1 Estimation

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THE RULE

- Round **every** number to **1 significant figure**, then work it out.
- Use **≈** ("approximately equal to"), **not** =.
- The point is a quick check you can do **without a calculator**.

WORKED EXAMPLES

$4.8 \times 19.6 \approx 5 \times 20 = \mathbf{100}$

$302 \div 4.9 \approx 300 \div 5 = \mathbf{60}$

$6.9 + 21.3 \approx 7 + 20 = \mathbf{27}$

$38.7 \times 0.21 \approx 40 \times 0.2 = \mathbf{8}$

ESTIMATING ROOTS

- Round to the nearest **square number** instead of 1 s.f.
- $\sqrt{38} \approx \sqrt{36} = \mathbf{6}$
- $\sqrt{99} \approx \sqrt{100} = \mathbf{10}$

A FRACTION ESTIMATE

Estimate $\frac{29.4 \times 4.8}{0.51}$

Round each: $\frac{30 \times 5}{0.5}$

$= 150 \div 0.5 = \mathbf{300}$

Dividing by **0.5** is the same as **× 2**.

OVER- OR UNDER-ESTIMATE?

- Rounding **both up** in a multiplication gives an **over**-estimate.
- Rounding **both down** gives an **under**-estimate.
- Dividing by a number you rounded **down** makes the answer **bigger**.
- Say which it is **and why** — the reason earns the mark.

SENSIBLE CHECKING

- Use an estimate to spot a **calculator slip**.
- If 4.8×19.6 gives 940 on your calculator, the estimate 100 shows it is wrong.

1 S.F. REMINDERS

Number	To 1 s.f.
4.8	5
19.6	20
302	300
0.21	0.2
0.051	0.05
3847	4000

KEEP THE SIZE RIGHT

- Use **place-holder zeros**: 3847 to 1 s.f. is **4000**, not 4.
- For decimals below 1, the first s.f. is the first **non-zero** digit.

MORE PRACTICE

$9.7 \times 5.2 \approx 10 \times 5 = \mathbf{50}$

$61.4 \div 2.9 \approx 60 \div 3 = \mathbf{20}$

$\sqrt{24} \approx \sqrt{25} = \mathbf{5}$

⚠ COMMON EXAM MISTAKES (recurring errors flagged in examiners' reports)

- ✕ Working out the **exact** answer instead of estimating — no marks.
- ✕ Rounding to 1 **decimal place** instead of 1 **significant figure**.
- ✕ Dropping **place-holder zeros** (3847 → 4 instead of 4000).
- ✕ Using = instead of ≈.
- ✕ Saying "over-estimate" with **no reason**.
- ✕ Rounding only **some** of the numbers.

Revise it: estimate each calculation with the answers covered, then check.

2 Circles

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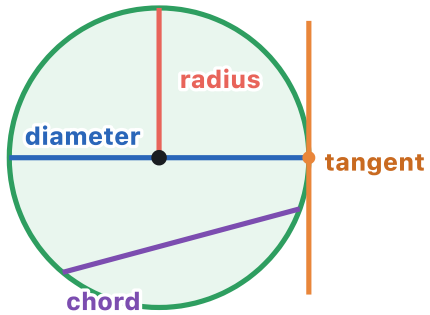
PARTS OF A CIRCLE



Diameter = 2 × radius. A **tangent** touches the circle at one point.

MORE PARTS

- **Circumference** — the distance **around** the circle.
- **Arc** — part of the circumference.
- **Sector** — a "pizza slice" between two radii.
- **Segment** — the region cut off by a chord.

THE TWO FORMULAS

$$C = \pi d = 2\pi r$$

$$A = \pi r^2$$

- **Circumference** uses the **diameter**; **area** uses the **radius**.
- If you are given the diameter, **halve it** before finding the area.

WORKED EXAMPLES

d = 10 cm: C = π × 10 = **31.4 cm** (1 d.p.)

r = 5 cm: A = π × 5^2 = 25π = **78.5 cm^2**

r = 3 m: C = 2 × π × 3 = **18.8 m**

d = 8 cm: r = 4, A = 16π = **50.3 cm^2**

LEAVING ANSWERS IN TERMS OF Π

- If asked, give the **exact** answer: A = 25π cm^2.
- Otherwise round as told — usually **1 d.p.** or **3 s.f.**

FRACTIONS OF A CIRCLE

Shape	Fraction
Semicircle	$\frac{1}{2}$ of the circle
Quarter circle	$\frac{1}{4}$ of the circle
Sector	$\frac{\text{angle}}{360}$ of the circle

⚠ PERIMETER OF A SEMICIRCLE

It is **not** just half the circumference — you must **add the diameter** (the straight edge).

d = 10: curved part = π×10÷2 = 15.7

Perimeter = 15.7 + 10 = **25.7 cm**

A **quarter** circle adds **two radii**.

COMPOUND SHAPES

- **Split** into a circle part and a straight-sided part, then add or subtract.
- For the **perimeter**, only count edges on the **outside**.

⚠ COMMON EXAM MISTAKES (recurring errors flagged in examiners' reports)

- ✕ Using the **diameter** in πr^2 instead of the radius.
- ✕ Mixing up the two formulas — **area** is the one that is squared.
- ✕ Semicircle perimeter: forgetting to **add the diameter**.
- ✕ Squaring πr instead of just r.
- ✕ Wrong units — area is cm^2, circumference is cm.
- ✕ Rounding **too early** in a multi-step question.

Revise it: write both formulas, then find C and A for a circle with the answers covered.

3 Angles in Parallel Lines

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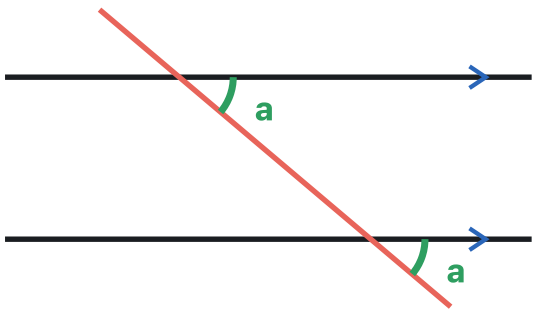
KEY WORDS

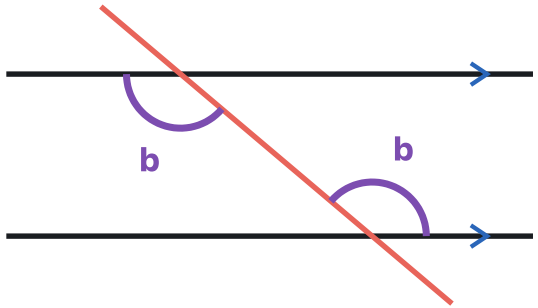
- **Parallel lines** never meet — marked with matching **arrows**.
- A **transversal** is a line that **crosses** the parallel lines.
- The three facts below only work when the lines are **parallel**.

CORRESPONDING ANGLES ARE EQUAL



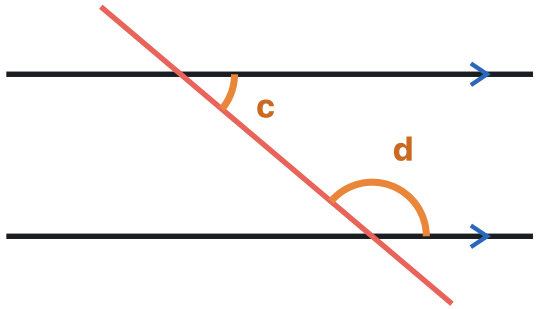
They sit in the **same position** at each crossing — an **F** shape.

ALTERNATE ANGLES ARE EQUAL



On **opposite sides** of the transversal, between the lines — a **Z** shape.

ALLIED (CO-INTERIOR) ANGLES ADD TO 180°



Same side, between the lines — a **C** shape.
c + d = 180°

⚠ NAME THE REASON PROPERLY

- Write **"corresponding angles are equal"**, not "F angles".
- Write **"alternate angles are equal"**, not "Z angles".
- Write **"allied (or co-interior) angles add to 180°"**, not "C angles" — **either name** is accepted.
- The letter shapes help you **spot** them — they are **not accepted** as reasons.

OTHER FACTS YOU STILL NEED

- Angles on a **straight line** add to 180°.
- Angles **around a point** add to 360°.
- **Vertically opposite** angles are equal.
- Angles in a **triangle** add to 180°.

WORKED EXAMPLE

A transversal crosses two parallel lines. One angle is 65°.

Corresponding angle = **65°**

Co-interior angle = 180 − 65 = **115°**

Vertically opposite = **65°**

Work in steps and give a reason for each one.

⚠ COMMON EXAM MISTAKES (recurring errors flagged in examiners' reports)

- ✕ Giving **"F, Z or C angles"** as the reason — these earn **no marks**.
- ✕ Saying **allied (co-interior)** angles are **equal** — they add to **180°**.
- ✕ Mixing up **alternate** and **corresponding**.
- ✕ Using the facts when the lines are **not parallel** (no arrows).
- ✕ Giving the answer with **no reason** on a "give reasons" question.
- ✕ Only doing one step when the question needs a **chain** of angles.

Revise it: sketch two parallel lines and a transversal, then mark and name each pair.