Chapter 1: Shapes Around Us

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Exercise 1.1 — Building Models — India Gate / Qutub Minar

Q1 What parts of the building have you shown in your model (for example, roof, pillars, base, etc.)?

SOLUTION

This is a hands-on observation question based on the model you built.
Typical parts shown in a model of India Gate: the large arch (the main arch shape), the flat top (roof/slab), the base/platform, and the two side towers/pillars.
Write the parts you actually used in your model.

Q2 Why did you select these parts?

SOLUTION

These parts were selected because they are the most recognisable features of the building.
For example, the arch of India Gate is its most distinctive feature, so including it makes the model look like the real building.
Write the reason that matches the parts you chose.

Q3 What shapes will model these parts well?

SOLUTION

Arch → a curved block or a half-cylinder/half-circle shape.
Pillars → cylinders or rectangular prisms (cuboids).
Base/platform → a flat rectangular prism (cuboid).
Roof/top slab → a flat cuboid.
Write the shapes that match the parts in your own model.

Q4 How is your model similar to the picture of the real building?

SOLUTION

The model and the real building share the same overall shape — the arch, the base, and the proportions.
Both have the same number and arrangement of main parts (arch, platform, towers).
Write the similarities you can see between your model and the picture.

Q5 How is it different from the real building?

SOLUTION

The model is much smaller than the real building.
The model uses simple blocks, so fine details like carvings, inscriptions, and the flame on top are missing.
The materials are different (wooden/paper blocks vs stone/concrete).
Write the differences you notice from your own model.

Exercise 1.2 — Qutub Minar Model

Q1 Do you think it (the block model) looks like the Qutub Minar?

SOLUTION

A single cylinder-like block can look like the Qutub Minar from a distance because the minar is tall and roughly circular/cylindrical.

However, the real Qutub Minar has 5 storeys that get narrower toward the top, while a plain cylinder does not taper.

Answer based on your own observation: Yes (if the block captures the tall, round shape) or No (if it looks too different).

Q2 What shape would you use if you made a model of the Qutub Minar? Why?

SOLUTION

A cylinder (or a cone on top of a cylinder) is the best shape for the Qutub Minar.

Why: The Qutub Minar is tall and roughly circular in cross-section; a cylinder captures this tall, round profile.

If using stacked cylinders of decreasing size, you can also show the tapering storeys.

Q3 How many such shapes will you use?

SOLUTION

The Qutub Minar has 5 storeys.

You would need 5 cylinders (of decreasing width) stacked on top of each other to show all 5 storeys.

A simpler model could use 1 cylinder for the whole tower.

Q4 What is common to all bricks (clay bricks, stone blocks, concrete blocks, hollow blocks, etc.)?

SOLUTION

All bricks are solid blocks with flat faces.

They are roughly rectangular (box-shaped / cuboid) so they can be stacked neatly.

The common property is that they are all cuboid (box) shapes.

Exercise 1.3 — Craft — Nets and 3D Shapes

Q1 Make a sphere-like shape with paper strips.

SOLUTION

This is a hands-on craft activity.
Take several long strips of paper. Interweave them by crossing them over each other at right angles, then gently curve and tuck the ends in.
When done carefully, the strips form a roughly spherical (ball-like) shape.
No numerical answer; the result is a 3D sphere-like paper model.

Q2 Use the nets given at the end of the book to make the models shown (prisms and pyramids). What shape of face is common to all the prisms?

SOLUTION

All prisms have rectangular faces connecting the two parallel bases.
The face common to ALL prisms is the rectangle (including squares, which are special rectangles).
Each prism also has two identical flat faces at the top and bottom (the base shape): triangle for a triangular prism, square for a square prism, hexagon for a hexagonal prism, etc.

Q3 What shape of face is common to all the pyramids?

SOLUTION

All the triangular faces of a pyramid meet at a single point (the apex).
The face common to ALL pyramids is the triangle — every pyramid has triangular side faces.
All the triangular faces meet at one point (the apex/top corner) of the pyramid.

Q4 What other shapes do the prisms have (apart from rectangles), and how many such faces each?

SOLUTION

Each prism has 2 faces that are the same shape as its base (one at each end).
Triangular Prism: 2 triangular faces (one at each end) + 3 rectangular side faces.
Square Prism (Cube): 2 square faces + 4 rectangular (square) side faces.
Hexagonal Prism: 2 hexagonal faces + 6 rectangular side faces.
So each prism has 2 faces of the base shape (triangular/square/hexagonal).

Q5 Identify any other shape in each of the pyramids (apart from triangular faces).

SOLUTION

Each pyramid has one base face whose shape names the pyramid.
Triangular Pyramid: all 4 faces are triangles (no other shape).
Square Pyramid: 1 square base face + 4 triangular side faces.
Pentagonal Pyramid: 1 pentagonal base face + 5 triangular side faces.
So the 'other shape' in most pyramids is the base shape: square, pentagon, etc.

Q6 Is a cube also a prism?

SOLUTION

Yes, a cube is a special type of square prism.
A prism has two identical parallel bases connected by rectangular side faces.
A cube has two square bases and four square side faces — all faces are squares, which are special rectangles.
So a cube is a square prism where all faces are squares (equal sides and equal height).

Q7 What is the difference between a prism and a pyramid?

SOLUTION

A prism has TWO identical, parallel flat bases (top and bottom) and rectangular side faces joining them.
A pyramid has ONE flat base; all other faces are triangles that meet at a single point called the apex.
Key difference: a prism has no apex point (two ends are equal); a pyramid has one apex where all triangular faces meet.

Exercise 1.4 — Faces, Corners, Edges Table (Euler's Formula)

Q1 Fill in the table: Number of faces (F), corners (V), and edges (E) for Cube/Square Prism, Cuboid/Rectangular Prism, Triangular Pyramid, Square Pyramid, and Triangular Prism.

SOLUTION

Cube/Square Prism: F = 6, V = 8, E = 12.
Cuboid/Rectangular Prism: F = 6, V = 8, E = 12.
Triangular Pyramid (Tetrahedron): F = 4, V = 4, E = 6.
Square Pyramid: F = 5, V = 5, E = 8.
Triangular Prism: F = 5, V = 6, E = 9.

Q2 Identify any relationship between the number of faces (F), edges (E), and corners (V). Calculate F + V – E in each case. What do you notice?

SOLUTION

Cube: F + V – E = 6 + 8 – 12 = 2.
Cuboid: F + V – E = 6 + 8 – 12 = 2.
Triangular Pyramid: F + V – E = 4 + 4 – 6 = 2.
Square Pyramid: F + V – E = 5 + 5 – 8 = 2.
Triangular Prism: F + V – E = 5 + 6 – 9 = 2.
Notice: F + V – E = 2 for every shape. This is called Euler's formula for 3D shapes.

Q3 Sort 3D shapes by the number of flat faces: 1 flat face, 2 flat faces, 4 flat faces, 5 flat faces, 6 flat faces, 8 flat faces.

SOLUTION

1 flat face: Cone (the circular base is the only flat face; the curved surface is not flat).
2 flat faces: Cylinder (two circular flat faces, one at each end).
4 flat faces: Triangular Pyramid / Tetrahedron (all 4 faces are flat triangles).
5 flat faces: Square Pyramid (1 square + 4 triangles) and Triangular Prism (2 triangles + 3 rectangles).
6 flat faces: Cube and Cuboid (6 rectangular/square flat faces each).
8 flat faces: Hexagonal Prism (2 hexagonal + 6 rectangular = 8 flat faces).

Q4 Can you construct a 3D shape with 3 flat faces?

SOLUTION

Yes — a triangular prism with very thin (almost flat) triangular ends has 5 faces, not 3.
A shape with exactly 3 flat faces would need to be something like a cylinder with two flat circular ends but that gives 2 flat + 1 curved.
It is not possible to make a standard 3D polyhedron (all flat faces) with exactly 3 flat faces,

because the minimum for a closed polyhedron is 4 faces (a tetrahedron).
So the answer is: No, you cannot construct a closed 3D shape with only 3 flat faces.

Q5 Sort 3D shapes by the number of straight edges: 6 edges, 8 edges, 9 edges, 12 edges.

SOLUTION

6 straight edges: Triangular Pyramid / Tetrahedron.
8 straight edges: Square Pyramid.
9 straight edges: Triangular Prism.
12 straight edges: Cube and Cuboid.

Exercise 1.5 — Let Us Observe — Die and Cube Colours

Q1 On a standard die, the face numbered 6 is opposite the face numbered 1. What is the face opposite to: a) face numbered 2, b) face numbered 3, c) face numbered 4?

SOLUTION

On a standard die, opposite faces always add up to 7.
a) Face opposite 2 = 7 – 2 = 5.
b) Face opposite 3 = 7 – 3 = 4.
c) Face opposite 4 = 7 – 4 = 3.

Q2 a) Which faces have common edges with the face numbered 1? b) Which face has no common edge with the face numbered 1?

SOLUTION

Face 1 shares a common edge with all faces that are adjacent to it.
a) The faces with common edges with face 1 are: 2, 3, 4, and 5 (the four side faces surrounding face 1).
b) The face with NO common edge with face 1 is: face 6 (the face directly opposite face 1).

Q3 Look at three different views of the same cube. a) What colour is the face opposite to the red face? b) What colour is the face opposite to the yellow face?

SOLUTION

Looking at the three views of the same cube shown in the figure: View 1 shows red (left face), green (top), blue (front). View 2 shows yellow (left), purple (top), blue (front). View 3 shows orange (top), blue (front), green (right). Red never appears in the same view as orange — they are always on opposite sides. Yellow never appears in the same view as purple — they are always on opposite sides. Blue always appears on the front face and green always appears on an adjacent face, so blue is opposite green. Therefore: a) The face opposite the red face is orange. b) The face opposite the yellow face is purple.

Exercise 1.6 — Follow Instructions — Shapes Along the Border

Q1 Colour all shapes with a rectangular face in red.

SOLUTION

Looking at the border shapes around the page: the shapes with at least one rectangular face are the rectangular prism/box (cuboid), the cube (Rubik's cube shape), the triangular prism, and the square prism. These are the shapes to colour red. Shapes like the sphere, cone, cylinder, and pyramids do NOT have rectangular faces (pyramids have triangular faces only).

Q2 Draw a smiley on shapes with a triangular face.

SOLUTION

Looking at the border shapes: the shapes with triangular faces are the triangular pyramid (tetrahedron), the square pyramid, and the triangular prism. Draw a smiley face on each of these three shapes in the border.

Q3 Draw a star on shapes with a curved face.

SOLUTION

Looking at the border shapes: the shapes with a curved face are the sphere (entirely curved surface), the cone (one curved side face), and the cylinder (one curved surface). Draw a star on each of these three shapes in the border.

Q4 Colour all shapes with no corner in blue.

SOLUTION

Looking at the border shapes: the shape with no corners at all is the sphere (it has 0 corners, 0 edges, and 1 curved surface). The cylinder has 0 corners but has circular edges. Colour the sphere blue (and the cylinder, since it has no sharp corner-vertices either). The sphere has no corners; colour it blue.

Q5 Circle the shapes that have the same opposite faces.

SOLUTION

Looking at the border shapes: the shapes that have the same opposite faces are the cube and the cuboid (rectangular prism). In a cube every opposite pair of faces is an identical square. In a cuboid every opposite pair of faces is an identical rectangle. Circle the cube and the cuboid in the border.

Exercise 1.7 — Sorting 3D Shapes

Q1 Sort the 3D shapes: (1) All faces look the same vs All faces do not look the same. Write the shape names in circles A and B.

SOLUTION

Circle A — All faces look the same: Cube (all 6 faces are identical squares).
Circle B — All faces do NOT look the same: Cuboid (opposite faces match but not all 6 faces are identical), Triangular Prism (2 triangular + 3 rectangular faces are different), Square Pyramid (1 square + 4 triangular faces), Triangular Pyramid if all faces are equilateral triangles → could be A, otherwise B.
A regular tetrahedron (all equilateral triangle faces) also goes in A.
Cylinder and Sphere are not strictly polyhedra but: Sphere → all surface looks the same (A); Cylinder → not all the same (B).

Q2 Sort the 3D shapes: (2) Shapes with straight edges (A) vs Shapes with curved edges (B).

SOLUTION

Circle A — Shapes with straight edges only: Cube, Cuboid, all Prisms (Triangular, Square, Hexagonal), all Pyramids (Triangular, Square, Pentagonal).
Circle B — Shapes with curved edges: Sphere (no straight edges), Cone (one circular curved edge at the base), Cylinder (two circular curved edges).
Note: A sphere has no edges at all. Cone and Cylinder have curved edges.

Q3 Sort the 3D shapes: (3) Shapes with triangular faces (A), shapes with rectangular faces (B), shapes with BOTH triangular and rectangular faces (A∩B).

SOLUTION

A only — Shapes with triangular faces but no rectangular faces: Triangular Pyramid / Tetrahedron (all triangular faces), Square Pyramid (triangular sides + square base, but no rectangles unless the square is counted as a special rectangle).
B only — Shapes with rectangular faces but no triangular faces: Cube, Cuboid (all rectangular faces).
A ∩ B — Shapes with BOTH triangular AND rectangular faces: Triangular Prism (2 triangular + 3 rectangular faces), Rectangular Pyramid (4 triangular + 1 rectangular base).
Triangular Prism and Rectangular Pyramid both go in the overlapping region.

Q4 In which circle did you write triangular prism and rectangular pyramid?

SOLUTION

Triangular Prism: it has 2 triangular faces AND 3 rectangular faces — so it belongs in BOTH circle A (triangular faces) and circle B (rectangular faces).

Rectangular Pyramid: it has 4 triangular side faces AND 1 rectangular base — so it also belongs in BOTH circles A and B.

Therefore, both Triangular Prism and Rectangular Pyramid are written in the overlapping region (intersection) of circles A and B.

Q5 Using circles, can you sort shapes into 'Shapes with curved faces' and 'Shapes with flat faces'?

SOLUTION

Shapes with curved faces only: Sphere.

Shapes with flat faces only: Cube, Cuboid, all Prisms, all Pyramids (Triangular, Square, Pentagonal).

Shapes with BOTH curved AND flat faces (overlapping region): Cone (1 flat circular base + 1 curved side), Cylinder (2 flat circular bases + 1 curved side).

Draw two overlapping circles: write Sphere in the curved-only circle, write Cone and Cylinder in the overlapping middle, and write all polyhedra (Cube, Cuboid, Prisms, Pyramids) in the flat-only circle.

Exercise 1.8 — Build with Cubes — Cube Towers

Q1 Build models A, B, C, D with cubes (from the Jaadui Pitara Kit or similar). How many cubes are there in each cube tower?

SOLUTION

Looking at the four cube structures in the figure: Structure A (red 2×2×2 block) = 8 cubes. Structure B (purple irregular L-shape) = 6 cubes (a row of 4 along the base plus 2 on top at one end). Structure C (orange/yellow stepped pyramid) = 1 + 4 + 9 = 14 cubes (top layer 1, middle layer 4 arranged 2×2, bottom layer 9 arranged 3×3). Structure D (pink stepped pyramid, wider) = 1 + 4 + 9 + 16 = 30 cubes (four layers: 1 on top, 2×2=4, 3×3=9, 4×4=16 at base). Tower A has 8 cubes, Tower B has 6 cubes, Tower C has 14 cubes, Tower D has 30 cubes.

Exercise 1.9 — Match Shapes to Descriptions

Q1 Match: 'I have 5 faces and 5 corners. I have 8 edges. 1 of my faces is a square and 4 of my faces are triangles.'

SOLUTION

Faces = 5, Corners = 5, Edges = 8.
Check Euler: F + V – E = 5 + 5 – 8 = 2. Correct.
1 square face + 4 triangular faces = Square Pyramid.
This shape is a Square Pyramid.

Q2 Match: 'I have 1 flat face, 1 curved face, and 1 edge.'

SOLUTION

1 flat face (a circle at the base), 1 curved surface (the slanting side), and 1 curved edge (the circle where the flat and curved faces meet).
This shape is a Cone.

Q3 Match: 'I have 1 curved face. I have no edges or corners.'

SOLUTION

Only 1 face (the entire curved surface), no edges, no corners.
This shape is a Sphere.

Q4 Match: 'I have 2 flat faces, 1 curved face, and 2 edges. I have no corners.'

SOLUTION

2 flat circular faces (top and bottom), 1 curved surface (the side), 2 circular edges (where the flat faces meet the curved surface), and no corners.
This shape is a Cylinder.

Q5 Match: 'I have 5 faces, 6 corners, and 9 edges, and 2 of my faces are triangles.'

SOLUTION

Faces = 5, Corners = 6, Edges = 9.
Check Euler: F + V – E = 5 + 6 – 9 = 2. Correct.
2 triangular faces (the two ends) + 3 rectangular faces (the sides) = Triangular Prism.
This shape is a Triangular Prism.

Q6 Match: 'I have 6 faces, 12 edges, and 8 corners.'

SOLUTION

Faces = 6, Edges = 12, Corners = 8.

Check Euler: F + V – E = 6 + 8 – 12 = 2. Correct.

6 rectangular or square faces, 8 corners, 12 edges = Cube or Cuboid.

This shape is a Cube (or Cuboid).

Exercise 1.10 — Nets — Match and Identify

Q1 Match the following nets (1), (2), (3), (4) to the appropriate solids (a), (b), (c), (d).

SOLUTION

Looking at the four nets in the figure: Net (1) shows a triangular shape with dashed fold lines forming a triangular pyramid — it matches solid (b) the triangular pyramid. Net (2) shows two circles with a rectangular band — it matches solid (d) the cylinder. Net (3) shows a cross-like arrangement of rectangles (6 faces) — it matches solid (a) the cuboid/rectangular prism. Net (4) shows a central rectangle with triangular flaps on each side and a rectangle on top — it matches solid (c) the triangular prism. So the matches are: (1)→(b), (2)→(d), (3)→(a), (4)→(c).

Q2 Which of the nets A, B, C, D can be folded to make the solid shown?

SOLUTION

Looking at the four nets A, B, C, D and the target solid (a cuboid/box): Net A shows a cross arrangement of 6 rectangles — this folds correctly into the cuboid. Net B shows three circles stacked — this would make a cylinder, not the cuboid. Net C shows two triangles and rectangles — this would make a triangular prism. Net D shows an arrangement with an extra overlapping face that would cause overlap when folded. Net A is the correct net that folds to make the given solid.

Q3 Nitesh cuts up a net on the folds. Its pieces are shown. Which solid has these pieces in its net?

SOLUTION

Looking at the pieces Nitesh cut: there is 1 pentagon (5-sided shape) and 5 triangles. A net with 1 pentagon and 5 triangles folds into a pentagonal pyramid (1 pentagonal base + 5 triangular side faces). Looking at the four solids (a), (b), (c), (d): the pentagonal pyramid matches solid (c). The answer is solid (c), a pentagonal pyramid.

Exercise 1.11 — When Lines Meet — Angles

Q1 How many angles are there in this boat drawing?

SOLUTION

Looking at the boat drawing in the figure: the boat has a hull (boat body) with angles at the front point and back corners, a mast (vertical pole) meeting the hull creating angles, and a sail with angles at its corners. Counting all places where two lines meet: the hull has 5 corners (front pointed tip + 2 upper corners + 2 lower corners), the mast meets the hull creating 2 angles, and the sail has 3 corners — giving a total of approximately 9 angles in the boat drawing. There are 9 angles in the boat drawing.

Exercise 1.12 — Let Us Do — Mark Angles

Q1 Mark the angles in the following pictures (a), (b), (c), (d), (e).

SOLUTION

For each picture, mark a small arc at every place where two lines meet: a) Scissors — mark angles at the pivot point (where the two blades cross) and at the tips of the handles: approximately 4 angles. b) Coat hanger — mark angles at the hook top and at the two bottom corners: 3 angles. c) Hand making a V-sign — mark angles between the fingers: approximately 2 angles (between index-middle and between other fingers). d) See-saw/balance — mark the angle at the pivot and where the beam meets the base: 2 angles. e) Slide — mark angles where the slide meets the platform at top and where it meets the ground at the bottom: 2 angles.

Q2 Where do you see angles in the classroom? Give a few examples.

SOLUTION

Angles in the classroom can be found at the corners of: the blackboard/whiteboard (right angles), the door frame (right angles), the windows (right angles), the corner of a book (right angle), the legs of a chair meeting the seat, the hands of the clock when they are not at 12, the corner of a ruler or set square.

Write 3–4 examples from your own classroom observation.

Exercise 1.13 — Right Angles

Q1 Identify the angles that you think are right angles and circle them in the dot grid. Check using your right angle checker.

SOLUTION

Looking at the dot-grid figures in the book: the figures drawn on the grid include various shapes. The angles that are right angles (exactly 90°, matching a square corner) should be circled. From the dot-grid figure, the shapes that have right angles include the L-shaped figure (which has multiple right angles at each inner and outer corner) and the rectangular shapes. The acute and obtuse angles (those that are clearly narrower or wider than a square corner) should NOT be circled. Circle only the corners that look exactly like the corner of a square.

Q2 Check for right angles in a book, window, and any other object. Write the names of objects where you find right angles.

SOLUTION

Right angles are found at the corners of: a book (all 4 corners are right angles), a window frame (all 4 corners), a door frame (all 4 corners), a table surface (all 4 corners), a floor tile (all 4 corners), a blackboard.

Write the names of objects you checked in your classroom.

Exercise 1.14 — Let Us Do — Draw Right Angles

Q1 Draw some right angles on the dot grid.

SOLUTION

On the dot grid, connect dots to form L-shapes (like the corner of a square).
Start from one dot, draw a horizontal line to another dot, then draw a vertical line going straight up or down from the first dot.
The angle between the horizontal and vertical lines is a right angle (90°).
Draw several such L-shapes at different positions on the grid.

Exercise 1.15 — Acute and Obtuse Angles

Q1 Name some objects from your classroom which have an acute angle.

SOLUTION

Acute angles (less than a right angle / less than 90°) are found in: the tip of a sharpened pencil, the pointed corner of a triangular set square (the 60° and 30° corners), the hands of a clock at certain times (e.g., 1 o'clock — the angle between the hands), the corner of a folded paper that is less than 90°.
Write 2–3 objects from your own classroom.

Q2 Name some objects from your classroom which have an obtuse angle.

SOLUTION

Obtuse angles (more than a right angle / greater than 90° but less than 180°) are found in: the lid of a box when partly open (if opened more than 90°), the open angle of a partially open book, an obtuse triangle corner, the angle of a door when swung more than 90° open.
Write 2–3 objects from your own classroom.

Q3 Identify all angles in the letters shown.

SOLUTION

Looking at the three letters V, A, Z shown in the figure: Letter V has 1 acute angle at the bottom point where the two arms meet. Letter A has 2 acute angles at the top tip (where the two slanted sides meet) and where the crossbar meets each side — the top is acute; the two bottom outer angles are acute too; there is no right angle in A. Letter Z has 2 acute angles (at the top-right and bottom-left inner corners where the diagonal meets the horizontal bars) and 2 obtuse angles (at the top-left and bottom-right outer corners). Total: V has 1 acute angle; A has 1 acute angle at the top tip and 2 acute angles at the feet; Z has 2 acute angles and 2 obtuse angles.

Exercise 1.16 — Let Us Do — Draw Acute and Obtuse Angles; Mark Angles

Q1 Draw some acute angles on the top grid. Draw a line to make an acute angle using each given line in the bottom grid.

SOLUTION

An acute angle is smaller than a right angle (less than 90°).
On the top grid: draw pairs of lines that open up less than a right angle — like a narrow V shape.
On the bottom grid: for each given line, draw a second line that meets it at a point, making the angle between them less than 90° (a narrow opening).

Q2 Draw some obtuse angles on the top grid. Draw a line to make an obtuse angle using each given line in the bottom grid.

SOLUTION

An obtuse angle is larger than a right angle (greater than 90° but less than 180°).
On the top grid: draw pairs of lines that open up more than a right angle — like a wide V shape.
On the bottom grid: for each given line, draw a second line meeting it so the angle between them is more than 90° (a wide opening).

Q3 In the figures given below, mark the acute angles in red, right angles in green, and obtuse angles in blue.

SOLUTION

Looking at the four stick-figure drawings in the figure: Figure 1 (arm down, leg back): the arm angle is acute (arm slanting down), the leg angle is acute — mark both red. Figure 2 (arms up in a Y shape, legs spread): the arm angles are acute (wide V at top), leg angles are acute — mark all red. Figure 3 (one arm up, legs spread apart): the arm meets the body at an acute angle, legs form acute angles with the body — mark red. Figure 4 (one arm raised to the side): the raised arm forms an obtuse angle with the body — mark blue; the standing leg meets the body at a right angle — mark green. Mark acute angles red, right angles green, obtuse angles blue in each figure.

Exercise 1.17 — Shapes with Straws — Rigidity and Angles

Q1 Does the shape of the triangle change if we gently push one of its sides? Yes/No

SOLUTION

No — the triangle does not change its shape when one side is gently pushed.
A triangle is rigid: once the lengths of its three sides are fixed, the shape (angles) cannot change.
This is why triangles are used in bridges and roofs for stability.

Q2 What kinds of angles does a triangle have?

SOLUTION

A triangle can have acute angles (less than 90°), right angles (exactly 90°), or obtuse angles (greater than 90°) depending on the type of triangle.
Every triangle has three angles, and they can include: all acute angles (acute triangle), one right angle (right-angled triangle), or one obtuse angle (obtuse triangle).
The straws triangle you made with different-length straws likely has three acute or mixed angles.

Q3 What kinds of angles do you see in the rectangle?

SOLUTION

A rectangle has exactly 4 right angles (all corners are 90°).
All four angles in a rectangle are right angles.

Q4 Does the shape of the rectangle change if we gently push one of its sides? Yes/No. What has happened to the angles?

SOLUTION

Yes — the rectangle changes shape when one side is pushed (it becomes a parallelogram).
Unlike a triangle, a quadrilateral (4-sided shape) is not rigid.
When pushed, the right angles change: two opposite corners become acute (less than 90°) and the other two become obtuse (greater than 90°).
The shape is no longer a rectangle — it has become a parallelogram with no right angles.

Q5 Similarly, push one side of a square. Are they still right angles? What types of angles have been formed?

SOLUTION

No — when one side of the square is pushed, the angles are no longer right angles.
The square changes into a rhombus (a parallelogram with equal sides but non-right angles).
Two opposite angles become acute and the other two become obtuse.

Q6 How are the angles of triangles and rectangles similar or different?

SOLUTION

Difference: A rectangle always has 4 right angles; a triangle can have acute, right, or obtuse angles but no triangle has 4 angles of any type.
Similarity: Both shapes have angles at each corner where two sides meet.
Key difference: A triangle is rigid (angles stay fixed when sides are fixed), while a rectangle is not rigid (angles can change when pushed even with sides the same length).

Exercise 1.18 — Shapes on Dot Grid — Right Angles

Q1 Use the dot grid to draw several three- and four-sided shapes. Circle the shapes that have one or more right angles. How many shapes have you made with: a) 1 right angle, b) 2 right angles, c) 3 right angles, d) all right angles?

SOLUTION

This is a drawing and exploration activity. Draw various triangles and quadrilaterals on the dot grid.

a) A shape with exactly 1 right angle: an obtuse or scalene triangle with one 90° corner is possible, or an irregular quadrilateral with just one right-angle corner.

b) A shape with exactly 2 right angles: a right trapezoid (one pair of parallel sides, two right angles at one end).

c) A shape with exactly 3 right angles: it is NOT possible for a closed polygon — if a quadrilateral has 3 right angles, the fourth must also be 90° (angle sum = 360°, so 3×90° leaves 90° for the fourth). A triangle cannot have 3 right angles (angle sum would be 270°, exceeding 180°).

d) All right angles: Rectangle and Square (4 right angles, angle sum = 4 × 90° = 360°).

Q2 In what ways are rectangle and square different from the other 4-sided shapes shown?

SOLUTION

Rectangles and squares have ALL FOUR angles as right angles (90° each).

Other 4-sided shapes (parallelogram, rhombus, trapezoid, irregular quadrilateral) have angles that are not all right angles.

Also, rectangles and squares have opposite sides equal and parallel; a square additionally has all four sides equal.

Exercise 1.19 — Pentagon and Circle with Straws

Q1 Try to make a 5-sided shape with all sides equal (Pentagon). Are these right angles? Does the shape of the pentagon change if we gently push one of its sides? Yes/No. How does this change the angles?

SOLUTION

A regular pentagon does NOT have right angles — each interior angle of a regular pentagon is 108°, which is an obtuse angle.

Yes — the shape of the pentagon changes when one side is pushed (it is not rigid, unlike a triangle).

When pushed, the 108° angles change: some become more acute and some become more obtuse, but the shape is no longer a regular pentagon.

Q2 Can you make a circle using straws? The lengths of the straws in the picture are ... (Equal/Unequal). What will happen if we take straws of unequal lengths?

SOLUTION

To approximate a circle with straws, all the straws must be of equal length.

The lengths of the straws in the picture are: Equal.

If we take straws of unequal lengths, the shape will no longer be a circle — it will become an irregular closed polygon that is not circular.

Exercise 1.20 — Let Us Make — Drawing a Circle

Q1 Mark a point A. Draw many points that are at an equal distance from point A. Connect the dots freehand. What do you get?

SOLUTION

When you mark point A and draw many points all at the same distance from A, all those points lie on a circle.

Connecting these equally-spaced points freehand gives you a circle.

Point A is the centre of the circle, and the equal distance from A to each point on the circle is the radius.

Exercise 1.21 — Amazing Circles — Diameter and Radius

Q1 Fold a circular paper in half three times in different ways and measure the crease each time. The length of all the creases are ... (Equal/Unequal).

SOLUTION

Every time you fold the circle exactly in half, the crease passes through the centre of the circle.
All such creases are diameters of the circle.
Since all diameters of a circle are equal in length, the creases are all Equal in length.

Q2 These creases are called diameters of the circle. Do all the diameters pass through the centre?

SOLUTION

Yes — every diameter of a circle passes through the centre.
When you fold a circle exactly in half, the fold line always passes through the centre point, creating a diameter.
This is true for every fold — all diameters pass through the centre.

Q3 Measure the length of the creases from the center to the border of the circle (radius). What is the relationship between the radius and the diameter?

SOLUTION

The radius is the distance from the centre to the edge of the circle.
The diameter is the full length of the crease from one edge through the centre to the other edge.
The diameter = 2 × radius (the diameter is double the radius).
Equivalently, radius = diameter ÷ 2.

Exercise 1.22 — Let Us Do — Diameter and Radius (Paper Folding)

Q1 Fold the circular paper in half, then fold this half again in half. The length of the diameter is ___ (half/double) of the length of the radius.

SOLUTION

After the first fold, the crease is the diameter (the full width of the circle through the centre).
After the second fold, the crease is the radius (half the diameter).
So the diameter is double the radius.
The length of the diameter is DOUBLE the length of the radius.

Exercise 1.23 — Wheels — Radius and Diameter

Q1 All wheels look like ... Name the wheel with the: 1. longest radius, 2. shortest radius, 3. longest diameter, 4. shortest diameter.

SOLUTION

Looking at the four wheels A, B, C, D in the figure: Wheel A (grey car tyre) is large. Wheel B (wooden spoked wheel) is large — appears to be the largest of the four. Wheel C (blue spoked wheel, bicycle-style) is medium-large. Wheel D (silver alloy wheel) is small. All wheels look like circles. 1. Longest radius: Wheel B (largest wooden wheel). 2. Shortest radius: Wheel D (smallest alloy wheel). 3. Longest diameter: Wheel B. 4. Shortest diameter: Wheel D.

Exercise 1.24 — Puzzling Shapes

Q1 Identify the hidden shapes and write their names.

SOLUTION

Looking at the Puzzling Shapes composite figure in the book: the figure shows overlapping red outlines of geometric shapes. The hidden shapes visible in the figure are: 2 triangles (triangular outlines), 1 rectangle, 1 circle, and 1 square (or additional rectangle). Write their names: triangle, rectangle, circle, square.

Q2 Draw 2 lines to divide the triangle into 1 square and 2 triangles.

SOLUTION

Start with the triangle.

Draw one horizontal line parallel to the base, cutting the triangle into a smaller triangle on top and a trapezoid at the bottom.

Then draw one vertical line through the trapezoid, dividing it into a square in the middle and two right triangles on the sides.

The result is: 1 square in the center-bottom + 2 smaller triangles on the sides + 1 triangle on top = but we need exactly 1 square and 2 triangles total.

Better approach: draw a vertical line from the midpoint of the top vertex straight down to the base, then draw a horizontal line across to form the square — adjust based on the exact triangle dimensions in the figure.

The exact solution depends on the triangle given in the book figure.

Q3 Draw 2 lines to divide the square into 3 triangles.

SOLUTION

Start with the square.

Draw one diagonal from one corner to the opposite corner — this splits the square into 2 triangles.

Now draw one more line from a third corner to any point on the diagonal.

This splits one of the two triangles into 2 smaller triangles, giving 3 triangles total.

Result: the square is divided into 3 triangles using 2 lines.

Q4 Draw lines to show the cuts needed on the shapes in the left column to get the smaller shapes on the right: (A), (B), (C).

SOLUTION

Looking at the three shape-cut pairs in the figure: (A) The large hexagon-like shape (a wide arrow/chevron shape) on the left → on the right it becomes a rectangle and two small right triangles (one on each side). Draw two diagonal cut lines, one on each side of the hexagon,

slicing off the two pointed ends to produce the rectangle in the middle and the two triangular off-cuts. (B) The green square on the left → on the right it becomes two triangles arranged in an N or Z pattern. Draw one diagonal line from one corner to the opposite corner, then one horizontal or vertical line to cut it into the pieces shown. (C) The orange triangle on the left → on the right it becomes one smaller triangle and one small quadrilateral (a trapezoid-like piece). Draw one horizontal line parallel to the base, cutting off the top to give a smaller triangle on top and a trapezoid below.

Exercise 1.25 — Card Game — Sort 2D Shapes by Sides

Q1 Sort the 2D-shape cards into three groups according to their sides. Draw the sorted shapes and explain why you sorted them this way.

SOLUTION

Group 1 — 3 sides (Triangles): equilateral triangle, isosceles triangle, right triangle, scalene triangle.
Group 2 — 4 sides (Quadrilaterals): square, rectangle, rhombus, trapezoid, parallelogram, kite.
Group 3 — 5 or more sides (Polygons): pentagon (5 sides), hexagon (6 sides), and any other polygon.
Why: Grouping by number of sides is a clear, logical classification — shapes in the same group share the property of having the same number of sides and corners.

Exercise 1.26 — Let Us Try — Squiggly Spiders and Matchsticks

Q1 How many triangles are in Squiggly's (triangular) web?

SOLUTION

Looking at Squiggly's triangular web figure: the web is a diamond shape made of a grid of triangles, with the wall segments numbered 1 through 12. Counting all triangles: the web contains small individual triangles and larger triangles formed by combining smaller ones. From the figure, the web has 4 rows of triangles forming a diamond pattern. Count: 8 small upward triangles + 4 small downward triangles = 12 small triangles + medium and large combinations. There are 13 triangles in total in Squiggly's web.

Q2 Can Squiggly begin at point A and reach back to the same point without walking on any wall more than once? Trace and show Squiggly's path.

SOLUTION

Looking at Squiggly's triangular web with walls numbered 1–12 and starting point A at the bottom: to walk every wall exactly once and return to A, check if all vertices have an even number of walls meeting them. In the figure the web is a diamond of triangles; each interior junction has an even number of edges meeting it (2, 4, or 6), and the outer boundary vertices all connect an even number of walls. Since every vertex has an even degree, an Euler circuit exists. Yes, Squiggly can start at A and return to A without walking on any wall more than once. One valid path follows the outer boundary first, then traces the inner diagonals.

Q3 How many rectangles can you see in Wiggly's (rectangular) web?

SOLUTION

Looking at Wiggly's rectangular web figure: the web is a 2×3 grid of rectangles (2 columns, 3 rows = 6 individual cells). Counting all rectangles of every size: 1×1 cells = 6; 1×2 vertical = 4; 1×3 vertical = 2; 2×1 horizontal = 3; 2×2 = 2; 2×3 (the whole grid) = 1. Total = 6 + 4 + 2 + 3 + 2 + 1 = 18 rectangles in Wiggly's web.

Q4 Can Wiggly begin at point A and leave from point B without walking on any wall more than once? Trace and show Wiggly's path.

SOLUTION

Looking at Wiggly's rectangular 2×3 web with start point A (top-left) and end point B (bottom-right): for an Euler path from A to B (not returning to A), exactly 2 vertices must have an odd number of edges, and those 2 vertices must be A and B. In a 2×3 grid, the four corner vertices have 2 edges each (even) except the two opposite corners if they serve as endpoints. Count degrees: corner vertices have 2 edges, edge-of-grid vertices have 3 edges (odd), interior vertices have 4 edges (even). The vertices with odd degree are the non-corner boundary

junction points. If A and B are positioned at two odd-degree vertices, the Euler path exists. Yes, Wiggly can walk from A to B without repeating any wall — trace the path by going along the outer border and weaving through the inner walls.

Q5 Use 5 matchsticks to make 2 triangles. Then draw it in the space provided.

SOLUTION

Draw two triangles that share one common side (edge).
Triangle 1 uses 3 matchsticks. Triangle 2 shares 1 matchstick with Triangle 1 and uses 2 more new matchsticks.
Total matchsticks = 3 (first triangle) + 2 (extra for second triangle) = 5.
The figure looks like two triangles joined at one side, forming a diamond/rhombus shape overall.

Q6 Move two of these matchsticks to form 4 triangles.

SOLUTION

Looking at the starting matchstick figure (3 triangles in a row, sharing sides: 7 matchsticks total in a row of 3 triangles). Moving 2 matchsticks: take the top matchstick of the rightmost triangle and the right side of the rightmost triangle, and reposition them to form a small triangle inside or on top of the arrangement. The result is 4 triangles: the original 2 remaining triangles on the left plus 2 new triangles formed by the repositioned sticks. Move the top-right stick and the right-side stick of the third triangle to form a new triangle above or between the existing ones, creating 4 triangles in total.

Q7 Remove 4 of these matchsticks to leave only 3 triangles.

SOLUTION

Looking at the starting matchstick figure for question 4 (a larger arrangement of 5 triangles in a 2-row pattern: top row 2 triangles, bottom row 3 triangles, sharing walls, like a triangular grid with about 9 matchsticks). To remove 4 matchsticks and leave exactly 3 triangles: remove 4 matchsticks that break 2 triangles while leaving 3 complete triangles intact. Remove the 4 shared-side matchsticks from the centre of the arrangement — specifically the 3 inner shared walls plus 1 outer wall of one of the triangles you want to dissolve. This leaves 3 separate complete triangles.

Exercise 1.27 — Let Us Try — Model Challenge and Classify Shapes

Q1 Model challenge: Can you make a solid shape with a) 12 straws and 8 clay balls?

SOLUTION

Straws represent edges (E) and clay balls represent corners/vertices (V).
E = 12, V = 8. By Euler's formula: F = 2 – V + E = 2 – 8 + 12 = 6.
A shape with F = 6, V = 8, E = 12 is a Cube (or Cuboid).
Yes — 12 straws and 8 clay balls make a Cube.

Q2 Model challenge: Can you make a solid shape with b) 9 straws and 6 clay balls?

SOLUTION

E = 9, V = 6. Euler: F = 2 – 6 + 9 = 5.
A shape with F = 5, V = 6, E = 9: Triangular Prism (2 triangular faces + 3 rectangular faces).
Yes — 9 straws and 6 clay balls make a Triangular Prism.

Q3 Model challenge: Can you make a solid shape with c) 15 straws and 10 clay balls?

SOLUTION

E = 15, V = 10. Euler: F = 2 – 10 + 15 = 7.
A shape with F = 7, V = 10, E = 15: Pentagonal Prism (2 pentagonal faces + 5 rectangular faces = 7 faces; 5 + 5 = 10 vertices; 5 + 5 + 5 = 15 edges).
Yes — 15 straws and 10 clay balls make a Pentagonal Prism.

Q4 Model challenge: Can you make a solid shape with d) 10 straws and 6 clay balls?

SOLUTION

E = 10, V = 6. Euler: F = 2 – 6 + 10 = 6.
A shape with F = 6, V = 6, E = 10: Pentagonal Pyramid (1 pentagonal base + 5 triangular faces = 6 faces; 1 apex + 5 base corners = 6 vertices; 5 base edges + 5 lateral edges = 10 edges).
Yes — 10 straws and 6 clay balls make a Pentagonal Pyramid.

Q5 Classify these shapes based on the number of angles: 3 angles (a), 4 angles (b, c, d), 5 angles (e, f, g). What relation do you notice between the number of sides and the number of angles?

SOLUTION

Looking at the 7 shapes (a) through (g) in the figure: (a) blue square — 4 angles; (b) red triangle — 3 angles; (c) green parallelogram — 4 angles; (d) purple right triangle — 3 angles; (e) purple pentagon — 5 angles; (f) green narrow quadrilateral (kite or arrow) — 4 angles; (g) red rectangle — 4 angles. Sorting: 3 angles (triangle group): (b) and (d). 4 angles (quadrilateral

group): (a), (c), (f), and (g). 5 angles (pentagon group): (e). Relation: the number of angles equals the number of sides in every shape — a shape with n sides always has exactly n angles.

Q6 Draw a 2D shape that has less than 5 angles.

SOLUTION

A shape with less than 5 angles is a polygon with fewer than 5 sides.
Examples: Triangle (3 angles/sides) or Quadrilateral (4 angles/sides).
Draw a triangle or a quadrilateral (square, rectangle, or irregular 4-sided shape) on the dot grid.

Q7 Draw a 2D shape with more than 5 angles.

SOLUTION

A shape with more than 5 angles is a polygon with more than 5 sides.
Examples: Hexagon (6 angles/sides), Heptagon (7 sides), Octagon (8 sides).
Draw a hexagon or any irregular 6-or-more-sided closed shape on the dot grid.

Q8 Mark the right angles and write the number of right angles in each figure. Which of the above shapes have only right angles?

SOLUTION

Looking at the 5 shapes in the figure for question 8: shape 1 (blue rectangle) — all 4 corners are right angles, count = 4; shape 2 (green parallelogram) — no right angles, count = 0; shape 3 (purple right triangle) — 1 right angle at the bottom-left corner, count = 1; shape 4 (orange trapezoid/irregular quadrilateral) — 0 right angles, count = 0; shape 5 (red square tilted at 45°) — all 4 corners are right angles, count = 4. Shapes with ONLY right angles: the blue rectangle (shape 1) and the red square (shape 5).

Q9 Observe the following shapes and identify the shape that has: (i) 2 right angles, 1 acute, and 1 obtuse angle; (ii) 1 right, 2 obtuse, and 1 acute angle; (iii) 2 obtuse and 2 acute angles; (iv) 4 right angles.

SOLUTION

Looking at the 14 numbered quadrilateral shapes in the figure on page 23: the shapes are small coloured quadrilaterals numbered 1–14 in various orientations. Matching by angle counts: (i) 2 right angles + 1 acute + 1 obtuse: this is a right trapezoid shape — shape 6 (the green right-trapezoid). (ii) 1 right + 2 obtuse + 1 acute: an irregular quadrilateral — shape 3 (orange). (iii) 2 obtuse + 2 acute (a parallelogram pattern): shape 9 or shape 10 (the slanted quadrilaterals). (iv) 4 right angles (rectangle or square): shape 1 (blue rectangle) or shape 7 (blue rectangle in the second row) or shape 13 (small blue rectangle).