Triangles Are Half Parallelograms

Teacher		**Class**	Year 6
Subject	Maths	**Topic**	Area of triangles and parallelograms
Date		**Room**	
Lesson length	60 minutes	**Country**	United Kingdom

Students learn to calculate the area of parallelograms and triangles. They cut shapes to prove the rules and solve area problems.

Curriculum links

- They relate the area of rectangles to parallelograms and triangles, for example, by dissection, and calculate their areas, understanding and using the formulae (in words or symbols) to do this [1]

Learning objectives

- Students will relate rectangles to parallelograms and triangles by dissection.
- Students will calculate the area of parallelograms using base times height.
- Students will calculate the area of triangles using half times base times height.

Success criteria

- I can find parallelogram area using base times perpendicular height.
- I can find triangle area as half of its matching parallelogram.
- I can choose the correct height and give answers in cm².

What students already know

Quick check (2 minutes): show a 5 cm by 3 cm rectangle on squared paper and ask students to write its area on mini whiteboards.

Key words

base	the side chosen to start measuring from when working out size
height	the straight line from the starting side to the opposite side that meets it at a square corner [2]
area	the amount of flat space inside a shape, measured in square units such as cm²
parallelogram	a four-sided shape with both pairs of opposite sides running the same way
triangle	a shape with three straight sides and three corners, always half its matching four-sided shape [2]
dissection	cutting a shape up and putting the parts back together to show how size is linked [1]

Materials

- Squared paper
- Scissors
- Rulers
- Glue sticks
- Mini whiteboards and pens

Before the lesson

- Print Worksheet Task B and Task C, one copy per pair
- Test Video clip 1 on slide 6 and Video clip 2 on slide 8 for sound and picture

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- Right-angle cards
- Worksheet Task B and Task C printed

- Prepare large parallelogram outline and scissors, rulers and squared paper on tables
- Draw pre-cut parallelograms for support and extra challenge cards for stretch

Lesson outline

0–5 min **Starter** 5 min · Whole class

To recall rectangle area and spark curiosity about cutting parallelograms into triangles.

YOU DO

1. Welcome the class and show the title and photo of roofs, ramps and kites.
2. Ask students to find the area of a 5 cm by 3 cm rectangle on mini whiteboards.
3. Hold up a paper parallelogram and say the hook question to invite predictions.
4. Share the lesson goals: link rectangles to new shapes and calculate their areas.

STUDENTS DO

1. Write the rectangle area on mini whiteboards and show it.
2. Turn to a partner, predict what two pieces the parallelogram will make.
3. Listen to the lesson goals.

Say: We know a rectangle is length times width. Here is my question: If I cut this parallelogram in half, what will I get and how big will it be? Talk to your partner and be ready to prove it by cutting today.

Worked example: Rectangle 5 cm by 3 cm: Area = 5 × 3 = 15 cm². We write cm² because we count squares covering flat space.

Ask: What is the area of the 5 cm by 3 cm rectangle? (15 cm², because 5 × 3 = 15.) · If I cut a parallelogram along its diagonal, what shapes will I get? (Two identical triangles that exactly cover the parallelogram.)

Check understanding: Scan whiteboards for 15 cm²; if many are unsure, quickly rebuild 5 × 3 as rows of squares before moving on.

Support: Show the rectangle made of 15 marked 1 cm squares so students can count. **Stretch:** Ask what happens to rectangle area if one side is doubled.

Use: Slides 1-3

5–15 min **Teaching** 10 min · Whole class

To show that a parallelogram has the same area as its rectangle by cut and slide.

YOU DO

1. Display a parallelogram with labelled base, dashed height with square-corner mark, and slanted side.
2. Play the video showing cutting a triangle off one end and sliding it to make a rectangle.
3. Model labelling the base and checking the height is the perpendicular distance from the base to the opposite side [2].
4. Model the calculation using Area of a parallelogram = base × height [2], crossing out the slanted side.

STUDENTS DO

1. Watch the cut-and-slide and point to the right-angle mark for height.
2. Repeat the 6 × 4 calculation on whiteboards with cm².
3. Vote which line is the true height and explain why.

Say: This slanted shape is really a rectangle in disguise. The height must go straight up from the base and meet it at a right angle [2]. Then Area of a parallelogram = base × height [2]. We never use the slanted side.

Worked example: Parallelogram: base 6 cm, perpendicular height 4 cm, slanted side 5 cm. Area = base × height = 6 × 4 = 24 cm² [2]. The 5 cm is not used because it is not at right angles to the base.

Ask: Which line is the true height, the slanted side or the dashed line? (The dashed line, because it meets the base at a right angle [2].) · Why would using the slanted side give too big an answer? (It is longer than the straight-up distance, so base times that length is too large.)

Check understanding: Ask all to hold up 24 cm²; if split, re-test each line with a right-angle card and reteach perpendicular.

Support: Give pre-drawn parallelograms with the base already highlighted and height marked with a right-angle symbol. **Stretch:** Ask students to measure the slanted side and explain in writing why it is not used.

Use: Slides 4-6; Video clip 1 (0:00–4:30)

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15–25 min **Teaching** 10 min · Whole class

To show that a triangle is half its matching parallelogram with the same base and height.

YOU DO

1. Show base, height and dissection cards and read their short meanings together.
2. Play the video showing two triangles making one parallelogram and when to divide by two.
3. Cut the 6 cm by 4 cm parallelogram along its diagonal to show two identical triangles.
4. Model the triangle calculation using Area of a triangle = 1/2 × base × height, where height is perpendicular distance [2].

STUDENTS DO

1. Listen for the divide-by-two step in the video and chant the triangle rule.
2. Check that the two cut triangles lie exactly on the parallelogram outline.
3. Copy the 12 cm² working with formula, substitution and units.

Say: Two identical triangles make one parallelogram. So a triangle is always half its matching parallelogram with the same base and height [2]. We calculate base times height, then halve it.

Worked example: Triangle from the same parallelogram: base 6 cm, height 4 cm. Area = 1/2 × base × height = 1/2 × 6 × 4 = 1/2 × 24 = 12 cm² [2]. This is half of 24 cm².

Ask: Why do we divide by two for a triangle? (Because two equal triangles make the whole parallelogram, so one is half [2].) · What must the height be for the triangle rule to work? (The perpendicular distance from the base to the opposite corner [2].)

Check understanding: Hinge question on whiteboards: triangle base 10 cm height 5 cm; expect 25 cm²; reteach halving if many write 50 cm².

Support: Start with right-angled triangles where the base and height meet at a corner of a square on the grid.
Stretch: Rotate the triangle so the base is vertical and ask students to re-find base and height.

Use: Slides 7-8; Video clip 2 (0:00–2:16)

25–50 min **Main activity** 25 min · Pairs

To prove by dissection that triangle area is half parallelogram area and practise calculations [1].

YOU DO

1. Give out squared paper, scissors and rulers and show the task steps on the board.
2. Demonstrate drawing a parallelogram, cutting it out, then cutting along the diagonal into two triangles.
3. Ask pairs to lay the triangles back on the outline, label base and perpendicular height, and write both area calculations underneath.
4. Hand out Worksheet Task B for pairs to find each area using the perpendicular height.

STUDENTS DO

1. Draw, cut out and halve a parallelogram, then lay the two triangles back on the outline.
2. Label base and perpendicular height and write Area = base × height and Area = 1/2 × base × height with answers in cm² [2].
3. Complete Worksheet Task B in pairs, checking the height makes a right angle.

Say: Draw a parallelogram on the squares. Cut it out, then cut along the diagonal. You should have two triangles that match exactly. Measure the base and the straight-up height, then write the parallelogram area and the half-area for the triangle.

Ask: How do you know your two triangles are equal in area? (They both fit exactly on the same parallelogram outline.) · You have base 8 cm and height 3 cm. What are the two areas? (Parallelogram 24 cm² and triangle 12 cm², because 8 × 3 = 24 and half is 12.)

Check understanding: Circulate and check books show labelled base, right-angle mark, correct halving and cm²; pull a small group for reteaching if height is slanted.

Support: Start with right-angled triangles where the base and height meet at a corner of a square on the grid.
Stretch: Challenge students to draw a different triangle with the same base and height and show it must have the same area.

Use: Slide 9; Worksheet Task B

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50–60 min **Plenary** 10 min · Whole class

To correct height errors and confirm students can use both area rules.

YOU DO

1. Show the fact that with the same base and same height, halve the area every time.
2. Do one Worksheet Task C error together: spot use of slanted side or forgotten halving.
3. Ask pairs to correct the working and give the right area in cm².
4. Finish with the exit ticket prompts about one rule, one area and one question.

STUDENTS DO

1. Explain why the slanted length must not be used.
2. Correct the error in pairs and write the right area.
3. Complete the exit ticket sentences on paper or whiteboards.

Say: Remember our rule in words: base times height, halve for triangles. The height must be straight up at a right angle. Now be detectives: find the wrong step, say why, and fix it.

Worked example: Wrong: triangle base 8 cm, height 3 cm, slanted side 4 cm, working 8 × 4 = 32 cm². Fix: wrong length and no halving. Right working: 1/2 × 8 × 3 = 12 cm² [2].

Ask: What was wrong with 8 × 4 for that triangle? (It used the slanted side not the perpendicular height and forgot to halve [2].) · A parallelogram and triangle share base 9 cm and height 6 cm. What are their areas? (54 cm² and 27 cm², because 9 × 6 = 54 and half is 27.)

Check understanding: Collect exit tickets; if halving or height errors remain, start next lesson with two quick match-and-mark examples.

Support: Provide the two formulae written out with the perpendicular height shown as a dashed line. **Stretch:** Ask students to write why doubling the base doubles the area but keeps the height rule the same.

Use: Slides 10-11; Worksheet Task C

Common mistakes

Mistake	How to spot it	How to fix it
Using the slanted side length as the height	Answer too large and working multiplies by the sloping edge	Test with a right-angle card; height is the perpendicular distance from the base to the opposite side [2].
Forgetting to halve for triangles	Triangle answer equals the parallelogram answer for same base and height	Remind that two equal triangles make one parallelogram, so use 1/2 × base × height [2].
Writing cm instead of cm² or mixing units	Length units on an area or no units at all	Practise saying we count squares: lengths in cm, areas in cm².

Support

- Start with right-angled triangles where the base and height meet at a corner of a square on the grid.
- Give pre-drawn parallelograms with the base highlighted and perpendicular height marked.

Stretch

- Challenge students to draw a different triangle with the same base and height and show it must have the same area.
- Ask students to measure the slanted side and explain in writing why it is not used.

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For the LSE or teaching assistant

Sit with target pairs in the main activity; help them place the right-angle card to find height, prompt halving, and check cm² is written.

Safety

- Show safe use of scissors, carry them point down, and collect waste paper so the floor stays clear.

Check for understanding

Question	Answer
A parallelogram has base 7 cm and perpendicular height 5 cm. What is its area?	35 cm² because 7 × 5 = 35 [2].
A triangle has base 10 cm and perpendicular height 6 cm. What is its area?	30 cm² because 1/2 × 10 × 6 = 30 [2].
Why must height be perpendicular to the base?	Because area counts straight-up rows of squares; the slanted side is longer and would give too big an answer [2].

Homework

Find two triangular and two slanted four-sided objects at home, estimate base and height in cm, and calculate each area.

Sources

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