GCSE Maths – Geometry and Measures

Measuring Lines, Angles and Bearings

Notes

WORKSHEET

Measuring Lines, Angles and Bearings

Measuring Line Segments

A line segment is a **portion** of a line that **connects two points**.

How to measure a line segment:

1. **Align** the starting point of the line segment with **"zero point"** on the ruler.
2. Keep the ruler in place with the start and **position** the ruler to follow the line. The ruler should be **parallel** to the line.
3. Read off the measurement at the point the line segment ends.

Example: Measure the line segment

1. Align the starting point of the line segment with "zero point" on the ruler.
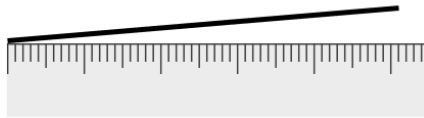
2. Keep the ruler in place with the start and position the ruler to follow the line. The ruler should be parallel to the line.

3. Read off the measurement at the point the line segment ends.

   Assuming the large increments on the ruler measure 1 cm*, then the line segment measures* $\mathbf{5.1 \text{ cm}}$*.*

   Note*: This measurement may differ depending on the scale of the page you are viewing.*

Measuring Angles

An angle is the measurement of the turn between **two intersecting lines**.

How to measure an angle:

1. Think about whether the angle is an **acute, obtuse or reflex angle.**
2. Use a **protractor** and line up the **right-angle cross of the protractor** with the **point of intersection**.
3. Keeping the cross on the intersection, **align** the **horizontal line** on the protractor with the line segment. Be careful not to align the bottom of the protractor.
4. Consider the **angle type** (acute or obtuse) and read off the angle measurement.
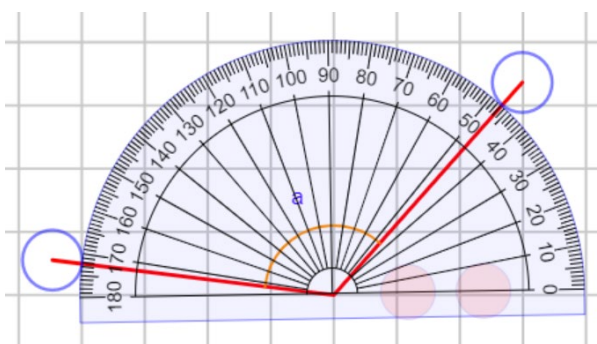
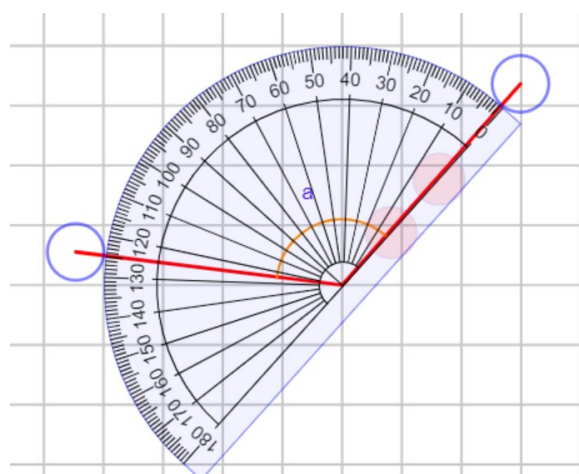**Example:** Measure the angle highlighted in the diagram below

1. Identify the type of angle.

    *The angle is more than 90°, therefore it is an **obtuse** angle.*

2. Using a protractor, line up the right-angle cross with the point of intersection.

3. Keeping the cross and the intersection, align the horizontal line on the protractor with the line segment.
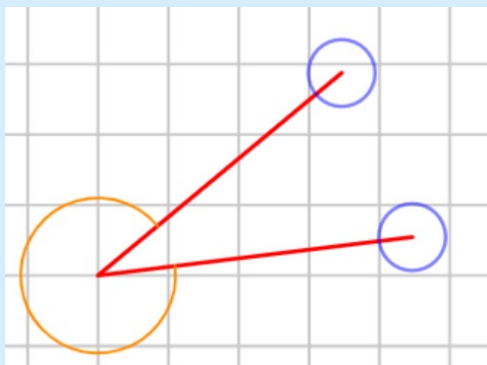

4. Read off the angle measurement.

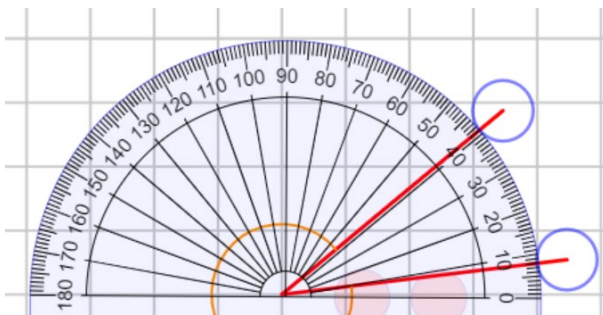   *As the angle is an obtuse angle, it reads as **125°**.*

**Example:** Measure the angle highlighted in the diagram below

1. Identify the type of angle.

   The angle is more than 180°, therefore it is a reflex angle. This means we will have to measure the inside angle first and take it away from 360°

2. Using a protractor, line up the right-angle cross with the point of intersection.

3. Keeping the cross and the intersection, align the horizontal line on the protractor with the line segment.
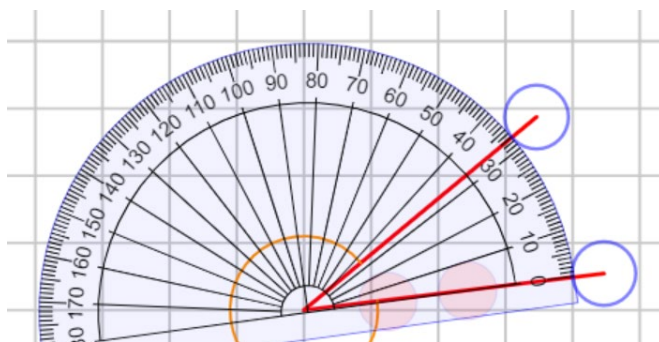
4. Read off the acute angle measurement.

   The acute angle reads off as 33°.

5. Calculate the required angle.

   We need to calculate the reflex angle since this is the one indicated.
   As angles around a point add up to 360°, we can calculate it using the acute angle found:

$$Reflex\ angle = 360° - 33° = \textbf{327°}$$

   *The angle highlighted is **327°**.*

Scales

Sometimes images, such as maps, will be drawn to a **smaller size**. This means to calculate the actual size of the distance between two points we need to use **a scale**. Scales may be given e.g. "every 1 cm represents 3 km " or may be given as a **drawing**, where we would measure the scale.

Example: On the grid, every 1 cm represents 600 m. What is the distance in kilometres between A and B?
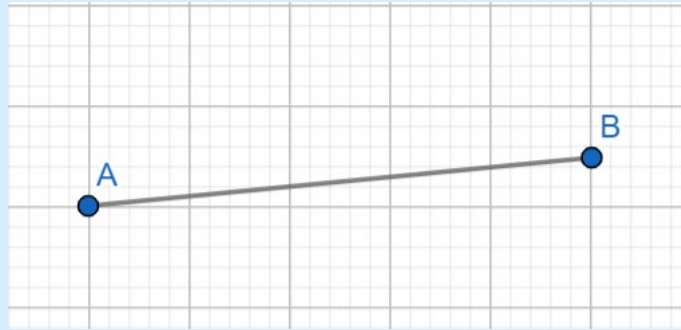
1. Measure the line segment using a ruler.
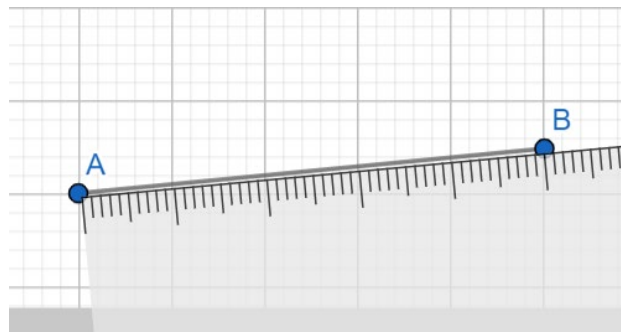
The line measures 5 cm.

2. Use the scale to calculate the actual distance between points A and B.

$$\times\, 5 \quad \curvearrowright \quad \begin{array}{c} 1\ \text{cm} : 600\ \text{m} \\ 5\ \text{cm} : 3000\ \text{m} \end{array} \quad \curvearrowleft \quad \times\, 5$$

The scale tells us that 1 cm *represents* 600 m. *Therefore, multiplying by* 5, 5 cm *must represent* 3000 m. *This means the actual distance between A and B is 3000 metres, which is equal to 3 km.*

3. Convert the solution into kilometres.

The conversion from metres to kilometres is '÷ 1000*' since* 1000 m = 1 km.

So, the distance in kilometres is 3000 ÷ 1000 = 3 km.

*Therefore, A and B are* **3 km** *apart.*

Bearings

Bearings measure the **angle** between **two points**. There are certain conditions of bearings which you must remember:

- Bearings are always measured from the **north line.** This is the line which points 'up' on the page. The north line is drawn at the point where the bearing is measured from.
- Bearings are always measured in a **clockwise motion**.
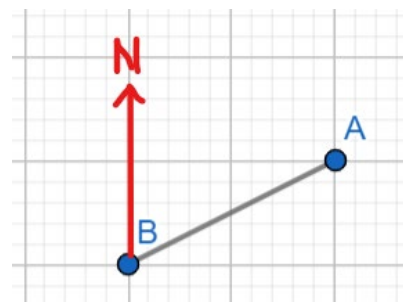- Bearings are always written in **three figures**. For example, a bearing of 60° should be written as 060°.

We can use properties of angles to measure different angles and bearings.

Example: Calculate the bearing from B to A in the following diagram
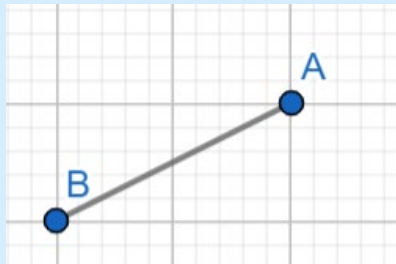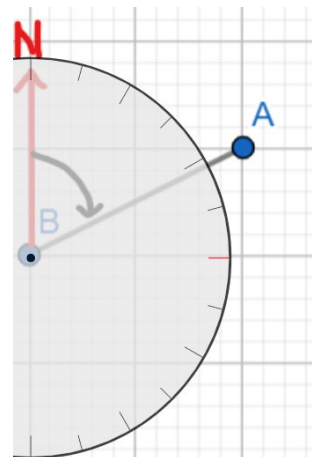

1. Draw the north line.

   The bearing is from B to A so the north line is drawn at point B.

2. Measure the angle between the north line and the line from B to A in a clockwise direction, starting at the north line.

3. Read off the measurement on the protractor and find the bearing.
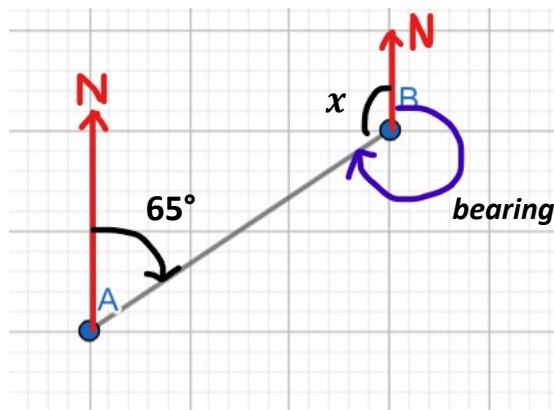
   The angle measures 63° to 1 decimal place. We must make sure that the bearing is a three-digit figure.

   *Therefore, the bearing from B to A is **063°**.*

Example: The bearing from A to B is 065°. Calculate the bearing from B to A.

1. Draw a quick sketch of the question and label angles.

2. Using parallel line rules, calculate angle x.

   Angle x and the angle measuring $65°$ are co-interior angles and therefore add up to $180°$:

   $$x + 65° = 180°$$
   $$x = 180° - 65°$$
   $$x = 115°$$

3. Use properties of angles to calculate the required bearing.

   The bearing and angle x are angles around a point. Using the property that angles around a point sum to $360°$:
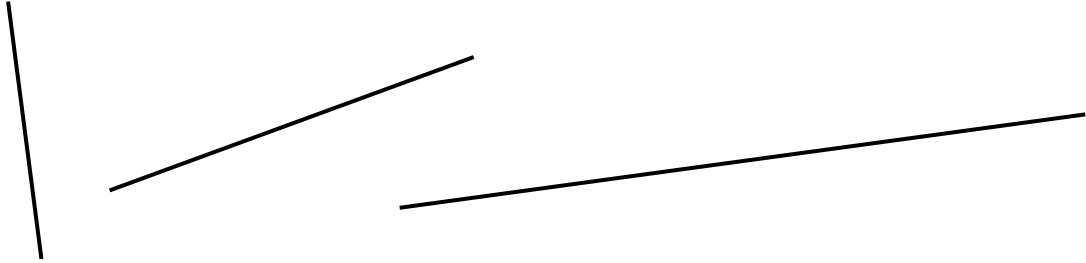
   $$115° + bearing = 360°$$
   $$bearing = 360° - 115°$$
   $$bearing = 245°$$

   *The bearing is already 3 figures long so we don't need to add a 0 at the start. Therefore, the **bearing from B to A is $245°$.***
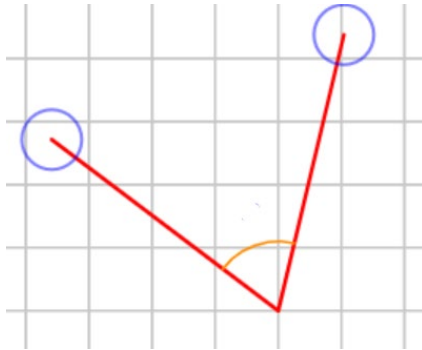
Measuring Lines, Angles and Bearings – Practice Questions

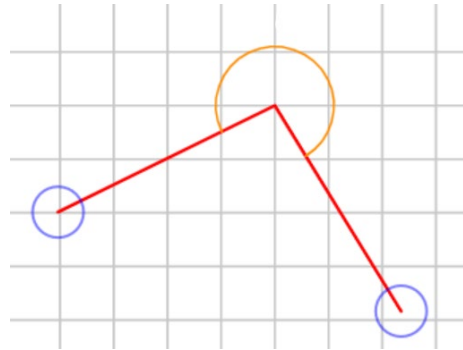1. Measure the following line segments.
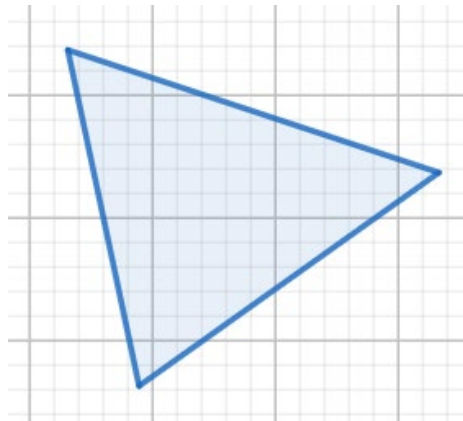
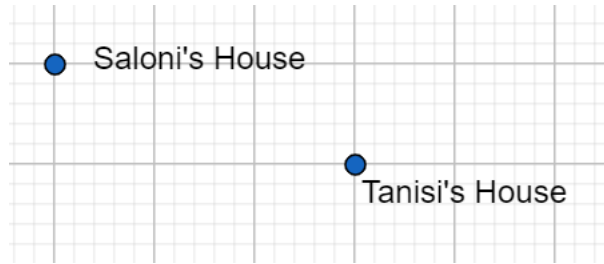2. Measure the angles which are highlighted:

   a)

   b)

3. Is this triangle an isosceles triangle?

4. A map has a scale $1\,\mathrm{cm} : 6\,\mathrm{miles}$. The actual distance between two towns is $108\,\mathrm{miles}$. What is the distance between the two towns on the map?

5. The map below shows the distance between two friends' houses. Every 1 centimetre represents 1200 metres.

Saloni's House

Tanisi's House

a) Calculate how far Tanisi and Saloni live from each other.
b) Tanisi says she has to walk further than the distance calculated. Suggest a reason why this may be.

6. Measure the bearing from B to A

B

A
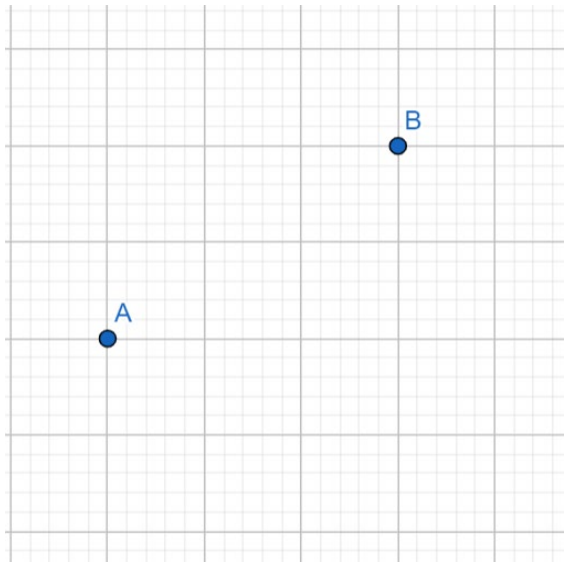
7. The bearing from Birmingham to London is 163°. Calculate the bearing from London to Birmingham.

Worked solutions for the practice questions can be found amongst the worked solutions for the corresponding worksheet file.