Lesson - Angles and lines

Year: Year 3

Hello, I am Otto! Look around you: the corner of this page, the hands of a clock, the edges of a door, the rails of a railway track. All of these show angles and lines. In Year 3 you learn to describe turns and angles and to name lines that are horizontal, vertical, parallel or perpendicular.

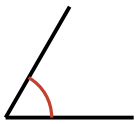
Starter activity

Stand up and face the board. Turn a quarter turn clockwise. Which wall are you facing now? Turn another quarter turn. Now you face the back of the room. How many quarter turns did it take to turn all the way back to the board? Try it with a friend, and call out "quarter turn", "half turn" or "three-quarter turn" for each move. You have just made angles with your body!

Angles and turns

Definition: angle

An **angle** is a measure of turn. Two lines that meet at a point make an angle. The point where they meet is called the **vertex**. The bigger the turn between the lines, the bigger the angle.



Two lines meet at a point and make an angle. The red curve shows the turn between the two lines.

Key fact: turns

- A **full turn** brings you back to where you started and is made of 4 right angles.
- A **half turn** is 2 right angles.
- A **quarter turn** is 1 right angle.
- A **three-quarter turn** is 3 right angles.

Example 1

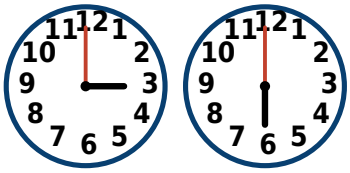
A robot faces north. It makes a half turn. Which way does it face?

A half turn is 2 quarter turns, so the robot turns round to face the opposite way. It faces **south**.

Clockwise and anticlockwise

Definition: clockwise and anticlockwise

Clockwise is the direction the hands of a clock move. **Anticlockwise** is the opposite direction. When we describe a turn, we say how much (quarter, half, three-quarter or full) and which direction.



The minute hand points to 12 on both clocks. The hour hand moves from 3 to 6: a quarter turn clockwise.

Example 2

The hour hand of a clock moves from 12 to 6. What turn is this?

From 12 to 3 is a quarter turn. From 12 to 6 is two quarter turns, which is a **half turn clockwise**.

Right angles

Definition: right angle

A **right angle** is a quarter turn. It is the angle in the corner of a square or a rectangle. We mark a right angle with a small square.



A right angle is marked with a small square at the vertex.

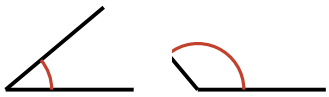
Method: checking for a right angle

1. Take a piece of paper with a straight corner, or use a right angle checker made by folding a sheet twice.
2. Place the corner of the paper at the vertex, with one edge along one line.
3. Look at the other line. If it fits exactly along the other edge, the angle is a right angle.
4. If the line is inside the paper corner the angle is smaller. If it sticks out, the angle is bigger.

Comparing angles with a right angle

Rule: acute, right and obtuse

- An angle **smaller than a right angle** is called an **acute** angle.
- An angle **equal to a right angle** is a right angle (a quarter turn).
- An angle **bigger than a right angle** but smaller than a half turn is called an **obtuse** angle.



The left angle is less than a right angle. The right angle is greater than a right angle.

Example 3

Describe the angle in the corner of a triangle shaped like a slice of pizza that looks narrow.

A narrow slice is a small turn, smaller than a quarter turn, so the angle is **less than a right angle** (acute). The angle in the corner of a piece of paper is exactly a right angle.

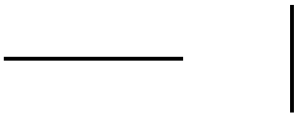
Watch out

The size of an angle does not depend on how long the lines are. Two angles with long arms and short arms can be exactly the same size. Compare the turn between the lines, not their length.

Horizontal and vertical lines

Definition: horizontal and vertical

A **horizontal** line is level, like the horizon or the surface of still water. A **vertical** line goes straight up and down, like the edge of a door or a flagpole.



The left line is horizontal. The right line is vertical.

A line that is neither horizontal nor vertical is called a **slanting** or **diagonal** line. A ramp or a roof edge is usually slanting.

Perpendicular and parallel lines

Definition: perpendicular lines

Two lines are **perpendicular** if they meet at a right angle. A horizontal line and a vertical line are always perpendicular.



The lines meet at a right angle: they are perpendicular. A small square marks the right angle.

Definition: parallel lines

Two lines are **parallel** if they always stay the same distance apart and never meet, however far they go. Railway tracks are a good example. We show parallel lines with matching arrows in diagrams.



These two lines are parallel: the red mark shows that the distance between them is always the same.

Example 4

Look at the letter H. Name a pair of parallel lines and a pair of perpendicular lines.

The two tall sides of the H are **parallel**. The middle bar meets each tall side at a right angle, so the bar and a tall side are **perpendicular**.

Angles in shapes

A square has 4 right angles and 2 pairs of parallel sides. A rectangle also has 4 right angles. A triangle can have a right angle, but it can also have only acute angles. A good way to describe a shape in Year 3 is to say how many right angles it has and which sides are parallel or perpendicular.

Example 5

How many right angles does a rectangle have? How many pairs of parallel sides?

A rectangle has **4 right angles**. Opposite sides are parallel, so it has **2 pairs** of parallel sides.

Did you know?

The word "perpendicular" comes from a Latin word meaning "hanging straight down", like a weight on a string. Builders still use a string with a weight, called a plumb line, to check that a wall is vertical.

Otto's tip

Use your own body or a piece of paper as a tester. A paper corner is a right angle. Hold it against any angle and ask: is it smaller, the same or bigger than this corner?