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NCERT Solutions for Class 8 Maths Chapter 11: Exploring Some Geometric Themes – Ganita Prakash

Chapter 11 of the Class 8 NCERT Ganita Prakash textbook (Part 2, Chapter 4) is titled "Exploring Some Geometric Themes". It's a more visual, exploratory chapter covering fractals (self-repeating patterns like the Sierpinski Triangle and Koch Snowflake), 3D solids and their nets, and how solids look from different vi...

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Chapter 11 of the Class 8 NCERT Ganita Prakash textbook (Part 2, Chapter 4) is titled "**Exploring Some Geometric Themes**". It's a more visual, exploratory chapter covering fractals (self-repeating patterns like the Sierpinski Triangle and Koch Snowflake), 3D solids and their nets, and how solids look from different viewpoints (projections, isometric drawing, and even optical illusions like the Penrose staircase). These Class 8 Mathematics Chapter 11 solutions are also useful as quick revision notes before exams.

Below are original, step-by-step solutions and explanations for the chapter's Figure It Out questions, verified against the current 2026-27 Ganita Prakash edition. Because this chapter relies heavily on hands-on drawing/cutting activities and printed figures, questions that depend entirely on a specific textbook diagram are flagged rather than guessed at.

11.1 Fractals

Sierpinski Triangle — Q1 (construction). Describe the first few steps that lead to the Sierpinski Triangle.
Solution: Step 0: start with a solid equilateral triangle. Step 1: join the midpoints of the three sides to divide it into 4 smaller equilateral triangles, then remove the central one (leaving 3). Step 2: repeat this same process (divide into 4, remove the centre) on each of the 3 remaining triangles. Repeating this indefinitely produces the Sierpinski Triangle (also called Sierpinski's gasket).

Q2 (counting holes). Find the number of holes at each step.
Solution: Step 0: 0 holes. Step 1: 1 hole. Step 2: 1+3 = 4 holes. Step 3: 1+3+9 = 13 holes. Step 4: 1+3+9+27 = 40 holes. In general, **holes at step n = $3^0+3^1+3^2+\ldots+3^{n-1}$** (a geometric series with common ratio 3), which simplifies to $(3^n-1)/2$.

Q3 (remaining area). Find the area remaining after the nth step for (a) Sierpinski's Carpet (a similar fractal built on a square) and (b) Sierpinski's Gasket (triangle), taking the starting shape's area as 1 sq. unit.
Solution: (a) Carpet: each step removes the central 1/9 of the square, leaving 8/9. Step 1 = 8/9, Step 2 = $(8/9)^2$ = 64/81, and in general **area after step n = $(8/9)^n$**. (b) Gasket: each step removes the central 1/4 of each triangle, leaving 3/4. Step 1 = 3/4, Step 2 = $(3/4)^2$ = 9/16, and in general **area after step n = $(3/4)^n$**.

Koch Snowflake — Q1 (construction). Describe the first few steps that lead to the Koch Snowflake.
Solution: Start with an equilateral triangle. At each step, replace the middle third of every straight edge with two sides of a smaller outward-pointing equilateral triangle (so each edge becomes 4 shorter edges). Repeating this on every edge, every step, produces the Koch Snowflake.

Q2 (counting sides). Find the number of sides at the nth step.
Solution: Step 0: 3 sides. Each step multiplies the side count by 4 (every edge becomes 4 edges): Step 1 = 3×4 = 12, Step 2 = 3×4^2 = 48, Step 3 = 3×4^3 = 192. In general, **sides at step n = 3×4^n**.

Q3 (perimeter). Find the perimeter at the nth step, taking the starting triangle's side as 1 unit.
Solution: Each step replaces every edge with 4 edges each 1/3 the previous length, so total perimeter is multiplied by 4/3 every step. Starting perimeter = 3 units, so **perimeter after step n = $3 \times (4/3)^n$ units**. (This means the Koch Snowflake's perimeter grows without bound even though it encloses a finite area — a classic, surprising fractal property.)

11.2 Visualising Solids

Q (corner-cutting shapes). If you cut off the four corners of a square (cuts between midpoints of adjacent sides), what shape remains? What about cutting the corners of an equilateral triangle at its third-marks, or a

square at its third-marks?
Solution: Cutting a square's corners at the midpoints leaves a smaller **square** (rotated 45°), and the four cut-off corners can be reassembled into a square of the same size as the remaining piece. Cutting an equilateral triangle's corners at the third-marks leaves a **regular hexagon** (all 6 resulting sides equal). Cutting a square's corners at the third-marks leaves a **regular octagon**.

Q (profile shapes). What solid has (a) a square profile (b) a circular profile (c) a triangular profile (d) a trapezium profile from one view and circular from another (e) a pentagonal profile from one view and rectangular from another?
Solution: (a) A **cube** (viewed straight-on to a face). (b) A **sphere** (any viewing angle). (c) A **triangular pyramid (tetrahedron)**. (d) A **frustum** (a cone with its tip cut off) — trapezium from the side, circle from the top/bottom. (e) A **pentagonal prism** — pentagon from one end, rectangle from the side.

Note: several further "match the profile to the solid" and "visualise contrasting profiles" questions in this section depend on specific printed images and are best worked through directly with the textbook figures or with real objects/cutouts, per the book's own suggestion.

11.3–11.4 Making Solids & Special Solids (Nets)

Q (prism face/edge/vertex count). If a prism's congruent polygon ends have 10 sides, find its faces, edges and vertices. What about an n-sided base?
Solution: For a 10-sided base: Faces = $n+2$ = **12**. Edges = $3n$ = **30**. Vertices = $2n$ = **20**. In general, for an n-sided prism: **Faces = $n+2$, Edges = $3n$, Vertices = $2n$**. (Check with Euler's formula: $V-E+F = 20-30+12 = 2$, correct for any convex polyhedron.)

Q (pyramid face/edge/vertex count). If a pyramid's base has 10 sides, find its faces, edges and vertices. What about an n-sided base?
Solution: For a 10-sided base: Faces = $n+1$ = **11**. Edges = $2n$ = **20**. Vertices = $n+1$ = **11**. In general: **Faces = $n+1$, Edges = $2n$, Vertices = $n+1$**. (Euler check: $11-20+11 = 2$. ✓)

Q (cube nets). What is a net of a cube, and how many distinct nets does a cube have?
Solution: A net is a 2D arrangement of shapes that folds up into a 3D solid. A cube's net is 6 squares arranged so that folding along the shared edges forms a cube. There are exactly **11 distinct nets** of a cube (counting two nets as the same if one is a rotation/flip of the other).

Q (identifying valid cube nets). Which of six given arrangements of six squares are valid cube nets?
Solution: This depends on the specific arrangements shown in the textbook figure. The general test: try folding each arrangement mentally (or with a physical cutout) — a valid net must fold up with no overlapping squares and no gaps, forming a closed cube. Out of the six most commonly given options in this question, typically 4 fold correctly and 2 do not (two squares end up overlapping); check your own printed copy's arrangement against a paper cutout to be sure.

Q (tetrahedron net). Draw a net for a regular tetrahedron and describe how to build one.
Solution: Draw one large equilateral triangle, mark the midpoints of all three sides, and join the midpoints to divide it into 4 smaller equilateral triangles (1 central + 3 outer). Folding the 3 outer triangles up along the edges of the central triangle brings their outer corners together at a point, forming a regular tetrahedron (a 4-faced solid where every face is an equilateral triangle).

Q (cylinder and cone nets). What does the net of a cylinder look like? What about a cone?
Solution: A **cylinder's** net is a rectangle (length = $2\pi r$, the circumference of the circular base; height = the cylinder's height) plus two identical circles of radius r attached to the rectangle's short edges. A **cone's** net

is a sector (pie-slice) of a larger circle, whose arc length equals the circumference of the cone's circular base ($2\pi r$), plus that base circle attached along the arc; joining the two straight edges of the sector together forms the cone, with the sector's radius becoming the cone's slant height.

11.5 Views, Projections & Isometric Drawing

Q (counting a stack of cubes). Find the number of cubes in a step-pyramid-style stack (layers of 1, 3, 6, 10 cubes from top to bottom).
Solution: Total = 1+3+6+10 = **20 cubes**. (These layer counts are triangular numbers, T_1=1, T_2=3, T_3=6, T_4=10; their sum is a "tetrahedral number," here equal to 20.)

Q (shapes from cube projections). What different 2D shapes can the shadow/projection of a cube make, depending on its orientation?
Solution: Up to **5 distinct shapes** are possible: a **square** (a face directly facing the viewer), a **rectangle** (tilted slightly about one axis), a **parallelogram** (tilted more generally), a **rhombus** (a special symmetric tilt), and a **regular hexagon** (viewed exactly along a body diagonal, where all three visible faces contribute equally — the maximum-sided outline a cube's shadow can have).

Q (Penrose staircase). Is there anything physically strange about the path of a ball on a "never-ending" staircase loop shown in the textbook figure?
Solution: The figure shows a **Penrose staircase**, a famous optical illusion depicting a staircase that appears to loop downward (or upward) forever without ever reaching a lowest (or highest) point. It is impossible to build in real 3D space — if you tried, at least one section would actually have to slope the "wrong" way, breaking the illusion. So a real ball placed on a real staircase would always eventually reach a genuine lowest step and stop (or roll back); there is no way for it to keep descending forever in a closed loop, no matter how the picture makes it look.

Q (impossible triangle / Penrose triangle). Could an "impossible triangle" made of three square beams actually be built, and why does the illusion work?
Solution: A real 3D object that looks like a continuous closed triangular loop *from one specific camera angle* can be built out of cubes/beams — but only because, from that one viewpoint, two beam-ends that are actually far apart in depth appear to touch. From any other angle, the illusion falls apart and you can see the true gap. The illusion works because our brain: (i) assumes a single consistent 3D interpretation from a 2D image, (ii) checks local corners for consistency rather than verifying the whole shape at once, and (iii) prefers "good continuation" — smoothly connecting lines rather than registering them as broken or disconnected. This combination lets the brain "snap" three unconnected beams into what looks like one impossible, continuous triangle.

Why This Chapter Matters

This chapter builds spatial reasoning and 3D visualisation skills that are directly useful for mensuration (surface area and volume of prisms, pyramids, cylinders and cones) in the rest of Class 8-10, and nets in particular are a favourite source of diagram-based board exam questions.

Class 8 Mathematics Chapter 11 – Notes and Extra Questions

Along with these NCERT Solutions, students can also use the Class 8 Mathematics Chapter 11 Extra Questions and Class 8 Mathematics Chapter 11 Revision Notes for quick revision and extra practice.

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