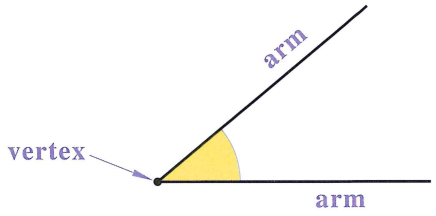
Chapter 3

Angles

Two straight lines meeting at a point form an angle. The lines are called the **arms** of the angle, and the point is called the **vertex**. The symbol for angle is ∠. Angles are measured in **degrees**.



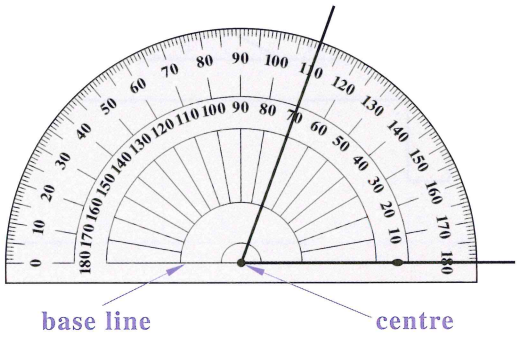
There are 360° in a full circle.

Protractor

A **protractor** is used to measure angles. The figure below shows a protractor that can be used to measure angles between 0° and 180°. It has two scales – an **inner scale** and an **outer scale**. These go in opposite directions.

The **outer scale** goes from zero on the left in a clockwise direction around to 180.

The **inner scale** goes from zero on the right in an anti-clockwise direction around to 180.



The diagram over shows how to draw an angle of 70°.

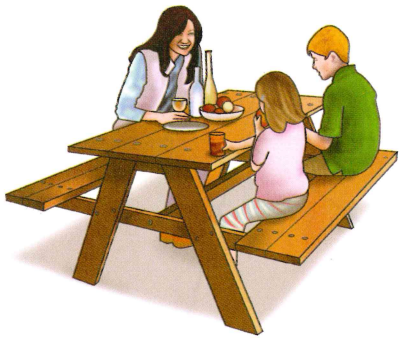
The **centre** of the protractor is positioned at the vertex of the angle.

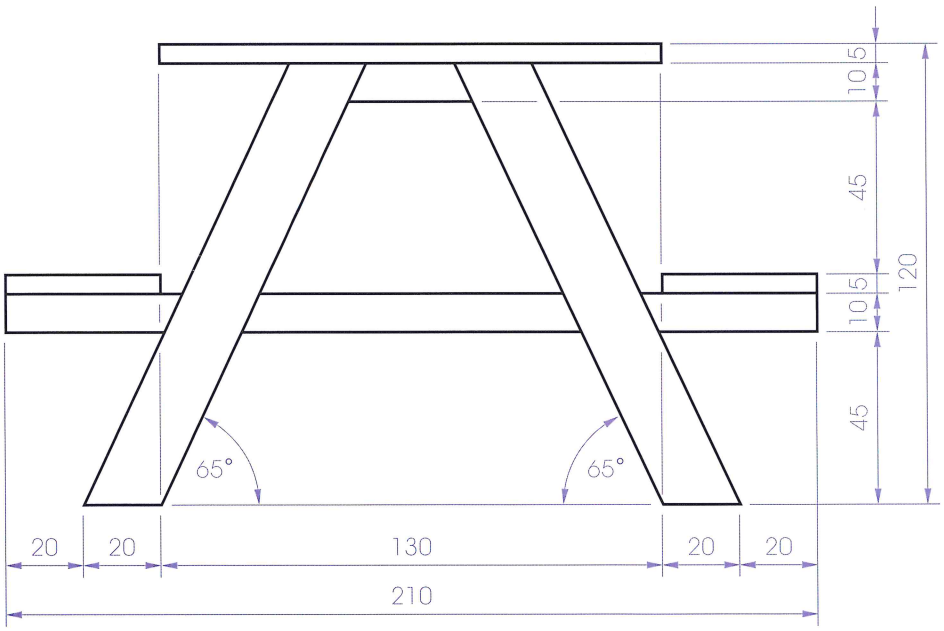
The **base line** of the protractor is placed exactly on one arm of the angle.

Answer Worksheet 3A

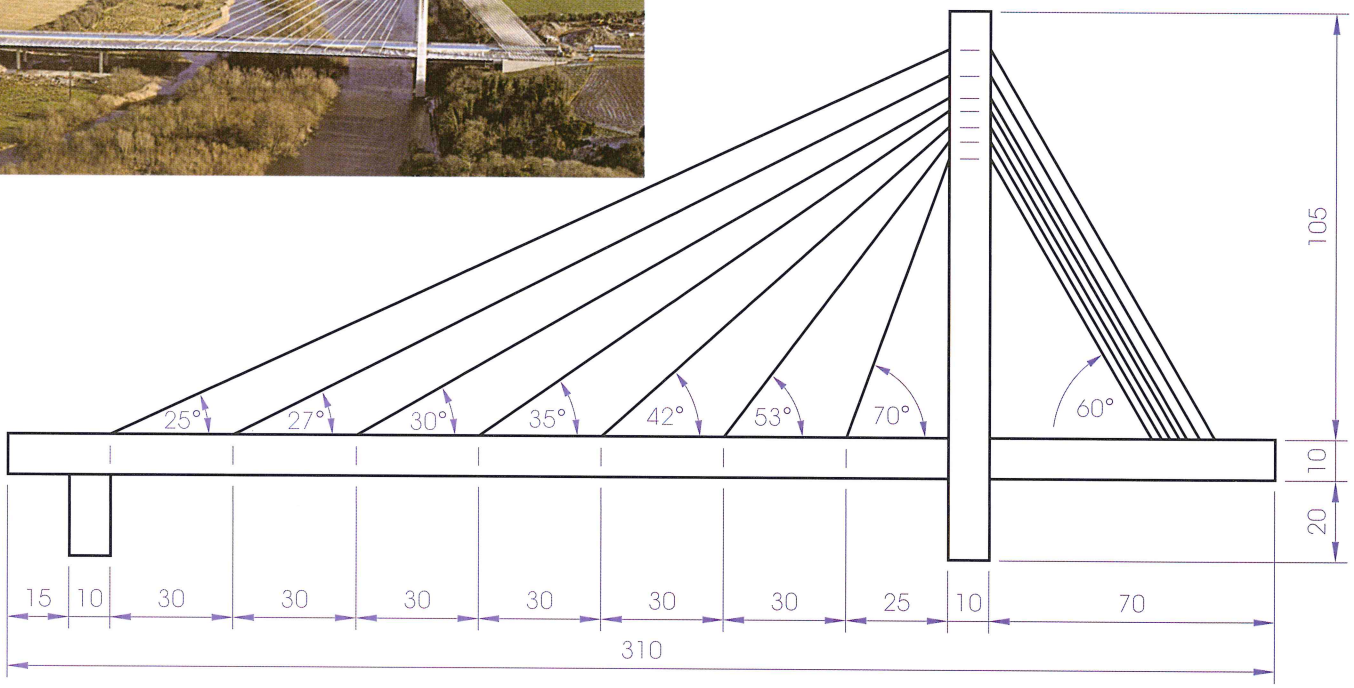
Exercises

1. Draw full-size the view of a **picnic bench** shown in the figure over.

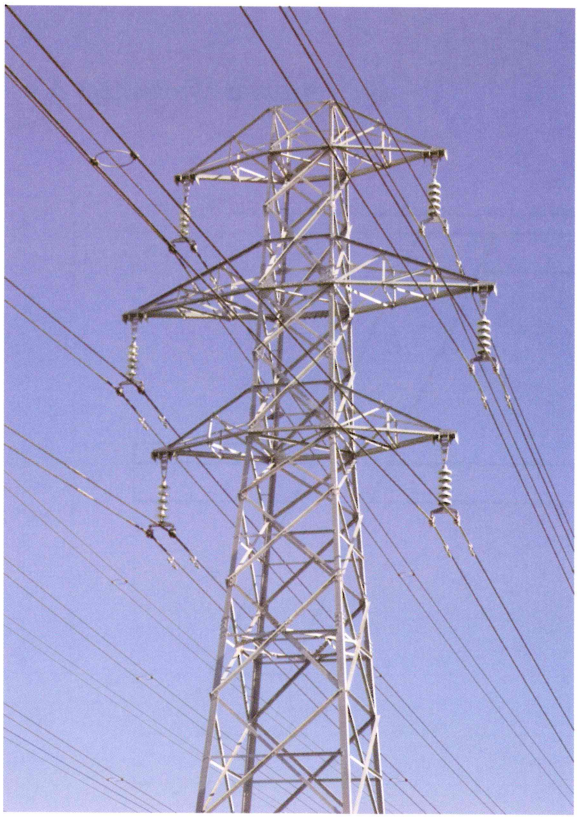


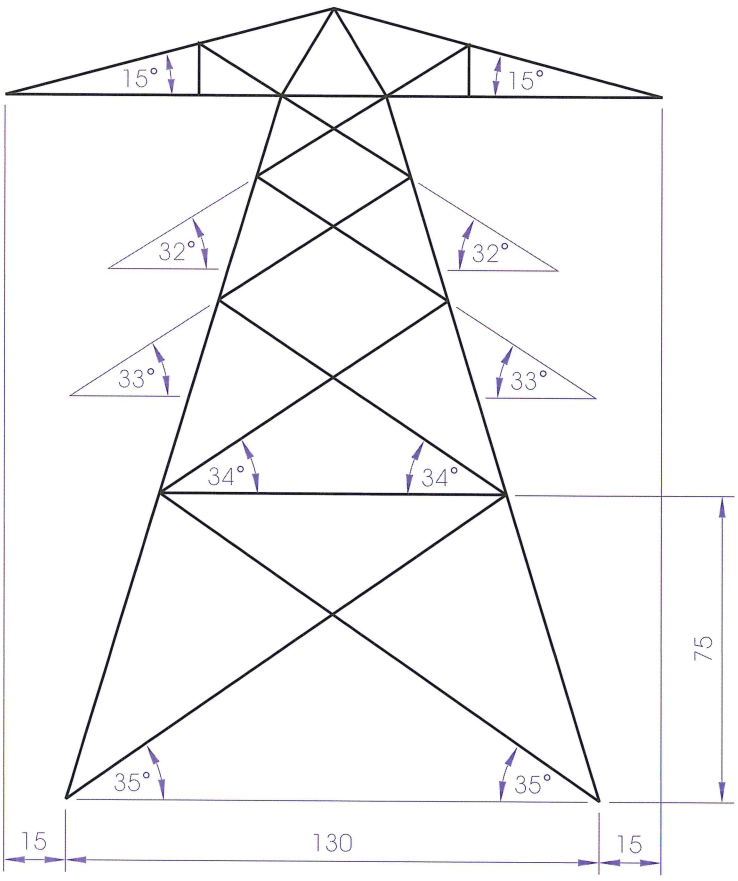


2. Shown below are a photograph and drawing of the **Boyne cable bridge**. Reproduce the given drawing.

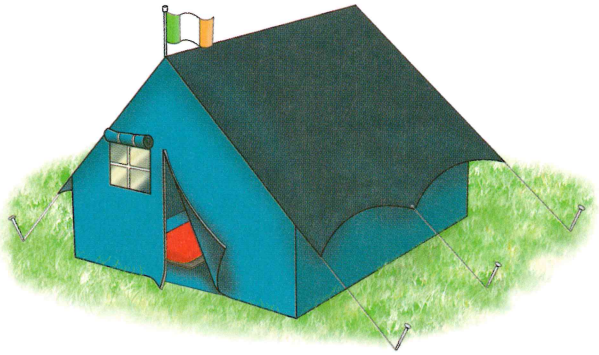


3. Make a drawing of the **pylon** to the given dimensions.

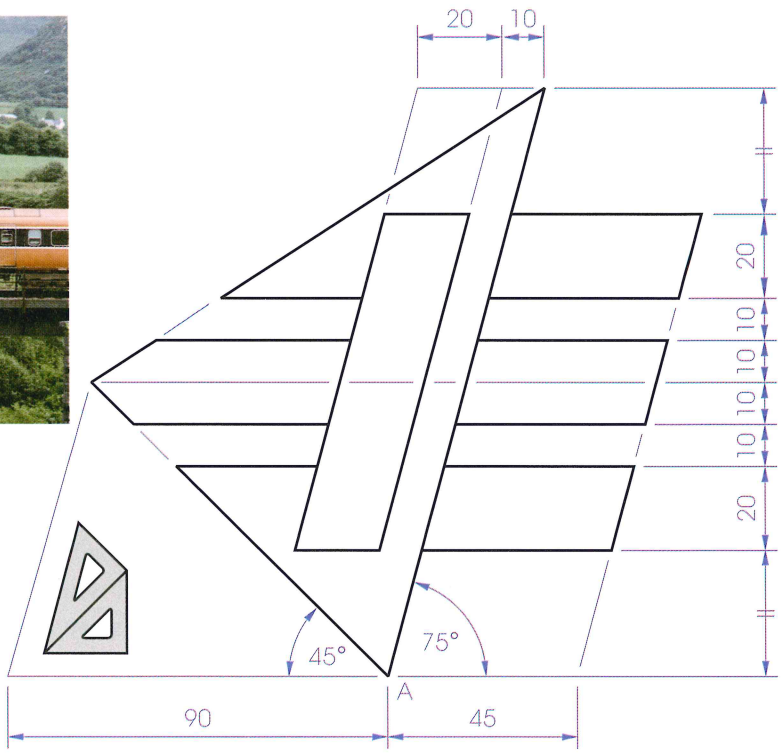




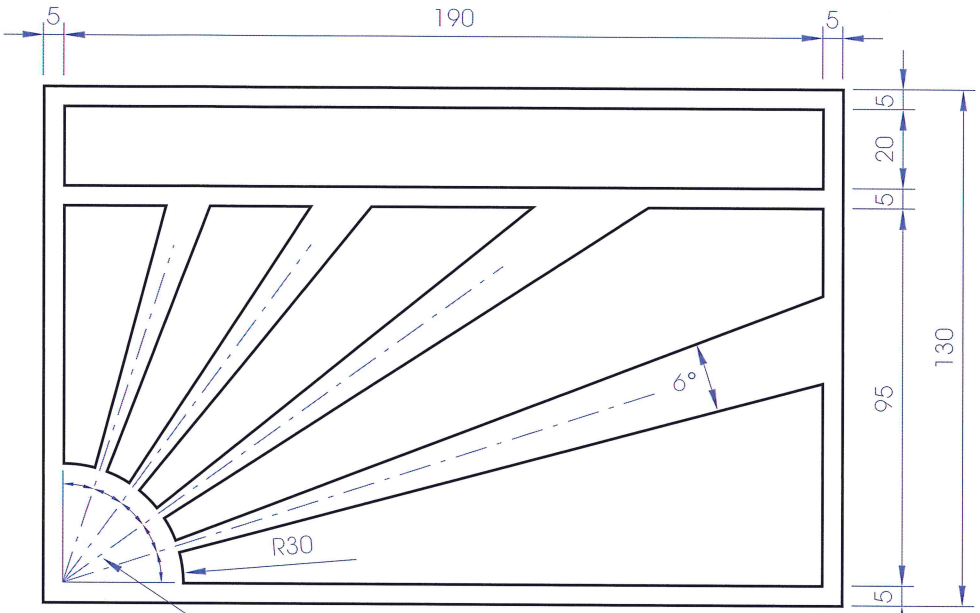
4. The drawing below shows a view of a **tent**. The window is in the shape of a **square**. Reproduce this drawing to the given dimensions.



5. This is the logo used by **Iarnród Éireann**. This sign gives the impression of movement and fast transportation. Make a drawing of this design showing all construction lines.
Start the drawing at point A. Don't forget to combine the two set squares to draw the lines at 75°.

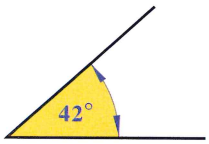


6. Make a full-size drawing of the **rectangular gate** shown below, showing all construction lines.

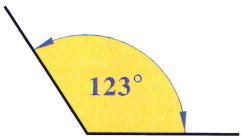


Each angle measures 18° (90° divided by 5)

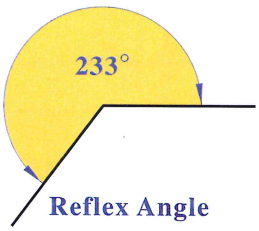
Types of Angles



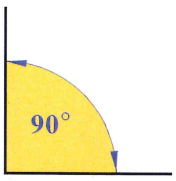
Acute Angle



Obtuse Angle



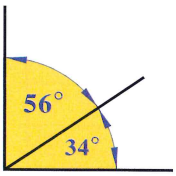
Reflex Angle



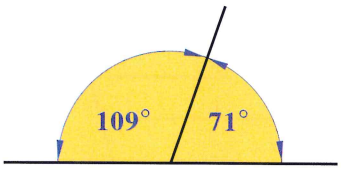
Right Angle

Acute angles are angles that are less than 90°.
Obtuse angles are angles that are more than 90° and less than 180°.
Reflex angles are angles that are more than 180°.
Right angles are angles that measure 90°.

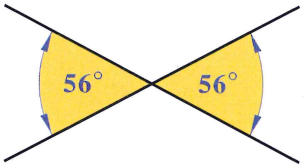
Pairs of Angles



Complementary



Supplementary



Vertically opposite
(look for the letter 'X')

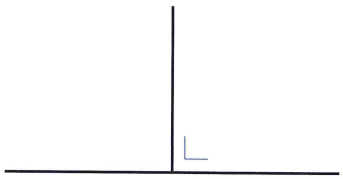
Complementary angles are two angles whose sum is 90°.
Supplementary angles are two angles whose sum is 180°.
Vertically opposite angles are formed when two straight lines cross.
Vertically opposite angles are always equal.

Answer Worksheets 3B and 3C

Perpendicular Lines

Perpendicular lines are lines that meet at right angles.

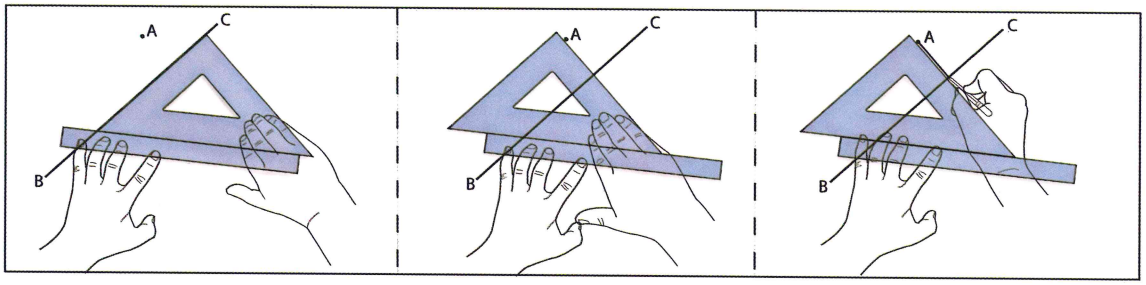
The figure over shows two perpendicular lines. The symbol shows that the angle between the two lines is 90°.



Perpendicular lines

Example

Draw a line from A perpendicular to the line BC.

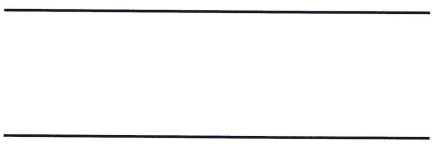


1. Place one of the shorter edges of the 45° set square so that it lines up with BC. Place the ruler against the set square as illustrated (above, left).
2. Hold the ruler firmly on the paper so that it remains stationary. Slide the set square along the ruler until the other edge of the set square is in line with A as illustrated (above, middle). Draw a line through A to meet the line BC. This line is perpendicular to BC (above, right).

Parallel Lines

Parallel lines are lines in a plane that never meet.

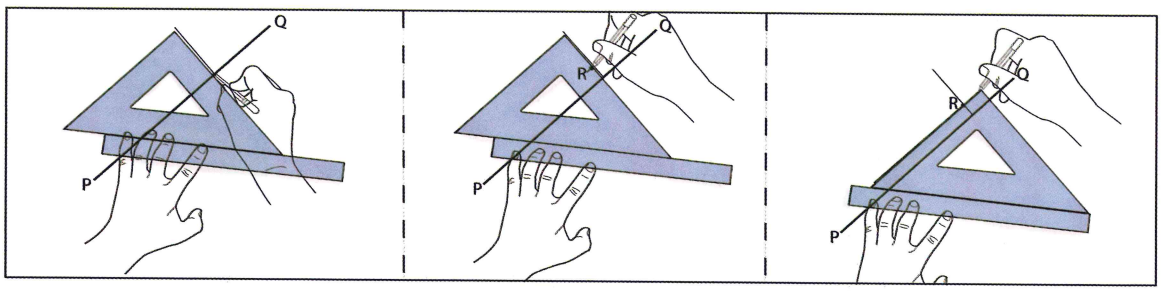
The figure across shows two parallel lines. These lines will never meet no matter how far they are extended.



Parallel lines

Example

Draw a line parallel to PQ and a distance of 20 mm from it.



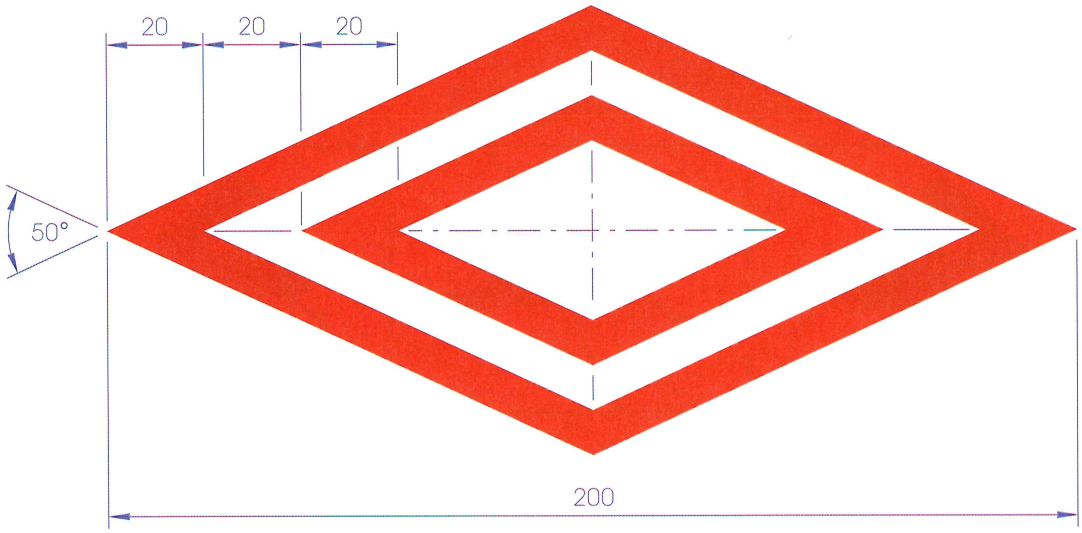
1. Place one of the shorter edges of the 45° set square so that it lines up with PQ. Hold the ruler firmly against the set square so that it remains stationary and slide the set square along the ruler for any distance. Draw a line perpendicular to PQ as illustrated (above, left).
2. Mark a point R on this line 20 mm from PQ (above, middle). Slide the set square along the ruler until the other edge of the set square is in line with R. Draw a line through R parallel to PQ (above, right).

Answer Worksheet 3D

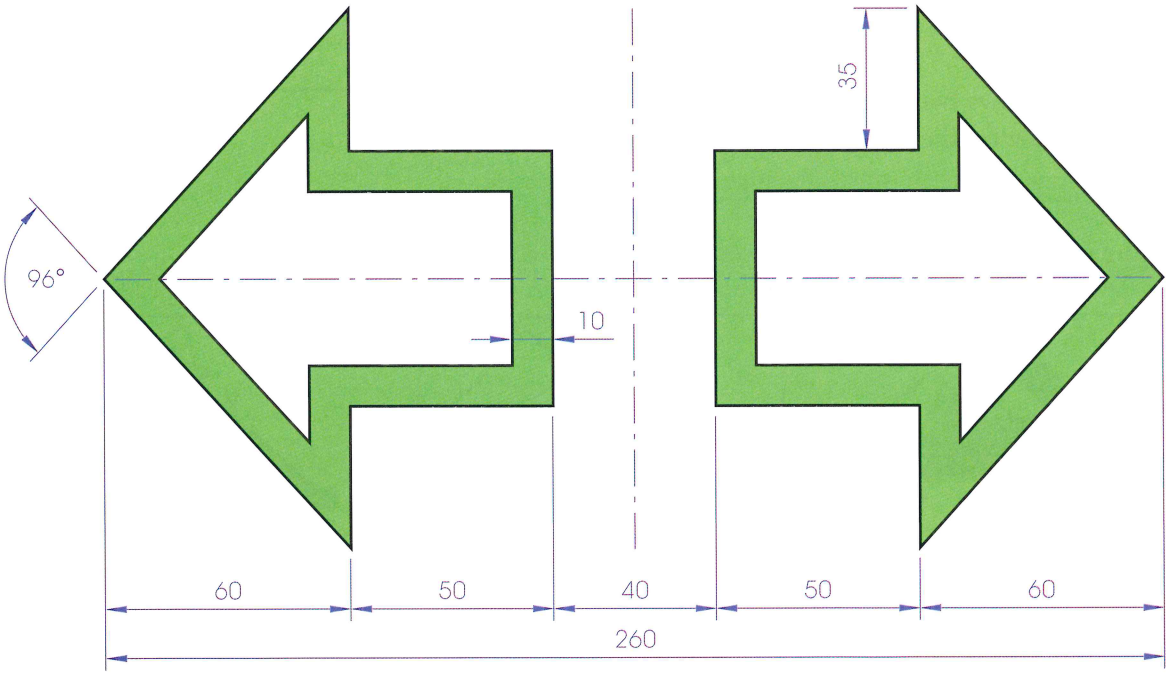
Exercises

1. Can you find a pair of **vertically opposite angles** in the drawing of the **Umbro** emblem shown in the figure below? Notice that the emblem is **symmetrical** i.e. the same shape on either side of the two centre lines.

Make a full-size drawing of the emblem. Apply shading or colour to enhance your drawing.



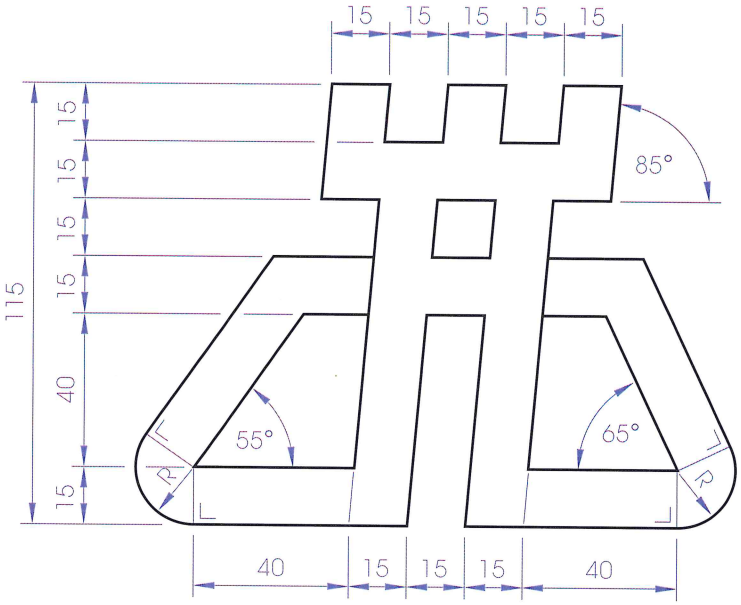
2. The figure below shows a drawing of **turn signals**. Reproduce this drawing full-size, showing all construction lines.



All margins are 10 mm

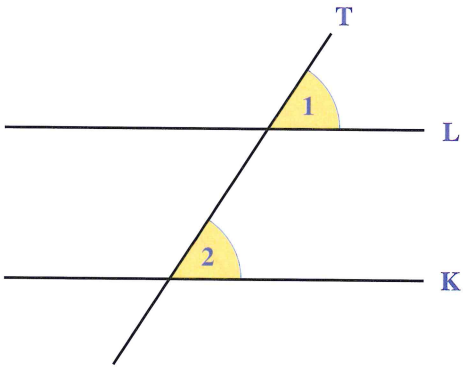
3. **(a)** Draw the **Dublin Bus** logo to the sizes given.

(b) Draw, to your own design, the side view of a double-decker bus. Incorporate the **Dublin Bus** logo in your drawing.

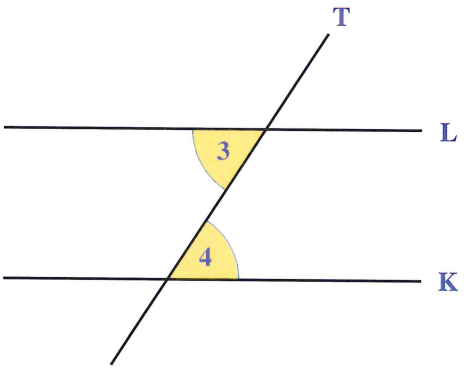


Corresponding and Alternate Angles

The figure below shows a straight line T and a pair of parallel lines, L and K. The line T cuts the parallel lines at two separate points. When a line cuts two parallel lines, pairs of **corresponding angles** and **alternate angles** are formed. The figure shows an example of a pair of **corresponding angles** (below, left) and a pair of **alternate angles** (below, right).



Corresponding angles



Alternate angles

$\angle 1$ and $\angle 2$ are called **corresponding angles** because the position of $\angle 1$ with respect to T and L is the same as the position of $\angle 2$ with respect to T and K. $\angle 3$ and $\angle 4$ are called **alternate angles** because they are positioned on alternate sides of the line T.

When a straight line cuts two parallel lines:

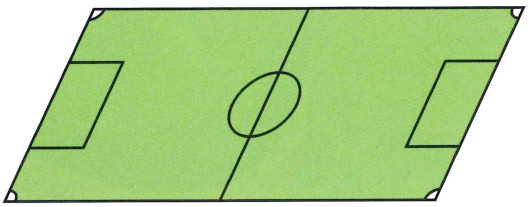
- Corresponding angles are equal.
- Alternate angles are equal.

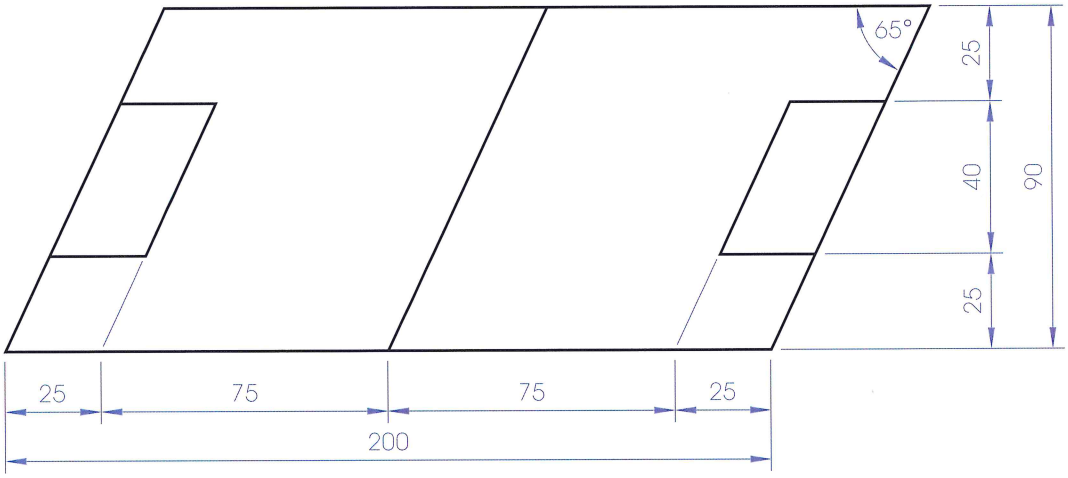
Answer Worksheet 3E

Exercises

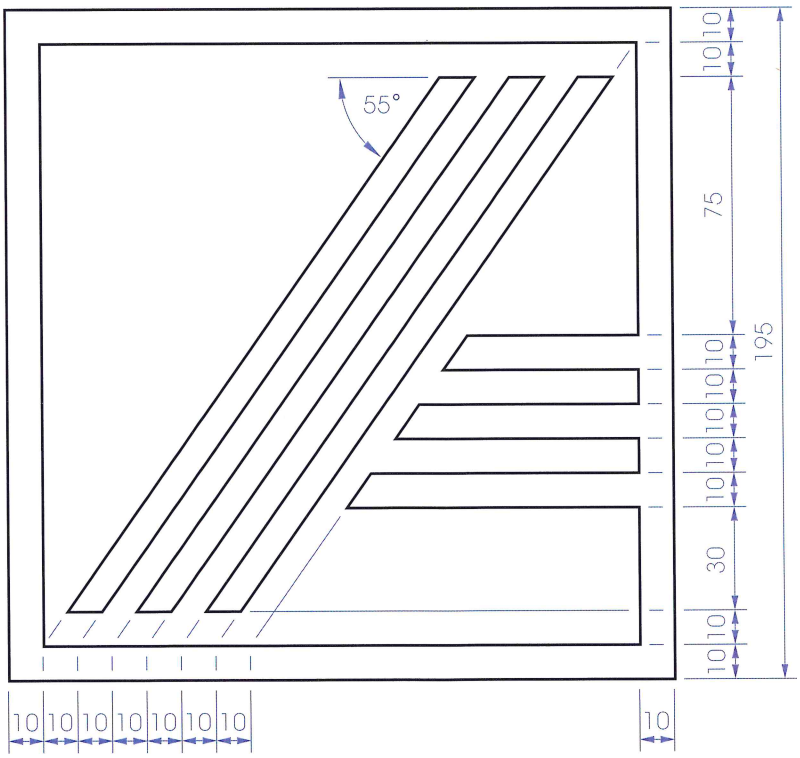
1. The figure below shows a sign for an **All-weather pitch**. Can you find two pairs of **alternate angles** in the drawing?

Reproduce the drawing of the sign to the given dimensions.

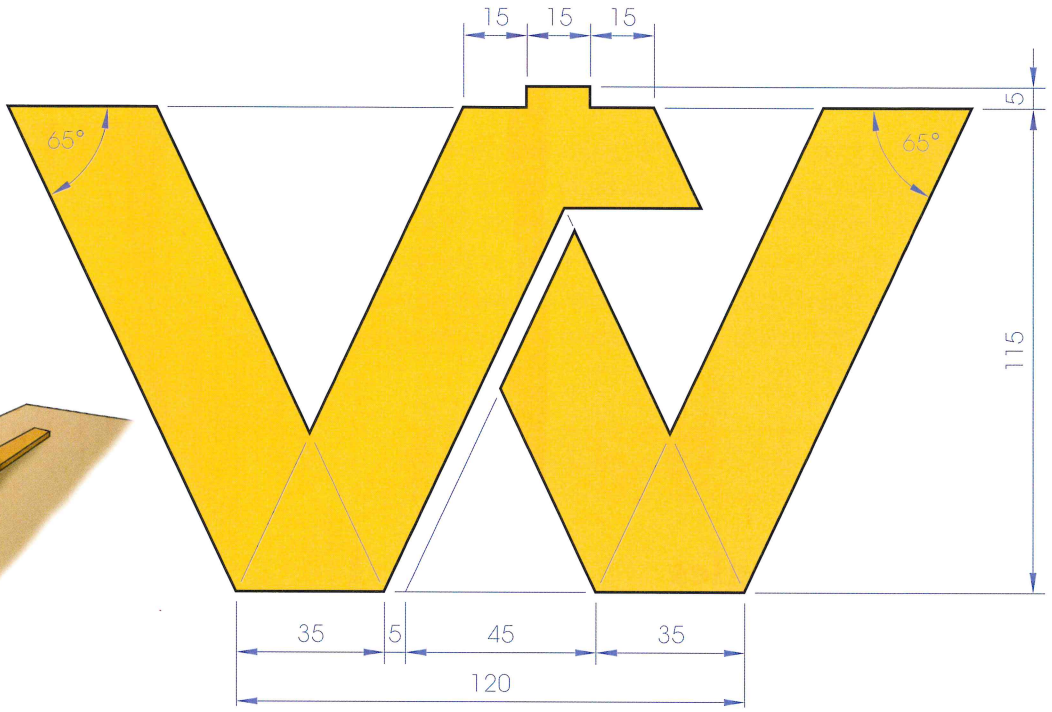




2. Reproduce the drawing of the **Aldi** sign to the given dimensions. Use a coloured pencil to enhance your drawing.



3. Make a full-size drawing of the **Woodie's** logo shown in the figure below.



4. Reproduce the drawing of the **Massey Ferguson** logo to the given dimensions. The three triangles in the design are **congruent**.

Congruent shapes are shapes that have the same shape and size.