

Angles in Parallel Lines

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (2 marks)

The diagram shows two parallel lines.

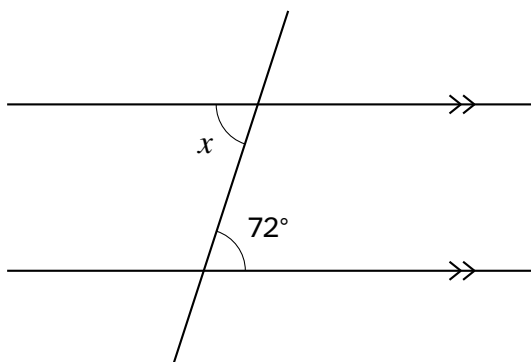


Diagram **NOT** accurately drawn

(a) Write down the size of angle x .

Angle x and the 72° angle are between the parallel lines, on opposite sides of the crossing line (a Z shape).

So they are equal.

Answer: 72°

(b) Give a reason for your answer.

Name the angle fact in full.

Answer: Alternate angles are equal

Tip: Write the full reason: “alternate angles are equal”. “Z angles” or “because the lines are parallel” does not get the mark.

2 (4 marks)

PQ and RS are parallel lines.

An angle of 62° is marked on the diagram.

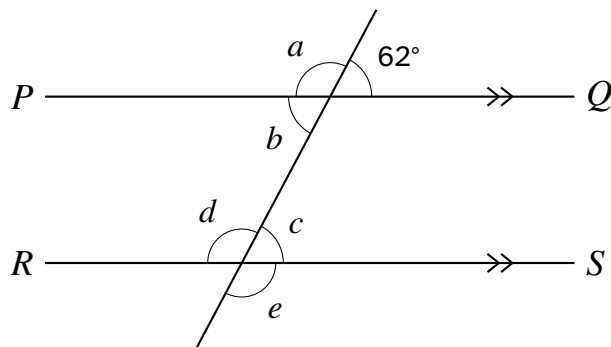


Diagram **NOT** accurately drawn

- (a) Write down the letters of the **two** angles that are equal to 62°

b is vertically opposite the 62° angle, so $b = 62^\circ$

c is in the same position at the lower crossing as the 62° angle (an F shape), so $c = 62^\circ$

Answer: b and c

- (b) Give a reason why angle c is 62°

c and the 62° angle are in the same position at each crossing (an F shape).

Answer: Corresponding angles are equal

Tip: Write the full reason: “corresponding angles are equal”. “F angles” does not get the mark.

- (c) Work out the size of angle d .

Give a reason for each stage of your working.

d and b are between the parallel lines, on the same side of the crossing line (a C shape).

$b = 62^\circ$ (vertically opposite angles are equal)

$d = 180 - 62 = 118^\circ$

Reason: co-interior angles add up to 180° .

(Or: $c = 62^\circ$ and d is next to c on a straight line, so $d = 180 - 62 = 118^\circ$.)

Answer: 118°

Marks: 1 mark for 118. 1 mark for correct reasons for each stage.

3 (3 marks)

The diagram shows two parallel lines.

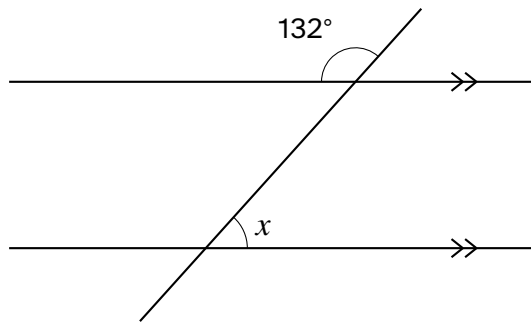


Diagram **NOT** accurately drawn

Work out the size of the angle marked x .

You must give a reason for each stage of your working.

At the upper crossing, find the angle below the line and to the left of the crossing line.

It is next to the 132° angle on a straight line.

$$180 - 132 = 48^\circ$$

Reason: angles on a straight line add up to 180° .

This 48° angle and x make a Z shape.

$$x = 48^\circ$$

Reason: alternate angles are equal.

Answer: 48°

Marks: 1 mark for $180 - 132$. 1 mark for 48. 1 mark for both reasons.

4 (4 marks)

AEB is parallel to FG .

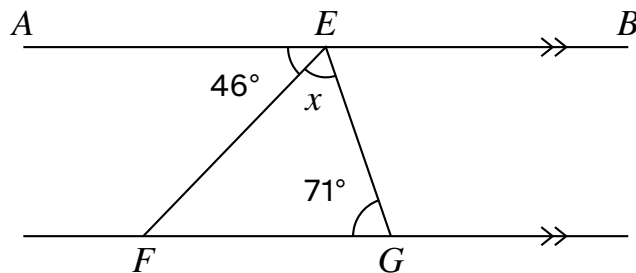


Diagram **NOT** accurately drawn

Work out the size of angle x .

Give a reason for each stage of your working.

AEB is parallel to FG .

Angle EFG and the 46° angle (angle AEF) make a Z shape, so angle $EFG = 46^\circ$

Reason: alternate angles are equal.

Now use triangle EFG . Its angles are 46° , 71° and x .

$$x = 180 - 46 - 71 = 63^\circ$$

Reason: angles in a triangle add up to 180° .

(Or: angle $BEG = 71^\circ$ because alternate angles are equal, then

$$x = 180 - 46 - 71 = 63^\circ \text{ because angles on a straight line add up to } 180^\circ.)$$

Answer: 63°

Tip: Write “angles in a **triangle** add up to 180° ”. A reason like “ 180° in a triangle” can lose the mark.

Marks: 1 mark for angle $EFG = 46$ (or angle $BEG = 71$). 1 mark for $180 - 46 - 71$. 1 mark for 63. 1 mark for correct reasons for each stage.

5 (2 marks)

The diagram shows two parallel lines.

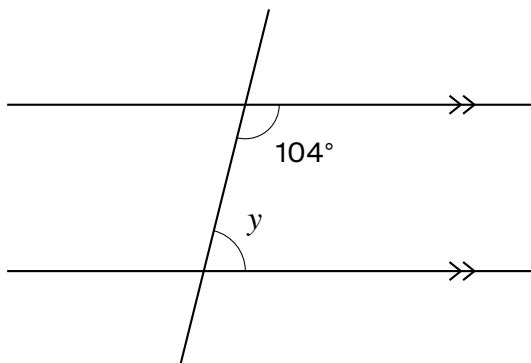


Diagram **NOT** accurately drawn

Work out the size of angle y .

Give a reason for your answer.

Angle y and the 104° angle are between the parallel lines, on the same side of the crossing line (a C shape).

Co-interior angles add up to 180° .

$$y = 180 - 104 = 76^\circ$$

Answer: 76° , co-interior angles add up to 180°

Marks: 1 mark for 76. 1 mark for the reason: co-interior angles add up to 180° .

6 (2 marks)

$ABCD$ is a parallelogram.

Angle $DAB = 64^\circ$

Work out the size of angle ABC .

Give a reason for your answer.

In a parallelogram, opposite sides are parallel, so AD is parallel to BC .

Angles DAB and ABC are co-interior angles.

Co-interior angles add up to 180° .

$$\text{Angle } ABC = 180 - 64 = 116^\circ$$

Answer: 116° , co-interior angles add up to 180°

Marks: 1 mark for 116. 1 mark for the reason.

7 (3 marks)

The diagram shows two parallel lines.

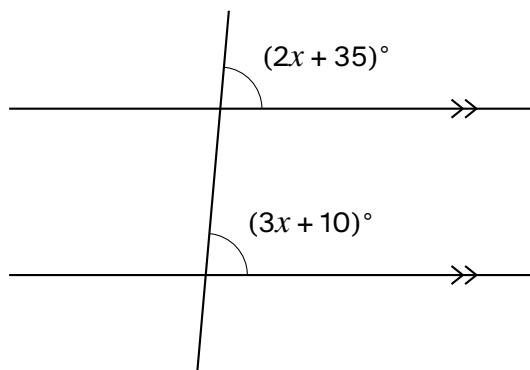


Diagram **NOT** accurately drawn

Work out the value of x .

The two angles are in the same position at each crossing (an F shape).

Corresponding angles are equal.

$$3x + 10 = 2x + 35$$

$$\text{Subtract } 2x \text{ from both sides: } x + 10 = 35$$

$$\text{Subtract 10 from both sides: } x = 25$$

$$\text{Check: } 3 \times 25 + 10 = 85 \text{ and } 2 \times 25 + 35 = 85 \quad \checkmark$$

Answer: $x = 25$

Tip: Corresponding angles are **equal**, so set the expressions equal to each other. Don't add them to make 180.

Marks: 1 mark for $3x + 10 = 2x + 35$. 1 mark for rearranging correctly. 1 mark for $x = 25$.

8 (2 marks)

A straight line crosses the lines RS and TU .

Nadia says,

' RS and TU are parallel.'

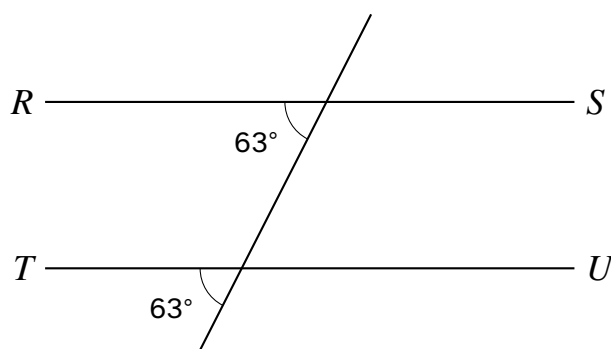


Diagram **NOT** accurately drawn

Is Nadia correct?

You must give your reasoning.

At the lower crossing, the angle above TU and to the right of the crossing line is vertically opposite the 63° angle.

So it is 63° (vertically opposite angles are equal).

This angle and the 63° angle at the upper crossing are between the lines, on opposite sides of the crossing line (a Z shape).

The alternate angles are equal, so RS is parallel to TU .

Nadia is correct.

(Or: the two 63° angles are in the same position at each crossing, so they are corresponding angles. They are equal, so the lines are parallel.)

Answer: Yes, the alternate angles are both 63°

Tip: Lines are parallel only if an angle fact works exactly. Say which angle fact you used.

Marks: 1 mark for linking the two 63° angles with an angle fact (e.g. vertically opposite, then alternate; or corresponding). 1 mark for "Yes" with the reason (alternate angles are equal, or corresponding angles are equal).

9 (4 marks)

ABC and $DEFG$ are parallel lines.

BE and BF are straight lines.

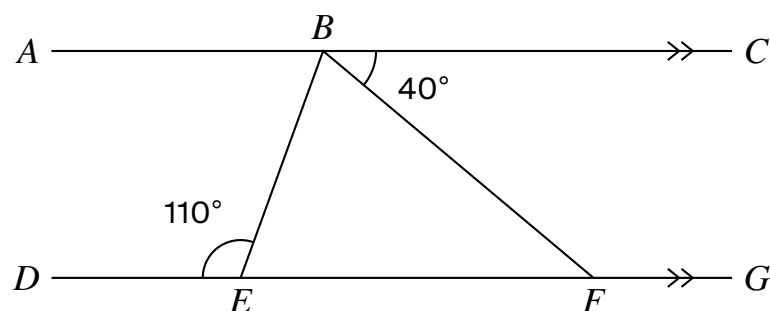


Diagram **NOT** accurately drawn

Show that triangle BEF is isosceles.

Give a reason for each stage of your working.

Angle BEF is next to the 110° angle on the straight line DG .

$$\text{Angle } BEF = 180 - 110 = 70^\circ$$

Reason: angles on a straight line add up to 180° .

ABC is parallel to DG , so angle $BFE = \text{angle } CBF$ (a Z shape).

$$\text{Angle } BFE = 40^\circ$$

Reason: alternate angles are equal.

$$\text{Angle } EBF = 180 - 70 - 40 = 70^\circ$$

Reason: angles in a triangle add up to 180° .

Angles BEF and EBF are both 70° .

Two angles are equal, so triangle BEF is isosceles.

Answer: Angle $BEF = \text{angle } EBF = 70^\circ$

Tip: Use three letters for each angle, like angle BEF . Finish by saying which two angles are equal.

Marks: 1 mark for 70 at E or 40 at F . 1 mark for $180 - 70 - 40$. 1 mark for showing two equal angles. 1 mark for all the reasons.