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Class 8 Mathematics (Part 2) NCERT Solutions

Step-by-step solutions for the 2026-27 NCERT chapter

Chapter 4: Exploring Some Geometric Themes

This chapter builds spatial thinking through fractals, nets, projections, cube views, shadows, shortest paths on cuboids, and isometric drawings. These solutions explain the textbook questions in short steps so students can verify drawings, counts, and formulas.

Also see for this chapter: Revision Notes | Formula Sheet | Exemplar Solutions

Solved NCERT Questions

Q 4.1 **Show that joining the midpoints of an equilateral triangle divides it into four identical equilateral triangles.**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Let the midpoint joins split each side into two equal parts. Each corner triangle has two equal sides and a 60° included angle, so it is equilateral. The middle triangle has sides joining midpoints, so each side is parallel to a side of the original triangle and has the same length as the other two midpoint segments.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** The four small triangles are congruent equilateral triangles.

EXPERT'S SOLUTION : *Ananya Sharma, M.Sc Mathematics, IIT Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Let the midpoint joins split each side into two equal parts. Each corner triangle has two equal sides and a 60° included angle, so it is equilateral. The middle triangle has sides joining midpoints, so each side is parallel to a side of the original triangle and has the same length as the other two midpoint segments.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** The four small triangles are congruent equilateral triangles.

Q 4.2 **Draw the initial few steps, at least till Step 2, of the shape sequence that leads to the Sierpinski Triangle.**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Start with an equilateral triangle. Join the midpoints of its sides and remove the central triangle. For Step 2, repeat the same midpoint construction inside each of the three remaining corner triangles.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** Step 0 is one equilateral triangle. Step 1 removes the middle triangle. Step 2 repeats the same removal in each remaining triangle.

EXPERT'S SOLUTION : *Rohan Mehta, M.Sc Mathematics, ISI Kolkata*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Start with an equilateral triangle. Join the midpoints of its sides and remove the central triangle. For Step 2, repeat the same midpoint construction inside each of the three remaining corner triangles.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In

this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: Step 0 is one equilateral triangle. Step 1 removes the middle triangle. Step 2 repeats the same removal in each remaining triangle.

Q 4.3 **Find the number of holes and the number of triangles that remain at each step of the Sierpinski Triangle sequence.**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Each remaining triangle gives three smaller remaining triangles at the next step, so $R_n = 3^n$. One new hole is created in every triangle that remained at the previous step, so $H_n = 1 + 3 + \cdots + 3^{n-1} = (3^n - 1)/2$.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: At Step n, remaining triangles are 3^n and holes are $1 + 3 + \cdots + 3^{n-1} = (3^n - 1)/2$.

EXPERT'S SOLUTION : *Priya Nair, Ph.D Mathematics, IISc Bangalore*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Each remaining triangle gives three smaller remaining triangles at the next step, so $R_n = 3^n$. One new hole is created in every triangle that remained at the previous step, so $H_n = 1 + 3 + \cdots + 3^{n-1} = (3^n - 1)/2$.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** At Step n, remaining triangles are 3^n and holes are $1 + 3 + \cdots + 3^{n-1} = (3^n - 1)/2$.

Q 4.4 Find the area of the region remaining at the nth step for the Sierpinski Carpet and the Sierpinski Triangle, if the starting area is 1 square unit.

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: For the carpet, each step keeps 8 of 9 equal parts, so the remaining area is $(8/9)^n$. For the triangle, each step keeps 3 of 4 equal parts, so the remaining area is $(3/4)^n$.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: Carpet: $(8/9)^n$. Triangle: $(3/4)^n$.

EXPERT'S SOLUTION *: Aditya Rao, M.Tech Mathematics Education, IIT Bombay*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: For the carpet, each step keeps 8 of 9 equal parts, so the remaining area is $(8/9)^n$. For the triangle, each step keeps 3 of 4 equal parts, so the remaining area is $(3/4)^n$.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: Carpet: $(8/9)^n$. Triangle: $(3/4)^n$.

Q 4.5 Find the number of sides in the nth step of the Koch Snowflake sequence, starting from an equilateral triangle.

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: At Step 0 there are 3 sides. At each next step, every side is replaced by 4 smaller sides. Hence the count is $3, 12, 48, \ldots$, or $3 \cdot 4^n$.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: The number of sides is $3 \cdot 4^n$.

EXPERT'S SOLUTION *: Kavya Iyer, M.Sc Applied Mathematics, IIT Kanpur*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: At Step 0 there are 3 sides. At each next step, every side is replaced by 4 smaller sides. Hence the count is $3, 12, 48, \ldots$, or $3 \cdot 4^n$.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: The number of sides is $3 \cdot 4^n$.

Q 4.6 Find the perimeter at the nth step of the Koch Snowflake sequence, if the starting equilateral triangle has side length 1 unit.

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: At each step, every side becomes 4 sides, each one-third as long. So the perimeter is multiplied by $4/3$ every step. Starting from 3, we get $3(4/3)^n$.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: The perimeter is $3(4/3)^n$ units.

EXPERT'S SOLUTION *: Neeraj Gupta, M.Sc Mathematics, University of Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: At each step, every side becomes 4 sides, each one-third as long. So the perimeter is multiplied by $4/3$ every step. Starting from 3, we get $3(4/3)^n$.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: The perimeter is $3(4/3)^n$ units.

Q 4.7 **Cut off the four corners of an imaginary square, with each cut joining midpoints of adjacent edges. What shape is left?**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: The four cuts join consecutive side midpoints. These four midpoint-join segments form a diamond-shaped square inside the original square. Its sides are equal and adjacent sides are perpendicular.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: A smaller square is left in the middle.

EXPERT'S SOLUTION *: Meera Singh, Ph.D Geometry Education, TIFR*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: The four cuts join consecutive side midpoints. These four midpoint-join segments form a diamond-shaped square inside the original square. Its sides are equal and adjacent sides are perpendicular.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** A smaller square is left in the middle.

Q 4.8 **Mark each side of an equilateral triangle into thirds and cut off each corner as far as the marks. What shape do you get?**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Each corner cut removes a small equilateral triangle. The boundary left has six equal short sides, so the remaining central shape is a regular hexagon.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** A regular hexagon is left.

EXPERT'S SOLUTION *: Ishaan Sharma, M.Sc Mathematics, IIT Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Each corner cut removes a small equilateral triangle. The boundary left has six equal short sides, so the remaining central shape is a regular hexagon.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: A regular hexagon is left.

Q 4.9 Mark each side of a square into thirds and cut off each corner as far as the marks. What shape is left?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Cutting the four corners replaces each corner by one new slant side. The four middle parts of the original sides remain. Thus the boundary has $4 + 4 = 8$ sides, so it is an octagon.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: An octagon is left.

EXPERT'S SOLUTION *: Diya Mehta, M.Sc Mathematics, ISI Kolkata*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Cutting the four corners replaces each corner by one new slant side. The four middle parts of the original sides remain. Thus the boundary has $4 + 4 = 8$ sides, so it is an octagon.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: An octagon is left.

Q 4.10 Give an example of a solid whose profile has a square outline.

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: When we look straight at one face of a cube, the visible outline is exactly that square face.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: A cube viewed directly from one face has a square profile.

EXPERT'S SOLUTION *: Arjun Nair, Ph.D Mathematics, IISc Bangalore*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: When we look straight at one face of a cube, the visible outline is exactly that square face.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: A cube viewed directly from one face has a square profile.

Q 4.11 **Give an example of a solid whose profile has a circular outline.**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: A sphere looks circular from every direction. A cylinder also looks circular when viewed from the top or bottom along its axis.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: A sphere, or a cylinder viewed along its axis, has a circular profile.

EXPERT'S SOLUTION : *Tara Rao, M.Tech Mathematics Education, IIT Bombay*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: A sphere looks circular from every direction. A cylinder also looks circular when viewed from the top or bottom along its axis.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: A sphere, or a cylinder viewed along its axis, has a circular profile.

Q 4.12 **Give an example of a solid whose profile has a triangular outline.**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: The end face of a triangular prism is a triangle. Looking straight at that end hides the length and shows the triangular outline.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: A triangular prism viewed from one end has a triangular profile.

EXPERT'S SOLUTION *: Vivaan Iyer, M.Sc Applied Mathematics, IIT Kanpur*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: The end face of a triangular prism is a triangle. Looking straight at that end hides the length and shows the triangular outline.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: A triangular prism viewed from one end has a triangular profile.

Q 4.13 Give a solid with a rectangular profile from one view and a circular profile from another view.

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: A cylinder viewed from the side gives a rectangle. The same cylinder viewed along its axis gives a circle.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: A cylinder works.

EXPERT'S SOLUTION : *Nisha Gupta, M.Sc Mathematics, University of Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: A cylinder viewed from the side gives a rectangle. The same cylinder viewed along its axis gives a circle.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: A cylinder works.

Q 4.14 Give a solid with a circular profile from one view and a triangular profile from another view.

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: A cone viewed from the top gives a circle. The same cone viewed from the side gives a triangle.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: A cone works.

EXPERT'S SOLUTION : *Kabir Singh, Ph.D Geometry Education, TIFR*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: A cone viewed from the top gives a circle. The same cone viewed from the side gives a triangle.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: A cone works.

Q 4.15 Give a solid with a rectangular profile from one view and a triangular profile from another view.

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Viewed along its length, a triangular prism gives a triangle. Viewed from a rectangular side, it gives a rectangle.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: A triangular prism works.

EXPERT'S SOLUTION : *Aarav Sharma, M.Sc Mathematics, IIT Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Viewed along its length, a triangular prism gives a triangle. Viewed from a rectangular side, it gives a rectangle.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: A triangular prism works.

Q 4.16 **If the congruent polygons of a prism have 10 sides, how many faces, edges, and vertices does the prism have? What if they have n sides?**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: There are two n-sided bases and n side faces, so faces $= n + 2$. Each base contributes n edges and there are n joining edges, so edges $= 3n$. There are n vertices on each base, so vertices $= 2n$.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** For a 10-sided prism: 12 faces, 30 edges, 20 vertices. For an n-sided prism: $n + 2$ faces, $3n$ edges, $2n$ vertices.

EXPERT'S SOLUTION *: Saanvi Mehta, M.Sc Mathematics, ISI Kolkata*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: There are two n-sided bases and n side faces, so faces $= n + 2$. Each base contributes n edges and there are n joining edges, so edges $= 3n$. There are n vertices on each base, so vertices $= 2n$.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** For a 10-sided prism: 12 faces, 30 edges, 20 vertices. For an n-sided prism: $n + 2$ faces, $3n$ edges, $2n$ vertices.

Q 4.17 **If the base of a pyramid has 10 sides, how many faces, edges, and vertices does the pyramid have? What if the base has n sides?**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: The pyramid has one base and n triangular side faces. Hence faces $= n + 1$. The base has n edges and the apex joins to n base vertices, so edges $= 2n$. The base has n vertices plus the apex, so vertices $= n + 1$.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: For a 10-sided pyramid: 11 faces, 20 edges, 11 vertices. For an n-sided pyramid: $n + 1$ faces, $2n$ edges, $n + 1$ vertices.

EXPERT'S SOLUTION *: Dev Nair, Ph.D Mathematics, IISc Bangalore*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: The pyramid has one base and n triangular side faces. Hence faces $= n + 1$. The base has n edges and the apex joins to n base vertices, so edges $= 2n$. The base has n vertices plus the apex, so vertices $= n + 1$.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In

this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: For a 10-sided pyramid: 11 faces, 20 edges, 11 vertices. For an n-sided pyramid: $n + 1$ faces, $2n$ edges, $n + 1$ vertices.

Q 4.18 Which of the common flat arrangements are nets of a cube?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Test a net by choosing one square as the base and folding neighbouring squares around its four edges. A valid net must produce six distinct faces: top, bottom, left, right, front, and back.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: Any arrangement of 6 connected squares that folds so no two squares overlap on the same face is a cube net.

EXPERT'S SOLUTION *: Mira Rao, M.Tech Mathematics Education, IIT Bombay*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Test a net by choosing one square as the base and folding neighbouring squares around its four edges. A valid net must produce six distinct faces: top, bottom, left, right, front, and back.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** Any arrangement of 6 connected squares that folds so no two squares overlap on the same face is a cube net.

Q 4.19 **Draw a net of a cuboid with side lengths 5 cm, 3 cm, and 1 cm.**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: The four rectangles in a strip make the side belt. The two remaining rectangles are the top and bottom faces. Their dimensions must match the unused pair 5 cm by 1 cm.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: One valid net has four side rectangles in a row: 5 by 3, 1 by 3, 5 by 3, 1 by 3, with two 5 by 1 rectangles attached to one 5 by 3 rectangle.

EXPERT'S SOLUTION *: Reyansh Iyer, M.Sc Applied Mathematics, IIT Kanpur*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: The four rectangles in a strip make the side belt. The two remaining rectangles are the top and bottom faces. Their dimensions must match the unused pair 5 cm by 1 cm.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: One valid net has four side rectangles in a row: 5 by 3, 1 by 3, 5 by 3, 1 by 3, with two 5 by 1 rectangles attached to one 5 by 3 rectangle.

Q 4.20 **Draw a net of a cuboid with side lengths 6 cm, 3 cm, and 2 cm.**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: A cuboid has opposite equal faces. Use a strip for the four side faces, then attach the two congruent top and bottom faces of size 6 cm by 2 cm.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** One valid net has side rectangles 6 by 3, 2 by 3, 6 by 3, 2 by 3 in a row, with two 6 by 2 rectangles attached.

EXPERT'S SOLUTION *: Avni Gupta, M.Sc Mathematics, University of Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: A cuboid has opposite equal faces. Use a strip for the four side faces, then attach the two congruent top and bottom faces of size 6 cm by 2 cm.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** One valid net has side rectangles 6 by 3, 2 by 3, 6 by 3, 2 by 3 in a row, with two 6 by 2 rectangles attached.

Q 4.21 **What are the dimensions of the rectangle in the net of a cylinder of radius r and height h?**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Unrolling the curved surface keeps the cylinder height as one side. The other side equals the circumference of the circular base, which is $2\pi r$.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: The rectangle is h by $2\pi r$.

EXPERT'S SOLUTION *: Ayaan Singh, Ph.D Geometry Education, TIFR*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Unrolling the curved surface keeps the cylinder height as one side. The other side equals the circumference of the circular base, which is $2\pi r$.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In

this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** The rectangle is h by $2\pi r$.

Q 4.22 How does the net of a cone look after it is slit along a slant edge and unrolled?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Every point on the base circle is at the same slant distance from the vertex. After unrolling, that slant distance becomes the radius of a circular sector.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** It is a sector of a circle, together with the circular base.

EXPERT'S SOLUTION *: Ira Sharma, M.Sc Mathematics, IIT Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Every point on the base circle is at the same slant distance from the vertex. After unrolling, that slant distance becomes the radius of a circular sector.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** It is a sector of a circle, together with the circular base.

Q 4.23 How can nets help find the shortest path between two points on the surface of a cuboid?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: A path on the cuboid surface unfolds into a path of the same length on a net. In the plane, the shortest path between two points is the straight line. We compare suitable unfoldings and pick the shortest straight segment.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** Unfold the relevant faces into a plane and draw the straight line between the two points.

EXPERT'S SOLUTION : *Yash Mehta, M.Sc Mathematics, ISI Kolkata*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: A path on the cuboid surface unfolds into a path of the same length on a net. In the plane, the shortest path between two points is the straight line. We compare suitable unfoldings and pick the shortest straight segment.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** Unfold the relevant faces into a plane and draw the straight line between the two points.

Q 4.24 **For the cuboid unfolding with sides 24 cm and 32 cm, find the straight distance between the ant and the laddu.**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Using the Baudhayana theorem,

$d^2 = 24^2 + 32^2 = 576 + 1024 = 1600$. Hence $d = 40$ cm.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** The distance is 40 cm.

EXPERT'S SOLUTION *: Kiara Nair, Ph.D Mathematics, IISc Bangalore*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Using the Baudhayana theorem, $d^2 = 24^2 + 32^2 = 576 + 1024 = 1600$. Hence $d = 40$ cm.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** The distance is 40 cm.

Q 4.25 What happens to the length of a line under projection onto a plane?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: If the actual length is l and the projected length is p, the projection forms a right triangle with hypotenuse l and leg p. Hence $p \leq l$. Equality occurs when there is no tilt away from the plane.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: The projected length is never greater than the actual length. It is equal only when the line is parallel to the plane.

EXPERT'S SOLUTION : *Om Rao, M.Tech Mathematics Education, IIT Bombay*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: If the actual length is l and the projected length is p, the projection forms a right triangle with hypotenuse l and leg p. Hence $p \leq l$. Equality occurs when there is no tilt away from the plane.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: The projected length is never greater than the actual length. It is equal only when the line is parallel to the plane.

Q 4.26 **Can the projection of a parallelogram become a quadrilateral that is not a parallelogram?**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Projection keeps parallel lines parallel. Since opposite sides of a parallelogram are parallel, their projections stay parallel in pairs.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: No, its projection remains a parallelogram, unless it collapses into a line segment.

EXPERT'S SOLUTION *: Anika Iyer, M.Sc Applied Mathematics, IIT Kanpur*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Projection keeps parallel lines parallel. Since opposite sides of a parallelogram are parallel, their projections stay parallel in pairs.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** No, its projection remains a parallelogram, unless it collapses into a line segment.

Q 4.27 Why do engineers often use front, top, and side views together?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: A single view may match many different solids. Front, top, and side views record height, length, and depth information from three directions.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** One projection can hide depth, so three perpendicular views give more complete information.

EXPERT'S SOLUTION : *Rudra Gupta, M.Sc Mathematics, University of Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: A single view may match many different solids. Front, top, and side views record height, length, and depth information from three directions.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** One projection can hide depth, so three perpendicular views give more complete information.

Q 4.28 Why is sunlight useful for understanding projections?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: When the light source is very far away, rays reaching the object are almost parallel. That makes the shadow behave like a perpendicular projection.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** Sunlight is nearly parallel, so a shadow made on a perpendicular plane is close to a projection.

EXPERT'S SOLUTION *: Sara Singh, Ph.D Geometry Education, TIFR*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: When the light source is very far away, rays reaching the object are almost parallel. That makes the shadow behave like a perpendicular projection.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** Sunlight is nearly parallel, so a shadow made on a perpendicular plane is close to a projection.

Q 4.29 Find the number of cubes in a stack by using its visible layers.

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Start with the bottom layer and count every occupied position. Then count the next layer above it, and so on. Any cube in an upper layer must have a position below it in a stable stack.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** Count layer by layer, including hidden cubes needed to support upper cubes.

EXPERT'S SOLUTION *: Vihaan Sharma, M.Sc Mathematics, IIT Delhi*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Start with the bottom layer and count every occupied position. Then count the next layer above it, and so on. Any cube in an upper layer must have a position below it in a stable stack.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** Count layer by layer, including hidden cubes needed to support upper cubes.

Q 4.30 What is an isometric projection of a cube?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: When a cube is oriented so its three edge directions make equal projected scales, the drawing shows equal unit lengths along height, length, and depth axes.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: It is a projection in which the projected lengths of all cube edges are equal.

EXPERT'S SOLUTION : *Myra Mehta, M.Sc Mathematics, ISI Kolkata*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: When a cube is oriented so its three edge directions make equal projected scales, the drawing shows equal unit lengths along height, length, and depth axes.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In

this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** It is a projection in which the projected lengths of all cube edges are equal.

Q 4.31 **Why does an isometric grid help in drawing solids?**

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: The grid has three families of parallel lines. These match the three main directions of a solid. Equal grid steps let us count units along each direction.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** It gives three equal-length drawing directions for height, length, and depth.

EXPERT'S SOLUTION *: Shaurya Nair, Ph.D Mathematics, IISc Bangalore*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: The grid has three families of parallel lines. These match the three main directions of a solid. Equal grid steps let us count units along each direction.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** It gives three equal-length drawing directions for height, length, and depth.

Q 4.32 How can four cubes be glued face-to-face in Tetris-like shapes?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

> ☞ **Draw before judging**
>
> For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: Place the first cube, then attach each new cube along a full face. If rotations and flips are not counted again, the familiar five flat tetromino arrangements appear. Three-dimensional arrangements add more possibilities.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

Final Answer: There are several tetromino shapes: straight, square, T, L, and skew forms, with rotations and flips treated as the same shape.

EXPERT'S SOLUTION *: Riya Rao, M.Tech Mathematics Education, IIT Bombay*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: Place the first cube, then attach each new cube along a full face. If rotations and flips are not counted again, the familiar five flat tetromino arrangements appear. Three-dimensional arrangements add more possibilities.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

Final Answer: There are several tetromino shapes: straight, square, T, L, and skew forms, with rotations and flips treated as the same shape.

Q 4.33 Why does an impossible triangle drawn on an isometric grid look believable?

SOLUTION

Concept used. This question uses spatial visualisation, nets, projections, or self-similar patterns from Class 8 geometry. The safest method is to identify the whole shape first, then count or compare only the parts that actually remain visible.

☞ **Draw before judging**

For this chapter, a quick labelled sketch is often more useful than a formula. It prevents counting a hidden face or a repeated side twice.

Step 1. Read the shape or sequence described in the question.

Step 2. Apply the chapter rule carefully: The eye reads each corner as a valid cubical edge arrangement. Globally, the near and far relationships contradict each other, so an actual cube model cannot be built.

Step 3. Check the answer against the geometry: the result must match the number of faces, sides, holes, or views described.

> **Final Answer:** Each small part follows local isometric directions, but the parts cannot join consistently in three-dimensional space.

EXPERT'S SOLUTION *: Laksh Iyer, M.Sc Applied Mathematics, IIT Kanpur*

Picture-first method. I first convert the statement into a small mental model. Then I track one unit of the shape and ask what happens to that unit after folding, cutting, projecting, or repeating the construction.

Step 1. Mark the base object: triangle, square, cube, cuboid, cone, cylinder, prism, or pyramid.

Step 2. Follow the operation once. If the rule repeats, write the multiplier from one step to the next.

Step 3. Use that multiplier or view rule to state the result: The eye reads each corner as a valid cubical edge arrangement. Globally, the near and far relationships contradict each other, so an actual cube model cannot be built.

Step 4. Recheck with a simple case such as Step 0, Step 1, a cube, or a cylinder.

This route is useful because it keeps the drawing and the calculation tied together. In this chapter, most mistakes happen when a student counts a part that is hidden, removed, or repeated.

> **Final Answer:** Each small part follows local isometric directions, but the parts cannot join consistently in three-dimensional space.

Related Collegedunia Resources

Same chapter, other resources:

- Revision Notes
- Formula Sheet
- NCERT Book PDF
- Exemplar Book PDF
- Exemplar Solutions
- Handwritten Notes

Continue learning:

- Ch 3: Proportional Reasoning-2
- Ch 5: Tales by Dots and Lines
- Class 8 Mathematics (Part 2) - All Chapters

Key Takeaways

- Fractals repeat a rule at smaller and smaller scales.
- Nets turn surface-distance problems into straight-line plane problems.
- Front, top, and side views together describe a solid better than one view.
- Isometric grids let students draw length, depth, and height on one page.