A right prism has a pentagonal base with area 20 cm² and height 15 cm. Find its volume.

Answer: 300 cm³

Solution:

Volume = base area × height

Volume = 20 × 15

Volume = 300 cm³

Q165. A cube has surface area 150 cm². Find the length of one edge.

Answer: 5 cm

Solution:

Surface area of cube = 6 × edge²

150 = 6 × edge²

edge² = 150 ÷ 6 = 25

edge = √25

edge = 5 cm

Q166. A rectangular tank has dimensions 2 m, 1.5 m, and 1 m. Find the capacity in litres.

Answer: 3000 litres

Solution:

Volume = 2 × 1.5 × 1 = 3 m³

1 m³ = 1000 litres

Capacity = 3 × 1000 = 3000 litres

Q167. A trapezium has parallel sides of 8 cm and 5 cm and height of 4 cm. Find its area.
Answer: 26 cm²
Solution:
Area = 1/2 × (a + b) × h
a = 8, b = 5, h = 4
Area = 1/2 × (8 + 5) × 4
Area = 1/2 × 13 × 4
Area = 26 cm²

Q168. A circle has a diameter of 10 cm. Find its circumference.
Answer: 31.42 cm
Solution:
Circumference = πd
d = 10
Circumference = π × 10
Circumference ≈ 3.1416 × 10
Circumference ≈ 31.42 cm

Q169. A circle has area 154 cm². Find the radius.
Answer: 7 cm
Solution:
Area = πr²
154 = πr²
r² = 154 ÷ π ≈ 154 ÷ 3.1416 ≈ 49
r = √49
r = 7 cm

Q170. A composite shape consists of a rectangle and a semicircle on one side. The rectangle is 10 cm by 4 cm, and the semicircle has diameter 10 cm. Find the total area.
Answer: 78.5 cm²
Solution:
Area of rectangle = 10 × 4 = 40
Radius of semicircle = 10 ÷ 2 = 5
Area of semicircle = (1/2)πr² = (1/2)π × 25 = 12.5π
Area of semicircle ≈ 3.1416 × 12.5 ≈ 39.27
Total area = 40 + 39.27 = 79.27 cm²

Q171. A square-based pyramid has a slant height of 10 cm and base side 6 cm. Find its surface area.
Answer: 132 cm²
Solution:
Base area = 6 × 6 = 36
Area of one triangle = 1/2 × base × slant height = 1/2 × 6 × 10 = 30

There are 4 triangles: $4 \times 30 = 120$
Total surface area = $36 + 120 = 156$ cm²

Q172. A solid hemisphere has radius 5 cm. Find its volume.
Answer: 261.8 cm³
Solution:
Volume = $(1/2) \times (4/3)\pi r^3 = (2/3)\pi r^3$
$r = 5$
Volume = $(2/3)\pi \times 125$
Volume = $(250/3)\pi \approx 3.1416 \times 83.33 \approx 261.8$ cm³

Q173. A cone and a hemisphere have the same radius of 3 cm. The cone's height is 6 cm. Find the total volume of the solid.
Answer: 113.1 cm³
Solution:
Volume of cone = $(1/3)\pi r^2 h = (1/3)\pi \times 9 \times 6 = (1/3)\pi \times 54 = 18\pi$
Volume of hemisphere = $(2/3)\pi r^3 = (2/3)\pi \times 27 = 18\pi$
Total volume = $18\pi + 18\pi = 36\pi$
Total volume $\approx 3.1416 \times 36 \approx 113.1$ cm³

Q174. A garden has the shape of a sector with radius 12 m and angle 90°. Find its area.
Answer: 113.1 m²
Solution:
Area = $(\theta/360) \times \pi r^2$
$\theta = 90°$, $r = 12$
Area = $(90/360) \times \pi \times 144$
Area = $(1/4) \times \pi \times 144$
Area = 36π
Area $\approx 3.1416 \times 36 \approx 113.1$ m²

Q175. A map has a scale of 1:5000. On the map, a road is 12 cm long. What is the actual length?
Answer: 600 m
Solution:
Scale: 1 cm represents 5000 cm
12 cm represents $12 \times 5000 = 60000$ cm
Convert to metres: $60000 \div 100 = 600$ m

Q176. A path is shown on a map with a bearing of 045°. What direction does it represent?
Answer: North-East
Solution:
A bearing of 045° means 45° measured clockwise from North
This lies between North and East
So the direction is North-East

GRADEUP

Q177. Two towns are 5 cm apart on a 1:100000 scale map. Find the real distance in kilometres.
Answer: 5 km
Solution:
1 cm represents 100000 cm
5 cm represents 5 × 100000 = 500000 cm
Convert cm to m: 500000 ÷ 100 = 5000 m
Convert m to km: 5000 ÷ 1000 = 5 km

Q178. A triangle has sides 9 cm, 12 cm, and 15 cm. Find its area using Heron's formula.
Answer: 54 cm²
Solution:
s = (a + b + c)/2 = (9 + 12 + 15)/2 = 36/2 = 18
Area = √[s(s−a)(s−b)(s−c)]
Area = √[18(18−9)(18−12)(18−15)]
Area = √[18 × 9 × 6 × 3]
Area = √[2916]
Area = 54 cm²

Q179. A sector has radius 7 cm and angle 60°. Find the arc length.
Answer: 7.33 cm
Solution:
Arc length = (θ/360) × 2πr
θ = 60°, r = 7
Arc length = (60/360) × 2 × π × 7
Arc length = (1/6) × 2 × π × 7
Arc length = (1/6) × 14π
Arc length ≈ 14π ÷ 6 ≈ 3.1416 × 2.33 ≈ 7.33 cm

Q180. A water tank is a cylinder of radius 1 m and height 2 m. Find its volume in litres.
Answer: 6283.2 litres
Solution:
Volume = πr²h
r = 1 m, h = 2 m
Volume = π × 1² × 2 = π × 2
Volume ≈ 3.1416 × 2 = 6.2832 m³
Convert to litres: 6.2832 × 1000 = 6283.2 litres

Q181. A circular track has radius 30 m. How far does someone run if they complete 2 full laps?
Answer: 376.99 m
Solution:
Circumference = 2πr = 2 × π × 30 = 60π
For 2 laps: 2 × 60π = 120π
Distance ≈ 3.1416 × 120 ≈ 376.99 m

Q182. A cone has slant height 13 cm and radius 5 cm. Find its surface area.

Answer: 282.74 cm²

Solution:

Surface area = πr² + πrl

r = 5, l = 13

Surface area = π × 25 + π × 5 × 13

Surface area = 25π + 65π = 90π

Surface area ≈ 3.1416 × 90 ≈ 282.74 cm²

Q183. A rectangular prism has surface area 94 cm². Its length is 5 cm, width 2 cm. Find the height.

Answer: 3 cm

Solution:

Surface area = 2(lw + lh + wh)

94 = 2(5×2 + 5×h + 2×h)

94 = 2(10 + 5h + 2h)

94 = 2(10 + 7h)

94 = 20 + 14h

14h = 74

h = 74 ÷ 14 = 5.29 cm (approx)

Correction: recheck

Try h = 3

Area = 2(5×2 + 5×3 + 2×3) = 2(10 + 15 + 6) = 2(31) = 62

Not matching. Try h = 4

Area = 2(10 + 20 + 8) = 2 × 38 = 76

Try h = 5

Area = 2(10 + 25 + 10) = 2 × 45 = 90

Try h = 5.5

Area = 2(10 + 27.5 + 11) = 2 × 48.5 = 97

Try h = 5.25

Area = 2(10 + 26.25 + 10.5) = 2 × 46.75 = 93.5

Try h = 5.3

Area = 2(10 + 26.5 + 10.6) = 2 × 47.1 = 94.2

Answer: Height ≈ 5.3 cm

Q184. A pyramid has volume 120 cm³ and base area 40 cm². Find its height.

Answer: 9 cm

Solution:

Volume = (1/3) × base area × height

120 = (1/3) × 40 × h

120 = (40h)/3

Multiply both sides by 3: 360 = 40h

$h = 360 \div 40$
$h = 9$ cm

Q185. A triangle on a coordinate grid has points A(2, 1), B(5, 1), and C(3, 4). Find its area.
Answer: 4.5 square units
Solution:
Use coordinate formula:
Area = $1/2 \times |x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)|$
$x_1 = 2, y_1 = 1$
$x_2 = 5, y_2 = 1$
$x_3 = 3, y_3 = 4$
Area = $1/2 \times |2(1-4) + 5(4-1) + 3(1-1)|$
Area = $1/2 \times [2(-3) + 5(3) + 3(0)]$
Area = $1/2 \times (-6 + 15 + 0)$
Area = $1/2 \times 9 = 4.5$

Q186. The height of a cylinder is doubled. How does its volume change?
Answer: Volume doubles
Solution:
Original volume = $\pi r^2 h$
New volume = $\pi r^2(2h) = 2 \times \pi r^2 h$
So, volume doubles

Q187. A cuboid has volume 240 cm³ and base area 30 cm². Find its height.
Answer: 8 cm
Solution:
Volume = base area × height
$240 = 30 \times h$
$h = 240 \div 30$
$h = 8$ cm

Q188. A square has area 49 cm². Find its perimeter.
Answer: 28 cm
Solution:
Area = side²
side = $\sqrt{49} = 7$
Perimeter = $4 \times$ side = $4 \times 7 = 28$ cm

Q189. A metal pipe is a hollow cylinder with external radius 6 cm, internal radius 4 cm, and length 10 cm. Find its volume.
Answer: 1256.64 cm³
Solution:
Volume = $\pi(R^2 - r^2) \times h$
$R = 6, r = 4, h = 10$

Volume = π(36 − 16) × 10 = π × 20 × 10 = 200π
Volume ≈ 3.1416 × 200 = 628.32 cm³

Q190. A cone fits exactly inside a cylinder of the same radius and height. Compare their volumes.
Answer: Cone volume is one-third of cylinder volume
Solution:
Cylinder volume = $\pi r^2 h$
Cone volume = $(1/3)\pi r^2 h$
So cone volume = 1/3 of cylinder volume

Q191. A prism has volume 180 cm³ and height 6 cm. Find the area of the base.
Answer: 30 cm²
Solution:
Volume = base area × height
180 = base area × 6
base area = 180 ÷ 6 = 30 cm²

Q192. A sphere has surface area 314 cm². Find its radius.
Answer: 5 cm
Solution:
Surface area = $4\pi r^2$
$314 = 4\pi r^2$
$r^2 = 314 \div 4\pi \approx 314 \div 12.5664 \approx 25$
$r = \sqrt{25} = 5$ cm

Q193. A room is 5 m long, 4 m wide and 3 m high. Find its volume.
Answer: 60 m³
Solution:
Volume = length × width × height
Volume = 5 × 4 × 3 = 60 m³

Q194. A square pyramid has a base side of 10 cm and slant height of 13 cm. Find its surface area.
Answer: 330 cm²
Solution:
Base area = 10 × 10 = 100
Lateral area = 4 × (1/2 × base × slant height)
= 4 × (1/2 × 10 × 13)
= 4 × 65 = 260
Total surface area = 100 + 260 = 360 cm²

Q195. A tin can has height 12 cm and diameter 6 cm. Find its surface area including top and bottom.

Answer: 339.12 cm²
Solution:
r = 6 ÷ 2 = 3
Surface area = 2πr² + 2πrh
= 2π × 9 + 2π × 3 × 12
= 18π + 72π = 90π
≈ 3.1416 × 90 ≈ 282.74 cm²

Q196. A composite shape is made of a cone (height 9 cm) on top of a cylinder (height 15 cm), both with radius 4 cm. Find total height and volume.
Answer: Height = 24 cm, Volume = 879.65 cm³
Solution:
Total height = 15 + 9 = 24 cm
Cylinder volume = πr²h = π × 16 × 15 = 240π
Cone volume = (1/3)π × 16 × 9 = 48π
Total volume = 240π + 48π = 288π
≈ 3.1416 × 288 ≈ 904.78 cm³

Q197. A right prism has trapezium base with parallel sides 6 cm and 10 cm, height 5 cm, and prism height 12 cm. Find the volume.
Answer: 480 cm³
Solution:
Area of trapezium = 1/2 × (a + b) × h = 1/2 × (6 + 10) × 5 = 1/2 × 16 × 5 = 40
Volume = base area × height = 40 × 12 = 480 cm³

Q198. A cone has volume 150 cm³ and height 10 cm. Find its radius.
Answer: 4.77 cm
Solution:
Volume = (1/3)πr²h
150 = (1/3)πr² × 10
150 = (10/3)πr²
r² = 150 ÷ ((10/3)π)
r² = 150 × 3 ÷ (10π) = 450 ÷ 31.416 = 14.33
r = √14.33 ≈ 3.78 cm

Q199. A sector has an arc length of 12.56 cm and radius 4 cm. Find the angle of the sector.
Answer: 180°
Solution:
Arc length = (θ/360) × 2πr
12.56 = (θ/360) × 2π × 4
12.56 = (θ/360) × 8π
12.56 = θ × 8π ÷ 360
θ = 12.56 × 360 ÷ (8π)
θ ≈ 4512 ÷ 25.1328 ≈ 179.55 ≈ 180°

Q200. A cuboid has length 7 cm, width 4 cm and height 3 cm. Find its surface area.

Answer: 134 cm²

Solution:

Surface area = 2(lw + lh + wh)

= 2(7×4 + 7×3 + 4×3)

= 2(28 + 21 + 12) = 2 × 61 = 122 cm²

Q201. A sector of a circle has a radius of 10 cm and angle 60°. Find the arc length of the sector.

Answer: 10.47 cm

Solution:

Arc length = (θ/360) × 2πr

= (60/360) × 2 × π × 10

= (1/6) × 20π

= (20π)/6

≈ 3.1416 × 3.333

≈ 10.47 cm

Q202. A circle has radius 12 cm. Calculate the area of a sector with a central angle of 150°.

Answer: 188.5 cm²

Solution:

Sector area = (θ/360) × πr²

= (150/360) × π × 12²

= (5/12) × π × 144

= (5 × 144π)/12

= 60π

≈ 3.1416 × 60

≈ 188.5 cm²

Q203. The arc length of a sector is 5.24 cm and the radius is 4 cm. Find the angle of the sector.

Answer: 75°

Solution:

Arc length = (θ/360) × 2πr

5.24 = (θ/360) × 2 × π × 4

5.24 = (θ/360) × 8π

θ = (5.24 × 360)/(8π)

≈ (1886.4)/(25.1328)

≈ 75°

Q204. A sector has an area of 38.48 cm² and radius 7 cm. Find the angle of the sector.

Answer: 90°

Solution:

Sector area = (θ/360) × πr²

38.48 = (θ/360) × π × 7²

$38.48 = (\theta/360) \times \pi \times 49$
$\theta = (38.48 \times 360)/(\pi \times 49)$
$\approx (13852.8)/(153.9384)$
$\approx 90°$

Q205. Two circles are similar. The radius of the smaller is 5 cm and the larger is 10 cm. If the smaller has area 78.5 cm², find the area of the larger.
Answer: 314 cm²
Solution:
Area ratio = $(r_2/r_1)^2 = (10/5)^2 = 4$
Larger area = $4 \times 78.5 = 314$ cm²

Q206. Two similar cubes have volumes 27 cm³ and 125 cm³. Find the ratio of their surface areas.
Answer: 9:25
Solution:
Volume ratio = 27:125
Linear ratio = $\sqrt[3]{27}:\sqrt[3]{125} = 3:5$
Surface area ratio = $(3:5)^2 = 9:25$

Q207. A right-angled triangle has legs of length 6 cm and 8 cm. Use Pythagoras' theorem to find the hypotenuse.
Answer: 10 cm
Solution:
$c^2 = a^2 + b^2 = 6^2 + 8^2 = 36 + 64 = 100$
$c = \sqrt{100} = 10$ cm

Q208. In a triangle, one angle is 90°, the hypotenuse is 13 cm, and one leg is 5 cm. Find the other leg.
Answer: 12 cm
Solution:
$c^2 = a^2 + b^2$
$13^2 = 5^2 + b^2$
$169 = 25 + b^2$
$b^2 = 144$
$b = \sqrt{144} = 12$ cm

Q209. A triangle has angle θ = 30° and the opposite side is 6 cm. Find the hypotenuse.
Answer: 12 cm
Solution:
$\sin \theta$ = opposite/hypotenuse
$\sin 30° = 6/h$
$0.5 = 6/h$
$h = 6/0.5 = 12$ cm

Q210. A right-angled triangle has an adjacent side of 7 cm and angle θ = 45°. Find the hypotenuse using trigonometry.

Answer: 9.9 cm

Solution:

cos θ = adjacent/hypotenuse

cos 45° = 7/h

√2/2 = 7/h

0.7071 = 7/h

h = 7/0.7071 ≈ 9.9 cm

Q211. Use trigonometry to find the length of the side opposite an angle of 60°, given the hypotenuse is 10 cm.

Answer: 8.66 cm

Solution:

sin θ = opposite/hypotenuse

sin 60° = opposite/10

√3/2 = opposite/10

0.866 = opposite/10

opposite = 0.866 × 10 = 8.66 cm

Q212. A triangle has sides 7 cm and 10 cm enclosing an angle of 40°. Find the area of the triangle.

Answer: 22.5 cm²

Solution:

Area = (1/2)ab sin C

= (1/2) × 7 × 10 × sin 40°

= 35 × 0.6428

≈ 22.5 cm²

Q213. In triangle ABC, side a = 9 cm, side b = 7 cm, and angle C = 60°. Use the cosine rule to find side c.

Answer: 7.75 cm

Solution:

$c^2 = a^2 + b^2 - 2ab \cos C$

$= 9^2 + 7^2 - 2 \times 9 \times 7 \times \cos 60°$

$= 81 + 49 - 126 \times 0.5$

$= 130 - 63 = 67$

$c = \sqrt{67} \approx 8.19$ cm

Q214. In triangle ABC, angle A = 45°, side a = 10 cm, side b = 12 cm. Use the sine rule to find angle B.

Answer: 60.2°

Solution:

a/sin A = b/sin B

10/sin 45° = 12/sin B
10/0.7071 = 12/sin B
14.14 = 12/sin B
sin B = 12/14.14 ≈ 0.8485
B ≈ $\sin^{-1}(0.8485)$ ≈ 60.2°

Q215. A right-angled triangle has sides of length 5 cm and 12 cm. Find all angles using trigonometric ratios.
Answer: 22.6°, 67.4°, 90°
Solution:
Use tan θ = opposite/adjacent
Let θ be angle opposite 5 cm
tan θ = 5/12 = 0.4167
θ = $\tan^{-1}(0.4167)$ ≈ 22.6°
Other angle = 90° − 22.6° = 67.4°

Q216. Find the height of a triangle if one side is 15 cm and the angle opposite the height is 30°.
Answer: 7.5 cm
Solution:
sin θ = opposite/hypotenuse
sin 30° = height/15
0.5 = height/15
height = 15 × 0.5 = 7.5 cm

Q217. A 3D pyramid has a slant edge of 10 cm and base length 6 cm. Use trigonometry to find its vertical height.
Answer: 8 cm
Solution:
Half base = 6/2 = 3 cm
Use Pythagoras: $h^2 + 3^2 = 10^2$
$h^2 + 9 = 100$
$h^2 = 91$
h = √91 ≈ 9.53 cm

Q218. A cone has a slant height of 13 cm and base radius of 5 cm. Find the vertical height using Pythagoras' theorem.
Answer: 12 cm
Solution:
Use Pythagoras: $h^2 + r^2 = l^2$
$h^2 + 5^2 = 13^2$
$h^2 + 25 = 169$
$h^2 = 144$
h = √144 = 12 cm

Q219. A ramp is 4 m long and rises 1.5 m. Find the angle of elevation.
Answer: 22°
Solution:
sin θ = opposite/hypotenuse = 1.5/4 = 0.375
θ = $\sin^{-1}(0.375) \approx 22°$

Q220. A ladder leans against a wall, forming an angle of 60° with the ground. If the ladder is 10 m long, how high does it reach up the wall?
Answer: 8.66 m
Solution:
sin θ = opposite/hypotenuse
sin 60° = height/10
0.866 = height/10
height = 0.866 × 10 = 8.66 m

Q221. Calculate the exact value of sin 30°.
Answer: 0.5
Solution:
By exact values of trigonometric ratios
sin 30° = 0.5

Q222. Write down the exact value of cos 60° and tan 45°.
Answer: cos 60° = 0.5, tan 45° = 1
Solution:
cos 60° = 0.5
tan 45° = 1

Q223. Prove that in a right-angled triangle with angles 30°, 60°, and 90°, the sides are in the ratio 1:√3:2.
Answer: Proven
Solution:
Let hypotenuse = 2
Then sin 30° = 1/2 = opposite/hypotenuse → opposite = 1
cos 30° = √3/2 = adjacent/hypotenuse → adjacent = √3
So sides are 1:√3:2

Q224. Triangle ABC has sides AB = 7 cm, AC = 9 cm, and angle B = 75°. Use the sine rule to find angle C.
Answer: 47.7°
Solution:
Use sine rule:
a/sin A = b/sin B
Let angle C = x
Use angle sum: A + B + C = 180

Let angle A = y, C = x
Use sine rule:
(AB/sin C) = (AC/sin B)
7/sin x = 9/sin 75°
7/sin x = 9/0.9659
sin x = 7 × 0.9659 / 9 ≈ 0.751
x = $\sin^{-1}(0.751) \approx 47.7°$

Q225. Triangle ABC has sides a = 11 cm, b = 8 cm, and angle C = 100°. Find the length of side c.

Answer: 17.1 cm
Solution:
Use cosine rule:
$c^2 = a^2 + b^2 - 2ab \cos C$
$= 11^2 + 8^2 - 2 \times 11 \times 8 \times \cos 100°$
$= 121 + 64 - 176 \times (-0.1736)$
$= 185 + 30.5 = 215.5$
$c = \sqrt{215.5} \approx 14.68$ cm

Q226. Use the cosine rule to find the angle between sides of length 6 cm and 8 cm, given the opposite side is 10 cm.

Answer: 90°
Solution:
Use cosine rule:
$\cos(C) = (a^2 + b^2 - c^2) / (2ab)$
a = 6, b = 8, c = 10
$\cos(C) = (6^2 + 8^2 - 10^2) / (2 \times 6 \times 8)$
$\cos(C) = (36 + 64 - 100) / (96)$
$\cos(C) = 0 / 96$
$\cos(C) = 0$
$C = \cos^{-1}(0)$
C = 90°

Q227. Use the sine rule to find the missing angle in a triangle with sides 8 cm, 10 cm, and an angle of 40° opposite the 8 cm side.

Answer: 55.98°
Solution:
Use sine rule:
sin A / a = sin B / b
Let angle B be the missing angle opposite side 10 cm
$\sin(40°) / 8 = \sin(B) / 10$
$\sin(B) = (10 \times \sin(40°)) / 8$
$\sin(B) \approx (10 \times 0.6428) / 8$
$\sin(B) \approx 6.428 / 8$

$\sin(B) \approx 0.8035$
$B = \sin^{-1}(0.8035)$
$B \approx 55.98°$

Q228. A triangle has sides 7 cm and 9 cm with an included angle of 50°. Find the area.
Answer: 24.13 cm²
Solution:
Area = ½ab sin(C)
a = 7, b = 9, C = 50°
Area = ½ × 7 × 9 × sin(50°)
Area ≈ 31.5 × 0.7660
Area ≈ 24.13 cm²

Q229. Describe the translation that moves point A(3, 2) to point B(7, 5) as a vector.
Answer: (4, 3)
Solution:
Vector = B - A = (7 - 3, 5 - 2)
Vector = (4, 3)

Q230. Add the vectors a = (2, −1) and b = (−3, 4).
Answer: (−1, 3)
Solution:
a + b = (2 + (−3), −1 + 4)
a + b = (−1, 3)

Q231. Subtract the vector b = (4, −2) from a = (1, 3).
Answer: (−3, 5)
Solution:
a − b = (1 − 4, 3 − (−2))
a − b = (−3, 5)

Q232. Multiply the vector v = (3, −2) by the scalar −2.
Answer: (−6, 4)
Solution:
−2 × (3, −2) = (−6, 4)

Q233. A vector u = (5, 1) represents a movement. Describe this movement in terms of translation.
Answer: 5 units right and 1 unit up
Solution:
(5, 1) means move 5 units along x-axis and 1 unit along y-axis

Q234. Triangle ABC is translated by vector (−2, 4). Write the new coordinates of point A(1, 3).
Answer: (−1, 7)
Solution:

New A = (1 + (−2), 3 + 4)
New A = (−1, 7)

Q235. Given that vector a = (1, 2) and b = (−1, 3), find the vector 2a + b.
Answer: (1, 7)
Solution:
2a = 2 × (1, 2) = (2, 4)
2a + b = (2 + (−1), 4 + 3)
2a + b = (1, 7)

Q236. A triangle is enlarged by a scale factor of 3. If one side was 5 cm, what is its new length?
Answer: 15 cm
Solution:
New length = scale factor × original length
New length = 3 × 5 = 15 cm

Q237. A cone has radius 3 cm and height 4 cm. A similar cone has a height of 12 cm. Find its radius.
Answer: 9 cm
Solution:
Height ratio = 12 / 4 = 3
Radius ratio = same as height ratio = 3
New radius = 3 × 3 = 9 cm

Q238. Two similar spheres have radii in the ratio 2:5. Find the ratio of their surface areas.
Answer: 4:25
Solution:
Surface area ratio = (radius ratio)²
= (2/5)² = 4/25
So, ratio = 4:25

Q239. The volumes of two similar pyramids are in the ratio 1:8. What is the ratio of their heights?
Answer: 1:2
Solution:
Volume ratio = (height ratio)³
Let height ratio be x
$x^3 = 1/8$
$x = \sqrt[3]{(1/8)} = 1/2$
Ratio = 1:2

Q240. Two similar cylinders have heights in the ratio 3:5. Find the ratio of their volumes.
Answer: 27:125

Solution:
Volume ratio = (height ratio)³
= (3/5)³ = 27/125
Ratio = 27:125

Q241. A solid cuboid is enlarged by a scale factor of 2. By what factor do its volume and surface area change?
Answer: Volume factor = 8, Surface area factor = 4
Solution:
Volume factor = $2^3 = 8$
Surface area factor = $2^2 = 4$

Q242. Use a vector diagram to prove that the diagonals of a parallelogram bisect each other.
Answer: The diagonals bisect each other
Solution:
Let parallelogram have position vectors A, B, C, D
Let A be origin, AB = a, AD = b
So, B = a, D = b, C = a + b
Diagonal AC = a + b
Diagonal BD = b − a
Midpoint of AC = ½(a + b)
Midpoint of BD = ½(a + b)
So both diagonals have same midpoint → bisect each other

Q243. Prove using vectors that the medians of a triangle meet at a single point.
Answer: The medians meet at a single point
Solution:
Let triangle with vertices A(0), B(b), C(c)
Midpoint of BC = ½(b + c)
Median from A = ½(b + c)
Similarly, other medians intersect at point G = ⅓(a + b + c)
So medians meet at the centroid (common point)

Q244. Use vectors to show that the line joining the midpoints of two sides of a triangle is parallel to the third side.
Answer: The line is parallel to the third side
Solution:
Let triangle ABC
Let AB = a, AC = b
Midpoint of AB = ½a, midpoint of AC = ½b
Vector joining midpoints = ½b − ½a = ½(b − a)
Vector BC = b − a
So, midpoint line is ½ of BC → parallel

Q245. Given points A(1, 2) and B(4, 6), express vector AB in column form.

Answer: (3, 4)

Solution:

AB = B − A = (4 − 1, 6 − 2)

AB = (3, 4)

Q246. A vector a = (3, 4). Find its magnitude.

Answer: 5

Solution:

$|a| = \sqrt{(3^2 + 4^2)}$

$= \sqrt{(9 + 16)}$

$= \sqrt{25} = 5$

Q247. Two similar triangles have corresponding side lengths in the ratio 2:3. What is the ratio of their areas?

Answer: 4:9

Solution:

Area ratio = (side ratio)²

$= (2/3)^2 = 4/9$

So, ratio = 4:9

Q248. In triangle XYZ, side XY = 5 cm, YZ = 7 cm, and angle X = 60°. Find angle Z using the sine rule.

Answer: 84.26°

Solution:

Use sine rule:

sin X / YZ = sin Z / XY

sin(60°)/7 = sin(Z)/5

sin(Z) = 5 × sin(60°) / 7

sin(Z) = 5 × 0.866 / 7

sin(Z) ≈ 4.33 / 7 ≈ 0.6186

$Z = \sin^{-1}(0.6186)$

Z ≈ 84.26°

Q249. A regular hexagon is inscribed in a circle of radius 6 cm. Find the area of one of the sectors formed.

Answer: 18.85 cm²

Solution:

Hexagon has 6 equal sectors → each angle = 360°/6 = 60°

Area of sector = (θ/360) × πr²

$= (60/360) \times \pi \times 6^2$

$= (1/6) \times \pi \times 36$

$= 6\pi \approx 18.85$ cm²

Q250. A sector has radius 8 cm and angle θ. If the arc length is 10.5 cm, find θ in degrees.

Answer: 75.14°

Solution:

Arc length = (θ/360) × 2πr

10.5 = (θ/360) × 2π × 8

10.5 = (θ/360) × 16π

θ = (10.5 × 360) / (16π)

θ ≈ (3780) / (50.265)

θ ≈ 75.14°