



Cross-sections of solids

GRADE 7 MATH

Answer keys for the exit ticket, practice worksheet, and homework, plus notes for the lesson slides. Each answer shows the steps and the most likely wrong answer (“If wrong”), so you can tell what a mistake means, not just that it is one. Questions go from **fluency** to **application** to **reasoning**.

Exit Ticket — answer key

Use: End of the cross-sections lesson. 5–8 min, independent. Items 1 and 2 are the same solid and are designed to be answered differently.

Timing: 5–8 min · independent. Modelling clay and a length of thread beats any diagram; cut the shapes live if you can.

1. Cylinder sliced horizontally? **FLUENCY**

Answer: **A circle**

1. The knife travels parallel to the base and meets only the curved wall.
2. That wall is circular all the way round, so the cut face is a circle — the same size as the base.

If wrong: Answered rectangle by picturing the side view of the cylinder rather than the cut face.

2. Cylinder sliced vertically? **REASONING**

Answer: **A rectangle**

1. Going straight down, the knife meets the flat top, then two opposite parts of the curved wall, then the flat bottom.
2. Top and bottom edges are straight; the two side edges are straight vertical lines up the wall.
3. Four straight edges with right angles: a rectangle.
4. The curved wall does not make a curved edge here, because the knife crosses it in a straight vertical line rather than travelling around it.
5. Same cylinder as question 1, and a completely different shape.

If wrong: Answered circle, assuming a round solid always cuts round. The direction of the slice decides, not the solid.

3. Pyramid sliced horizontally, then vertically APPLICATION

Answer: **A square, then a triangle**

1. Horizontal slice: parallel to the square base, so the cut face is a square — smaller than the base, but still a square.
2. Vertical slice through the apex: the knife meets two slanted faces and the base, giving three straight edges.
3. That is a triangle.
4. Again one solid gives two different cross-sections depending on direction.

If wrong: Said both are triangles, picturing the pyramid's outline instead of the cut face.

4. Sphere sliced any way? REASONING

Answer: **Always a circle — the sphere is the only solid with no flat faces or edges**

1. Every point on a sphere is the same distance from its centre.
2. So a flat cut always meets the surface in a curve that is equally far from a central point: a circle.
3. Direction makes no difference — horizontal, vertical or diagonal all give circles, differing only in size.
4. Every other solid here has flat faces or straight edges, so its cross-section can change with direction.
5. The sphere is the only one whose answer is the same no matter how you slice it.

If wrong: Said the shape depends on direction, generalising from the cylinder. The sphere is the exception, and the reason is that it has no flat faces at all.

Quick answers for fast checking:

#	Level	Answer
1	fluency	circle
2	reasoning	rectangle
3	application	square, then triangle
4	reasoning	always a circle

Practice Worksheet — answer key

Use: During the lesson after the deck. Item 9 requires a genuine counterexample, and the common wrong move — offering the sphere — is worth naming aloud.

Timing: 15–25 min · pairs or independent · clay and thread, or even sliced fruit, make this concrete in a way diagrams cannot. Circulate on 3 and 9.

1. Prism sliced horizontally? **FLUENCY**

Answer: **A rectangle**

1. The knife meets four flat vertical faces, giving four straight edges at right angles.

If wrong: Answered cube. A cube is a solid; the cross-section is a flat shape.

2. Prism sliced vertically? **FLUENCY**

Answer: **A rectangle**

1. Again four flat faces are met, giving four straight edges.
2. The dimensions differ from question 1, but it is still a rectangle.

If wrong: Answered square without checking the dimensions.

3. Why is the prism the same both ways? **REASONING**

Answer: **Because every face is flat, so every cut edge is straight**

1. A prism has six flat faces and no curved surfaces at all.
2. A flat face cut by a flat knife always gives a straight edge.
3. So whichever way you slice, you get straight edges meeting at right angles — a rectangle.
4. A cylinder has a curved wall. Travelling AROUND that wall gives a circle; cutting straight ACROSS it gives two straight lines.
5. The presence of a curved surface is what allows the answer to change with direction.

If wrong: Said the prism is symmetrical. Symmetry is not the reason — the absence of curved surfaces is.

4. Cone sliced horizontally? **APPLICATION**

Answer: **A circle**

1. The knife travels around the curved wall, meeting it in a full loop.
2. That gives a circle, smaller than the base.

If wrong: Answered triangle, picturing the cone's silhouette.

5. Cone sliced vertically through the apex? APPLICATION

Answer: **A triangle**

1. The knife meets the flat base once, giving a straight edge.
2. It meets the curved wall on two sides, and each of those cuts is a straight line running up to the point.
3. Three straight edges: a triangle.

If wrong: Answered circle, assuming the curved wall must produce a curve.

6. Cylinder both ways? APPLICATION

Answer: **Circle, then rectangle**

1. Horizontal: around the curved wall → circle.
2. Vertical: across the wall, plus the flat top and bottom → rectangle.

If wrong: Gave circle for both.

7. Which have a curved surface? APPLICATION

Answer: **Cylinder, cone and sphere**

1. Cylinder: curved wall. Cone: curved wall. Sphere: entirely curved.
2. Prism and pyramid are made only of flat faces.

If wrong: Included the pyramid because of its slanted faces. Slanted is not curved — a slanted face is still flat.

8. Which always gives a circle? REASONING

Answer: **The sphere only**

1. Sphere: every point is equidistant from the centre, so any flat cut gives a circle.
2. Cylinder: circle horizontally, rectangle vertically — not always.
3. Cone: circle horizontally, triangle vertically — not always.
4. Prism and pyramid have no curved surfaces, so they cannot give a circle at all.
5. Only the sphere has a surface that curves the SAME way in every direction, which is why only it gives one answer.

If wrong: Included the cylinder and cone because they have circular bases. Having a circular base is not the same as always cutting circular.

9. 'Round solids give round cross-sections' REASONING

Answer: **Counterexamples: cylinder cut vertically gives a rectangle; cone cut vertically gives a triangle**

1. Cylinder sliced vertically → rectangle. Cone sliced vertically through the apex → triangle. Both are round solids with straight-sided cross-sections.
2. A better rule: the cross-section depends on the DIRECTION of the slice as well as the solid.
3. More precisely: you get a curved edge only where the knife travels AROUND a curved surface. Cutting straight across one gives a straight edge.
4. The only solid where direction cannot matter is the sphere, because it curves identically in every direction.

If wrong: Offered the sphere as a counterexample. The sphere supports the student's claim rather than refuting it — a counterexample has to be a round solid with a straight-sided cross-section.

Quick answers for fast checking:

#	Level	Answer
1	fluency	rectangle
2	fluency	rectangle
3	reasoning	all faces are flat
4	application	circle
5	application	triangle
6	application	circle, rectangle
7	application	cylinder, cone, sphere
8	reasoning	sphere only
9	reasoning	cylinder and cone vertically

Homework — answer key

Use: Parallels the practice sheet. Item 7 asks students to find the shared feature rather than recall answers, which is the difference between memorising a table and understanding slicing.

Timing: ~15 min at home · independent · review item 7 as the next-day warm-up.

1. Cylinder horizontal? FLUENCY

Answer: **A circle**

1. The knife goes around the curved wall.

If wrong: Answered rectangle.

2. Cylinder vertical? FLUENCY

Answer: **A rectangle**

1. Flat top, flat bottom, and two straight cuts up the wall.

If wrong: Answered circle.

3. Pyramid vertical through the apex? APPLICATION

Answer: **A triangle**

1. Two slanted faces give two straight edges meeting at the apex; the base gives the third.

If wrong: Answered square, picturing the base.

4. Pyramid horizontal? APPLICATION

Answer: **A square**

1. Parallel to the base, so the cut face is a smaller square.

If wrong: Answered triangle, picturing the silhouette.

5. Cone vertical through the apex? APPLICATION

Answer: **A triangle**

1. The base gives one straight edge; the curved wall is cut straight on each side, giving two more.

If wrong: Answered circle.

6. Sphere horizontal? FLUENCY

Answer: **A circle**

1. Any flat cut through a sphere gives a circle.

If wrong: Answered oval.

7. Which give a triangle vertically? What do they share? REASONING

Answer: **The pyramid and the cone — both come to a point at the top**

1. Pyramid sliced vertically through the apex: a triangle.
2. Cone sliced vertically through the apex: a triangle.
3. What they share is an APEX — a single point at the top that the solid narrows towards.
4. Slicing down through that point means the two sides of the cut converge on it, producing two edges meeting at a vertex.
5. The cylinder and prism have flat tops of the same size as their bases, so their vertical cuts have parallel sides and give rectangles.
6. Narrowing to a point is what produces a triangle.

If wrong: Listed the shapes without finding what they share. The question asks for the common feature, which is the apex.

8. Prism always a rectangle, cylinder not — why? REASONING

Answer: **The prism has only flat faces; the cylinder has a curved wall**

1. Every face of a rectangular prism is flat, and a flat face cut by a flat plane always gives a straight edge.
2. So every cross-section is bounded by straight edges meeting at right angles: a rectangle, whatever the direction.
3. A cylinder has a curved wall. Travelling AROUND that wall gives a circular edge; cutting straight ACROSS it gives a straight one.
4. So the cylinder's answer depends on direction and the prism's does not.
5. The general principle: a solid made only of flat faces cannot produce a curved cross-section, no matter how it is cut.

If wrong: Said the prism is more regular. Regularity is not the reason; having no curved surface is.

Quick answers for fast checking:

#	Level	Answer
1	fluency	circle
2	fluency	rectangle
3	application	triangle
4	application	square
5	application	triangle
6	fluency	circle

7	reasoning	pyramid and cone — both have an apex
8	reasoning	flat faces only

Lesson slides — teaching notes & timing

Mini-lesson deck: ~12–15 min, then the practice sheet. Modelling clay and a length of thread, or a cut apple and carrot, will teach this faster than any diagram.

Slide	~Time	Note
1/8	0:00	Frame it: a cross-section is a flat shape, so the answer is always 2-D. Never ‘a cube’.
2/8	1:00	Hook — poll circle vs rectangle. Do NOT resolve. Circle wins, because the solid is round.
3/8	2:30	Give them the method before the answer: follow the knife, face by face.
4/8	4:30	WE1 — resolve the hook. If you have clay and thread, cut it in front of them; the reveal does the work.
5/8	6:30	WE2 — the same cylinder the other way. Hold both cut faces up together.
6/8	8:30	CFU — all-student response. Triangle. Watch for circle, from the curved wall.
7/8	10:30	The two solids where direction does not matter, and why each is exceptional for a different reason.
8/8	13:00	Launch the in-class practice sheet.