Find the F and the Z to Find Missing Angles

Teacher		**Class**	Year 7
Subject	Maths	**Topic**	Angles in parallel lines
Date		**Room**	
Lesson length	60 minutes	**Country**	United Kingdom

Pupils learn that corresponding and alternate angles are equal on parallel lines. They find missing angles and give the angle reason each time.

Curriculum links

- understand and use the relationship between parallel lines and alternate and corresponding angles
- constructing, measuring and using geometric notation, followed by looking at developing geometric reasoning in Lines and Angles [2]

Learning objectives

- Students will recognise equal corresponding angles in F shapes on parallel lines.
- Students will recognise equal alternate angles in Z shapes on parallel lines.
- Students will find missing angles using alternate and corresponding angle facts.

Success criteria

- I can spot F pairs and Z pairs where a transversal cuts parallel lines.
- I can find a missing angle and say why it is equal.
- I can check parallel arrows before I use the equal-angle rules.

What students already know

2-minute mini-whiteboard check: show two parallel lines cut by a transversal and ask pupils to name angles on a straight line and opposite angles where lines cross.

Key words

parallel lines	straight lines that stay the same distance apart and never meet [3]
transversal	a straight line that cuts across two or more other lines [3]
corresponding angles	pair in matching corners at each crossing that are the same size when lines never meet [4]
alternate angles	pair on opposite sides of the crossing line, inside the two lines, that are the same size [3][4]

Materials

- Slides 1, 4, 6, 7, 9, 12
- Video clip 2 alternate and corresponding step-by-step (0:00–5:00) on slide 6
- printed practice questions (Worksheet Task B, page 2)
- mini-whiteboards and pens
- protractors and rulers

Before the lesson

- Print practice questions - Worksheet Task B page 2, one per pupil plus spares
- Test Slide 6 Video clip 2 (0:00–5:00) and Slides 1, 4, 7, 9, 12 on classroom display
- Set out mini-whiteboards, protractors, rulers and highlighters

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- two-colour highlighters or colour pencils
- Prepare reason bank cards: corresponding angles are equal / alternate angles are equal / angles on a straight line add to 180 degrees

Lesson outline

0–10 min **Starter** 10 min · Whole class

Recall basic angle facts and create curiosity about finding angles without measuring.

YOU DO

1. Show Slide 1 Angles in Parallel Lines [title]: Find the F and the Z and say the hook: I am given one angle of 53 degrees and I can tell you three others without measuring — watch.
2. Show Slide 4 What do we already know? mindmap and elicit: angles on a line add to 180 degrees, opposite angles where lines cross are equal, parallel lines never meet.
3. Do a 2-minute check: draw one 53-degree angle on parallel lines cut by a transversal and ask pupils to show on mini-whiteboards what other angles they could work out.
4. Share the lesson goal: we will calculate missing angles using alternate and corresponding facts and always give the reason.

STUDENTS DO

1. Look at Slide 1 and listen to the 53-degree challenge.
2. Call out ideas for Slide 4 and write quick answers on mini-whiteboards.
3. Hold up boards to show angles on a straight line and opposite equal angles.

Say: Look at this diagram. I know just one angle is 53 degrees. I can tell you three other angles without my protractor. By the end of today you will do the same. First, show me what we already know about angles on a line and where lines cross.

Ask: When one slanted line cuts two parallel lines, how many different angle sizes do you see? (Two sizes - one acute set and one obtuse set - all acute angles match and all obtuse angles match.) · If one angle on a straight line is 53 degrees, what is the angle next to it? (127 degrees because angles on a straight line add to 180 degrees.)

Check understanding: Scan mini-whiteboards for 127 degrees with reason; if many are unsure, quickly re-model 180 minus 53 on the board before moving on.

Support: Show the 53-degree and 127-degree pair colour-coded on the board and let pupils copy the number sentence 180 - 53 = 127. **Stretch:** Ask who can already predict where the next 53-degree angle will be on the second crossing and why.

Use: Slides 1, 4

10–22 min **Teaching** 12 min · Whole class

Model how F shapes show equal corresponding angles and Z shapes show equal alternate angles.

YOU DO

1. Define parallel lines as lines that stay the same distance apart and never meet, marked with matching arrows [3], and a transversal as a line which crosses the parallel lines [3].
2. Play Video clip 2 alternate and corresponding step-by-step on Slide 6, pausing to trace the F-shape for corresponding angles and Z-shape for alternate angles.
3. Model a worked example on the board using Slide 7 Two key facts to use, stressing you must check for matching parallel-line arrows before using equality [5].
4. Insist on full reasons each time, since mark schemes award a mark for the correct reason as well as the correct value [5].

STUDENTS DO

1. Watch the video and trace F and Z shapes in the air with a finger.
2. Copy the 53-degree worked example, highlighting the F pair in one colour and the Z pair in another.
3. Chant back the two reasons: corresponding angles are equal, alternate angles are equal [4].

Say: Parallel lines never meet and they stay the same distance apart. The slanted line across them is called the transversal. If you can trace an F, those matching-corner angles are equal. If you can trace a Z, those zig-zag angles are equal. But first check the little arrows - no parallel arrows, no equal rule.

Worked example: Two horizontal parallel lines with arrows cut by a transversal. Marked top-left angle is 53 degrees. Step 1: bottom-left angle is 53 degrees because corresponding angles are equal - it is the same corner at the other crossing, F-shape. Step 2: bottom-right inside angle on opposite side is also 53 degrees because alternate angles are equal - Z-shape on opposite sides within the lines [3]. Step 3: angle next to it on a straight line is 180 - 53 = 127 degrees.

Ask: Where do corresponding angles sit and what is their size? (In the same position at each intersection [3] and they are equal [4] - think F-shape.) · Where do alternate angles sit and what is their size? (On opposite sides of the transversal within the parallel lines [3] and they are equal [4] - think Z-shape.) · What must you check before you say equal? (That the two lines are marked as parallel with matching arrows [5][7].)

Check understanding: Cold-call pupils to point to the F and Z on the worked example and state the reason; re-trace thick F and Z if pointing is vague.

Support: Give a sheet with the F and Z faintly outlined to trace, focusing on how corresponding angles sit in the same position at each intersection [3]. **Stretch:** Ask pupils to find a second, upside-down or back-to-front F or Z on the same diagram and explain why it still counts.

Use: Slide 6, Slide 7, Video clip 2 (0:00–5:00)

22–42 min **Main activity** 20 min · Pairs

Practise calculating missing angles on parallel lines with correct F and Z reasons.

YOU DO

1. Hand out printed practice questions from Worksheet Task B and give one protractor and mini-whiteboard per pair.
2. Direct pairs to first colour the target F or Z, then write size plus reason, for example 53 degrees because corresponding angles are equal.
3. Circulate, asking pupils to point to parallel arrows and name F for equal corresponding angles or Z for equal alternate angles [4].
4. Stop the class once for a two-step demo: alternate then angles on a straight line to find an angle two moves away.

STUDENTS DO

1. Work in pairs on Worksheet Task B: find each missing angle and give a reason each time.
2. Colour the F or Z before calculating and check with a protractor where helpful.
3. Write each answer as size plus reason and compare with another pair.

Say: You have diagrams with one marked angle on parallel lines cut by a transversal. First colour the F or the Z. Then write the size and the reason. Your partner must agree that the arrows show parallel and the shape matches the reason.

Ask: You found 110 degrees - is that an F or a Z, and why? (F means corresponding angles are equal [4]; Z means alternate angles are equal [4] - point to matching positions or opposite sides.) · How do you finish the set when the angle you want is not the F or Z partner? (Use angles on a straight line or vertically opposite angles alongside [5], e.g. 180 minus the F angle.)

Check understanding: Collect three pairs' whiteboards with F-corresponding or Z-alternate labelled with equal sizes; if reasons are missing, re-issue the reason bank and model one more.

Support: Colour the target F or Z before calculating, and provide a reason bank with corresponding angles are equal and alternate angles are equal to choose from. **Stretch:** Chain two steps, such as alternate then angles on a straight line, to find an angle two moves away.

Use: Worksheet Task B

42–52 min **Draw and check** 10 min · Pairs

Secure understanding by drawing accurate parallels and proving pairs match by measuring.

YOU DO

1. Show Slide 9 Your task: draw 2 parallel lines with arrows, cut by a transversal, measure one angle, find its F and Z partners.
2. Remind pupils that a transversal creates eight angles with the parallel lines [3] and F can be upside down or back to front [4].
3. Direct partner checks: measure both angles in the pair - are they equal and can you say why?
4. Pick two good drawings to display and narrate the F and Z reasons.

STUDENTS DO

1. Draw the diagram with ruler, arrows and transversal and label one measured angle.
2. Highlight one F pair in one colour and one Z pair in another colour and write equal sizes.
3. Swap with partner who re-measures and asks: equal? Say why.

Say: Now make your own. Use a ruler, draw two parallel lines with arrows and one slanted transversal. Measure one angle carefully, then predict its F partner and its Z partner. Your partner measures to check you are right.

Worked example: Pupil draws parallels 5 cm apart with arrows, transversal at about 60 degrees. Measures top angle as 60 degrees. Labels F-corresponding partner as 60 degrees because corresponding angles are equal, and Z-alternate partner as 60 degrees because alternate angles are equal, then measures to confirm 60 degrees.

Ask: How do you know your two lines are parallel on paper? (They stay the same distance apart, never meet [3], and I drew matching arrows on them.) · Your F is upside down - does it still count? (Yes, the F shape can be upside down or back to front [4] as long as it is matching positions.)

Check understanding: Gallery of books held up: look for arrows, transversal and colour-coded equal pairs; redraw one non-parallel example to contrast if needed.

Support: Give squared paper with the two parallel lines already drawn with arrows, so pupils only add the transversal and colour the pairs. **Stretch:** Add a second transversal at a different angle and compare how the alternate pair changes but stays equal within each transversal.

Use: Slide 9

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52–60 min **Plenary** 8 min · Whole class

Check the two key facts and correct the idea that equal rules work without parallel lines.

YOU DO

1. Show Slide 12 True or false? and read each statement: corresponding equal when parallel, F positions, alternate add to 180, alternate equal.
2. Ask pupils to vote true or false on mini-whiteboards and justify with F, Z or arrows.
3. Stress the non-parallel trap: both pictures can have a Z shape but pairs are only certainly equal when lines are parallel, shown by arrows [7].
4. Link back to success criteria and set homework.

STUDENTS DO

1. Vote true or false for each statement and hold up boards.
2. Explain one vote using the sentence frame: this is true/false because alternate/corresponding angles are equal and the lines are/are not parallel.
3. Record exit answers and note which memory trick they will use.

Say: Vote true or false. Remember, the rules need the lines to be parallel. If there are no arrows, you cannot assume equal, even if you see a Z. Tell your partner your one-sentence reason every time.

Ask: Alternate angles add up to 180 degrees - true or false? (False - alternate angles are equal [4]; it is co-interior C-shape angles that add to 180 degrees [4].) · Corresponding angles sit in matching F positions and are equal when lines are parallel - true or false? (True - corresponding angles are equal when lines are parallel in matching spots [4].)

Check understanding: Count true/false boards; if more than a few miss the alternate-180 trap, re-draw Z versus straight line and re-vote.

Support: Provide sentence frames such as This is ___ because alternate/corresponding angles are equal and the lines are parallel. **Stretch:** Ask pupils to explain what extra check they would do if the arrows were missing, such as measuring both angles.

Use: Slide 12

Common mistakes

Mistake	How to spot it	How to fix it
Using F or Z equality without checking lines are parallel	Pupil writes corresponding/alternate are equal on a diagram with no arrows or with lines that would meet	Stop and check for matching parallel-line arrows before using equality [5]; rules need the lines to be parallel, shown by arrows [7].
Saying alternate angles add to 180 degrees	Pupil writes 180 minus the angle for a Z pair	Re-trace the Z and stress alternate angles are equal [4]; 180 degrees is for angles on a straight line or C-shape co-interior angles [4].
Missing upside-down or back-to-front F and Z pairs	Pupil only finds upright F or Z and says there are no others	Rotate the sheet and re-trace; the F shape can be upside down or back to front and the Z can be back to front [4].

Support

- Colour the target F or Z before calculating, and provide a reason bank with corresponding angles are equal and alternate angles are equal to choose from.

Stretch

- Chain two steps, such as alternate then angles on a straight line, to find an angle two moves away.
- Find a second, upside-down or back-to-front F or Z on the same diagram and explain why it still counts.

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- Give squared paper with the two parallel lines already drawn with arrows, so pupils only add the transversal.
- Use faint F and Z outlines to trace while learning matching positions at each intersection [3].
- Draw a second transversal at a different angle and compare how the alternate pair changes but stays equal.

For the LSE or teaching assistant

Stay with pairs needing tracing support: help them highlight F in one colour and Z in another, prompt arrow-check and reason-bank choice, and re-measure one pair with the protractor.

Check for understanding

Question	Answer
Two parallel lines cut by a transversal. One angle is 70 degrees. What is its corresponding angle and why?	70 degrees because corresponding angles are equal.
Two parallel lines cut by a transversal. One angle is 115 degrees. What is its alternate angle and why?	115 degrees because alternate angles are equal.
A diagram shows a Z shape but the two lines have no parallel arrows. Can you say the angles are equal? Why?	No - check for matching arrows first [5]; the equal rules need the lines to be parallel [7].

Homework

Complete Worksheet Task D: find the missing angle in each diagram.

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