

# E4.6 Angles

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_ **Total: 26 marks**

**KEY WORDS** polygon 多边形 • angles 角 • co-interior 同旁内角 • alternate 内错角  
• corresponding 同位角

## Objective

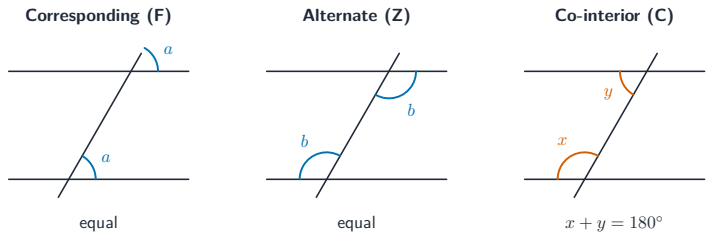
Build the skills to answer Extended exam questions on **angles** 角 — **angles in parallel lines** 平行线中的角, **triangle and quadrilateral** 三角形和四边形 angles, and **polygon** 多边形 angles. Always **give a reason**.

**You must be able to:**

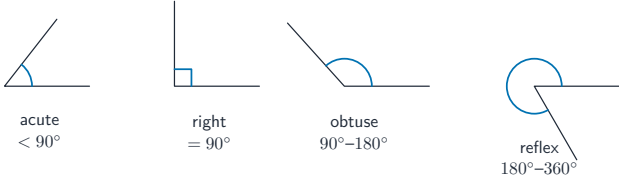
- use corresponding, alternate and co-interior angles
- use the angle sums of triangles and quadrilaterals
- find interior and exterior angles of a regular polygon

## 1 Worked examples

### ■ Angle facts



*Give the correct reason, not just the number*



### *The basic types of angle*

- Angles on a line  $= 180^\circ$ ; at a point  $= 360^\circ$ ; **vertically opposite** 对顶角 equal.
- **Corresponding** 同位角 (F) and **alternate** 内错角 (Z) angles equal; **co-interior** 同旁内角 (C) add to  $180^\circ$ .
- Polygon: sum of interior angles  $= (n - 2) \times 180^\circ$ ; exterior angles sum to  $360^\circ$ .
- **Worked:** regular hexagon — exterior  $= \frac{360}{6} = 60^\circ$ , interior  $= 120^\circ$ .

**Answer shapes:** M1 a correct method, A1 the correct answer.

## 2 Practice

**2.1** Three angles on a straight line are  $x$ ,  $55^\circ$  and  $65^\circ$ . Find  $x$ . [2]

**2.2** A triangle has angles  $x$ ,  $2x$  and  $60^\circ$ . Find  $x$ . [2]

**2.3** Find the exterior angle of a regular pentagon. [2]

## 3 Exam-style questions

**3.1** A line crosses two parallel lines. One angle is  $72^\circ$ . Find the co-interior angle, giving a reason. [2]

**3.2** Find the size of each interior angle of a regular octagon. [3]

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**3.3** The interior angle of a regular polygon is  $156^\circ$ . Find the number of sides. [3]

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**3.4** In the diagram,  $PQ$  is parallel to  $RS$ . A straight line crosses  $PQ$  at  $A$  and  $RS$  at  $B$ . The angle between the line and  $PQ$  on the upper right at  $A$  is  $(3x + 10)^\circ$ , and the angle between the line and  $RS$  on the lower left at  $B$  is  $(5x - 30)^\circ$ .

(a) Explain why these two angles are equal, naming the angle fact you use, and find  $x$ . [4]

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(b) Find the size of each of the two angles. [2]

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(c) A regular polygon has an exterior angle of  $24^\circ$ . Find the number of sides and the sum of its interior angles. [4]

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(d) Explain why a regular polygon cannot have an interior angle of  $160.5^\circ$ . [2]

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## Solutions

Marking: **M1** a correct method, **A1** the correct answer.

**2.1**  $x + 55 + 65 = 180 \rightarrow x = 60^\circ$ .

**2.2**  $x + 2x + 60 = 180 \rightarrow 3x = 120 \rightarrow x = 40^\circ$ .

**2.3** exterior angle  $= \frac{360^\circ}{5} = 72^\circ$ .

**3.1** co-interior angle  $= 180 - 72 = 108^\circ$  (reason: co-interior angles add to  $180^\circ$ ).

**3.2** exterior angle  $= \frac{360}{8} = 45^\circ \rightarrow$  interior  $= 180 - 45 = 135^\circ$ .

**3.3** exterior angle  $= 180 - 156 = 24^\circ$ ; number of sides  $= \frac{360}{24} = 15$ .

**3.4** (a) They are **alternate angles** between the parallel lines  $PQ$  and  $RS$ , cut by the same transversal, so they are equal;  $3x + 10 = 5x - 30$ ;  $40 = 2x$ , so  $x = 20$ .

(b)  $3(20) + 10 = 70^\circ$ ;  $5(20) - 30 = 70^\circ$  — the same, as expected.

(c) The exterior angles of any polygon add to  $360^\circ$ ;  $n = \frac{360}{24} = 15$  sides; the interior angle sum  $= (n - 2) \times 180 = 13 \times 180 = 2340^\circ$ .

(d) An interior angle of  $160.5^\circ$  gives an exterior angle of  $180 - 160.5 = 19.5^\circ$ ;  $\frac{360}{19.5} = 18.46 \dots$ , which is not a whole number, so no such regular polygon exists.