



eClassroom

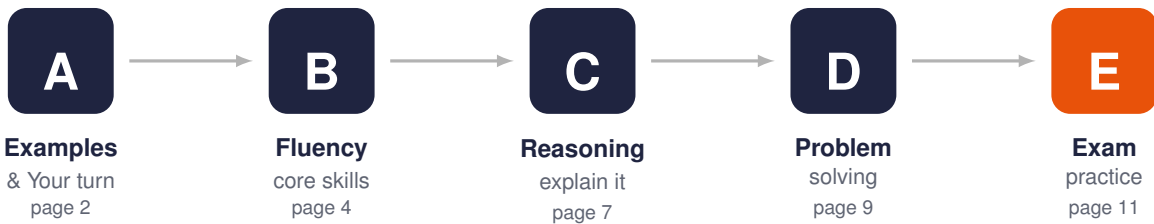
GCSE MATHEMATICS • GEOMETRY

Angle Rules

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Free Angle Rules worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: use angles on a line, at a point and vertically opposite • use alternate, corresponding and co-interior angles • use angles in triangles, quadrilaterals and polygons • work with bearings • give a reason for every step • *Higher:* polygon reasoning, back bearings, algebra with angles and proof.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER The same rules where Higher papers use them: polygon reasoning, bearings, algebra with parallel lines and geometric proof. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	23	10	13	15
Higher marks	16	14	17	15
My score				

Full worked solutions

Geometry revision engine

Free courses

Formula sheet builder

Name

Class

Date



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

A

Worked examples & Your turn

Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION

Everyone starts here

Worked example A1

Work out the value of x .

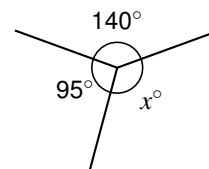
Angles on a straight line add up to 180°



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

Your turn A1

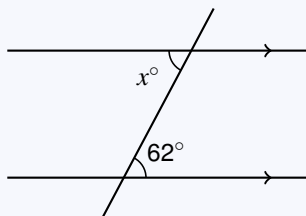
Work out the value of x .



Worked example A2

Work out the value of x . Give a reason.

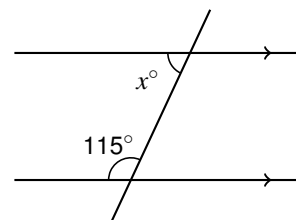
The angles are between the parallel lines, on opposite sides of the transversal.



$$x = 62^\circ \text{ (alternate angles)}$$

Your turn A2

Work out the value of x . Give a reason.



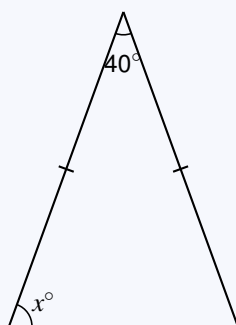
Worked example A3

Work out the value of x .

Isosceles: the base angles are equal.

$$180 - 40 = 140, \text{ then}$$

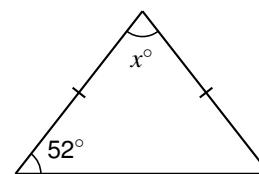
$$140 \div 2$$



$$x = 70^\circ$$

Your turn A3

Work out the value of x .



HIGHER*Higher strategies: polygons, bearings and multi-step reasons***Worked example A4: angles in a regular polygon**

Find the exterior and interior angles of a regular hexagon. *Exterior angles add up to 360° : $360 \div 6$.
Interior = $180 - \text{exterior}$.*

60° ; 120°

Your turn A4

Find the exterior and interior angles of a regular 12-sided polygon.

Worked example A5: the number of sides

A regular polygon has exterior angles of 40° . How many sides does it have? *Number of sides = $360 \div \text{exterior angle}$*

9

Your turn A5

A regular polygon has exterior angles of 18° . How many sides does it have?

Worked example A6: back bearings

The bearing of B from A is 070° . Find the bearing of A from B . *The North lines are parallel, so add 180° (or subtract if over 180°).*

250°

Your turn A6

The bearing of Q from P is 145° . Find the bearing of P from Q .

Worked example A7: more than one step

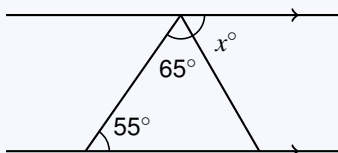
Work out the value of x . Give reasons.

Triangle:

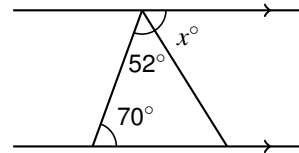
$$180 - 55 - 65 = 60.$$

Then alternate angles.

$x = 60^\circ$

**Your turn A7**

Work out the value of x . Give reasons.



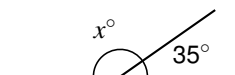
B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

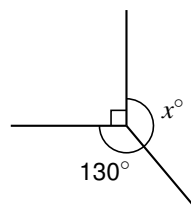
FOUNDATION*Everyone starts here*

B1 Work out the value of x in each diagram.

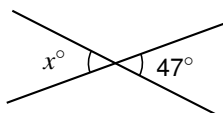
(a)



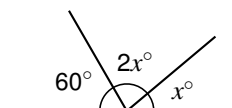
(b)



(c)



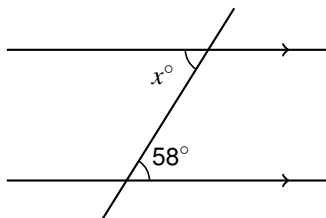
(d)



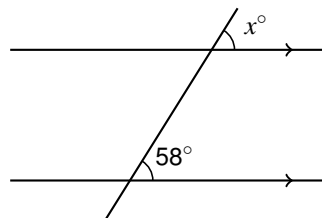
[4 marks]

B2 Work out the value of x in each diagram.

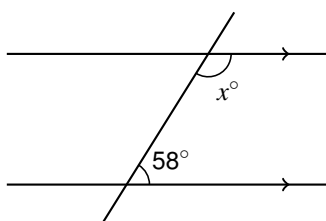
(a)



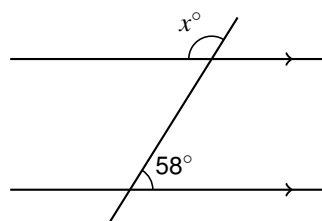
(b)



(c)



(d)



[4 marks]

B3 Find the missing angle.

(a) A triangle has angles of 50° and 70°

(b) An isosceles triangle has a top angle of 30° . Find a base angle.

(c) A right-angled triangle has an angle of 35°

(d) An exterior angle of a triangle is 110° and one opposite interior angle is 45°

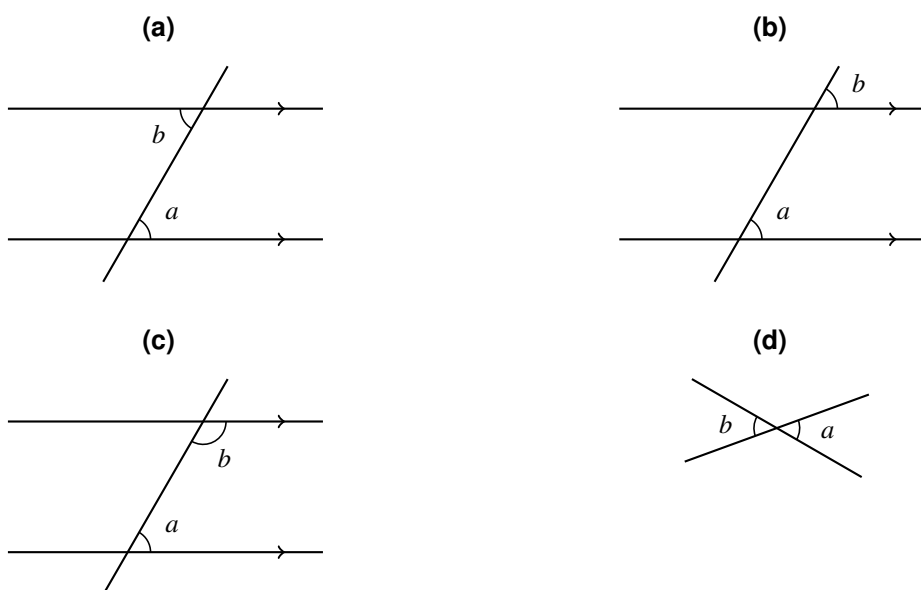
[4 marks]



- B4** (a) A quadrilateral has angles of 80° , 95° and 110° . Find the fourth angle.
(b) Find the sum of the interior angles of a pentagon.
(c) Find the sum of the interior angles of a hexagon.
(d) A pentagon has angles of 100° , 110° , 95° and 120° . Find the fifth angle. [4 marks]

FOUNDATION *continued: bearings and reasons*

- B5** (a) B is due east of A . Write down the bearing of B from A .
(b) C is south-west of A . Write down the bearing of C from A .
(c) The bearing of D from E is 040° . Find the bearing of E from D . [3 marks]
- B6** Name the angle fact that connects a and b , and say whether they are equal or add up to 180°



[4 marks]

HIGHER *Higher tier only*

- B7** (a) Find the exterior angle of a regular octagon. (b) Find its interior angle.
(c) A regular polygon has exterior angles of 24° . How many sides?
(d) A regular polygon has interior angles of 160° . How many sides? [4 marks]
- B8** (a) A polygon's interior angles add up to 1440° . How many sides does it have?
(b) Can a regular polygon have an interior angle of 130° ? Explain.
(c) Each interior angle of a regular polygon is 5 times its exterior angle. How many sides does it have?
(d) A pentagon has angles x , $x + 10$, $x + 20$, $x + 30$ and $x + 40$ degrees. Find the largest angle. [4 marks]



HIGHER*continued: bearings and algebra with parallel lines*

- B9**
- (a) The bearing of B from A is 115° . Find the bearing of A from B .
 - (b) The bearing of D from C is 300° . Find the bearing of C from D .
 - (c) The bearing of B from A is 050° and the bearing of C from B is 140° . Find angle ABC .
 - (d) The bearing of P from Q is 310° . Find the bearing of Q from P . [4 marks]
- B10** Find x in each case.
- (a) Alternate angles of $3x^\circ$ and $(2x + 25)^\circ$
 - (b) Co-interior angles of $(4x + 10)^\circ$ and $(2x - 10)^\circ$
 - (c) Corresponding angles of $(5x - 20)^\circ$ and $(3x + 30)^\circ$
 - (d) Vertically opposite angles of $(7x - 8)^\circ$ and $(5x + 12)^\circ$ [4 marks]



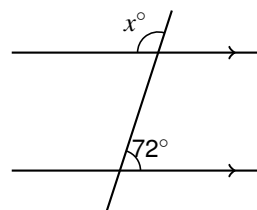
C**Reasoning**

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** Tom says, "Alternate angles add up to 180° ." Explain Tom's mistake. [2 marks]
- C2** Could a triangle have angles of 60° , 70° and 60° ? Explain. [2 marks]
- C3** Explain why the angles in any quadrilateral add up to 360° [3 marks]
- C4** Show that $x = 108^\circ$. Give a reason for each step.

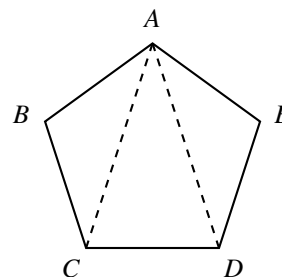


[3 marks]



HIGHER*Higher tier only*

- C5** Explain why a regular polygon cannot have an interior angle of 100° [3 marks]
- C6** The bearing of B from A is 080° . Kai says the bearing of A from B is also 080° . Explain Kai's mistake, and find the correct bearing. [3 marks]
- C7** A triangle has interior angles a , b and c . The side next to angle c is extended to make an exterior angle d . Prove that $d = a + b$ [3 marks]
- C8** $ABCDE$ is a regular pentagon.
- (a) Find angle BCA
 - (b) Find angle ACD
 - (c) Prove that AC is parallel to ED



[5 marks]



D**Problem solving**

You decide the method. Read the whole question first, and show every step.

FOUNDATION

Everyone starts here

- D1** ABD is a straight line. Work out the size of angle x . Give reasons.

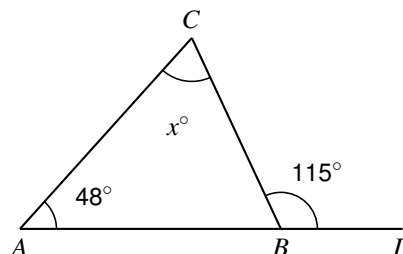


Diagram NOT accurately drawn

[3 marks]

- D2** A ship sails from A to B on a bearing of 060° , then from B to C on a bearing of 150°
- (a) Find angle ABC
- (b) Find the bearing of A from B

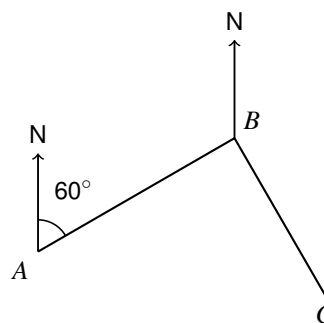


Diagram NOT accurately drawn

[4 marks]

- D3** The two lines are parallel. Work out the value of x .
- Hint: draw a third parallel line through the corner.

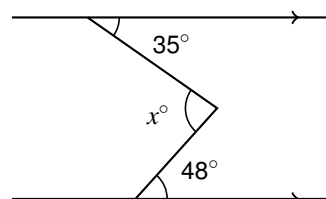


Diagram NOT accurately drawn

[3 marks]

- D4** Explain why regular hexagons fit together with no gaps, but regular pentagons do not.

[3 marks]



HIGHER

Higher tier only

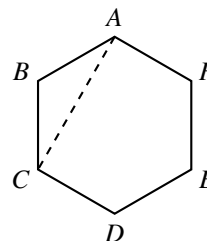
D5 $ABCDEF$ is a regular hexagon.**(a)** Find angle BAC **(b)** Find angle ACD 

Diagram NOT accurately drawn

[4 marks]**D6** A square, a regular octagon and one other regular polygon meet at a point, fitting together with no gaps.

Show that the third polygon is also a regular octagon.

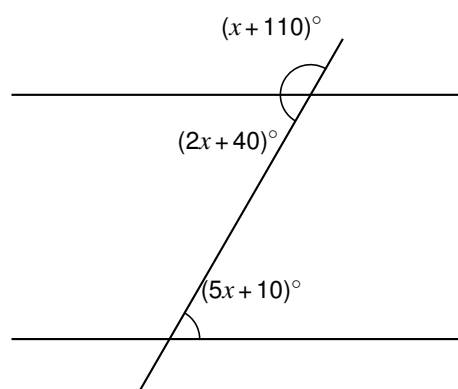
[4 marks]**D7** The bearing of B from A is 070° and the bearing of C from A is 130° . C is due south of B .Find angle ACB **[4 marks]****D8** The diagram shows two lines crossed by a transversal. The lines are not marked as parallel.**(a)** Work out the value of x .**(b)** Prove that the two lines are parallel.

Diagram NOT accurately drawn

[5 marks]

E**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION

Foundation and Higher crossover

E1 Work out the values of x and y .

.....
(1)

.....
(1)

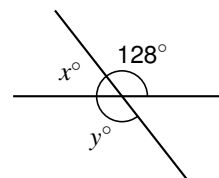


Diagram NOT accurately drawn

(Total for Question E1 is 2 marks)

E2 The two lines are parallel.

(a) Work out the value of x .

.....
(1)

(b) Give a reason for your answer.

.....
(2)

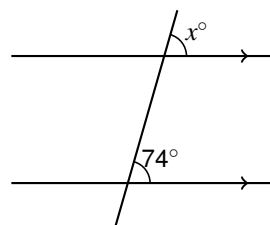


Diagram NOT accurately drawn

(Total for Question E2 is 3 marks)

E3 The triangle is isosceles.

(a) Work out the value of x .

.....
(2)

(b) Give a reason why the two base angles are equal.

.....
(1)

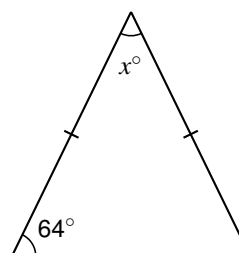


Diagram NOT accurately drawn

(Total for Question E3 is 3 marks)



E4 A regular polygon has exterior angles of 24°

(a) How many sides does it have?

.....
(2)

(b) Find the size of each interior angle.

.....
(2)

(Total for Question E4 is 4 marks)

E5 The bearing of B from A is 070°

(a) Find the bearing of A from B .

.....
(2)

(b) Explain how the North lines help you find it.

(1)

(Total for Question E5 is 3 marks)

HIGHER

Higher tier only

E6 $PQ = PR$. The two lines are parallel.

Work out the value of x . Give reasons for each step.

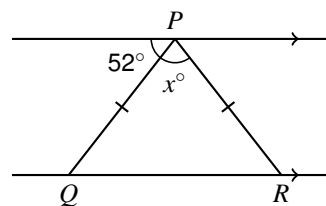


Diagram NOT accurately drawn

.....
(Total for Question E6 is 3 marks)



- E7** The interior angle of a regular polygon is 4 times its exterior angle.
How many sides does the polygon have?

.....
(Total for Question E7 is 3 marks)

- E8** The two lines are parallel.
(a) Work out the value of x .

.....
(3)

- (b) Find the size of each marked angle.

.....
(1)

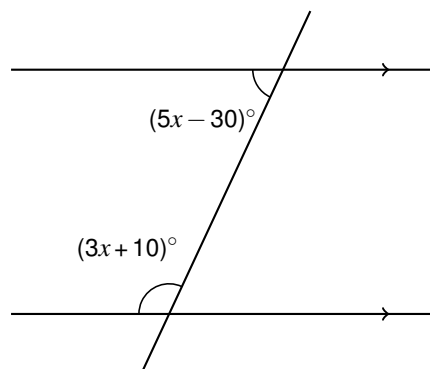


Diagram NOT accurately drawn

(Total for Question E8 is 4 marks)

- E9** One regular polygon has n sides. Another regular polygon has $2n$ sides. The interior angle of the second polygon is 15° greater than the interior angle of the first.

- (a) Show that the difference between the two interior angles is $\frac{180}{n}$ degrees.

(3)

- (b) Find n .

.....
(2)

(Total for Question E9 is 5 marks)

Finished? Mark your work with the **full worked solutions**, fill in your scores on the front page, then keep the skill sharp with unlimited questions on the **Geometry revision engine**.



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk