UNIT 4

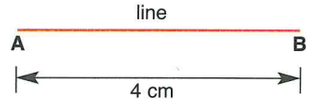
Surfaces and angles

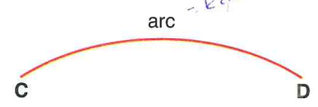
CD 1-16

Section 1 *Vocabulary*

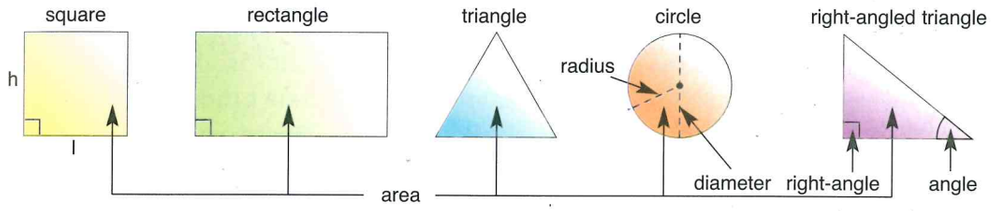
A. Read the text and look at the diagram.

One-dimensional (1D) shapes





Two-dimensional (2D) shapes



A line has only **one dimension**: length (l). For example, the line from Point A to Point B has a length of 4 centimeters (cm). An **arc** is also a one-dimensional shape. It is a curved line between two points.

Some shapes have **two dimensions**: length and **height** (h). **Squares, rectangles, triangles** and **circles** are two-dimensional shapes. The length around most shapes is called the **perimeter** but the length around a circle is the **circumference**. The **width** of a circle is the **diameter**. The length from the center to the edge of the circle is called the **radius** (r).

The space between two lines is an **angle**. Squares and rectangles have four angles of 90 **degrees**. The sign for degrees is a small ° above the line. Some triangles have a 90° angle. These are called **right-angled** triangles. The sign for a right angle in a triangle is a small square. The sign for any other angle is a curved line.

Two-dimensional shapes have **area**. The **formula** for the area of a rectangle is *length* × *height*. For example, a rectangle 4 cm × 3 cm has an area of 12 square centimeters (**cm²**). The formula for the area of a triangle is $\frac{1}{2}$ × length (or **base**) × height. For example, a triangle with base 4 cm and height 3 cm has an area $\frac{1}{2} \times 4 \times 3 = 6$ cm².

The formula for the area of a circle is πr^2, where π, pronounced **pi**, is a constant – roughly 3.142. The area of a circle of radius 4 cm is $3.142 \times 4^2 = 50.272$ cm^2. We use π to calculate the length of the circumference too. The formula is $2\pi r$. So the circumference of the same circle of radius 4 cm is $2 \times 3.142 \times 4 = 25.136$ cm.

B. Look at Figure 1. Answer the questions.

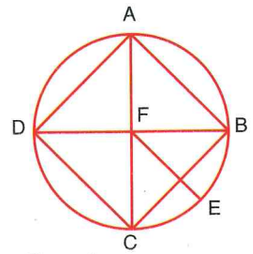


Figure 1

1. What is ABCD?
2. What is BCD?
3. How many right-angled triangles are there?
4. What size is angle BFE?
5. What is the curved line from A to B?

C. Look at Figure 2. Match each item to the correct area or length.

12 cm / 18.852 cm / 25 cm^2 / 16 cm / 6 cm^2 / 20 cm^2

1. The square is _____.
2. The rectangle is _____.
3. The right-angled triangle is _____.
4. The perimeter of the right-angled triangle is _____.
5. The perimeter of the other triangle is _____.
6. The circumference of the circle is _____.

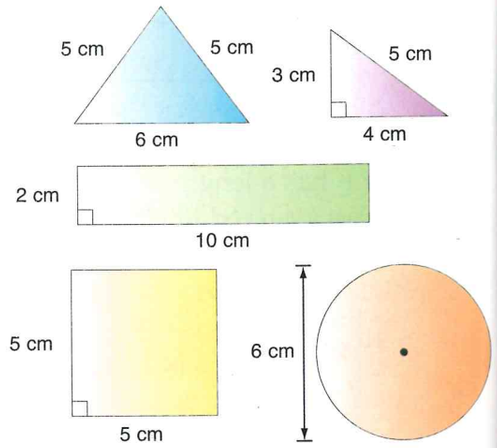


Figure 2

CD 1-17

Section 2 Reading

1 There are several kinds of triangles (see Figure 3 on the next page) but there are two rules that apply to all triangles. Firstly, the internal angles of a triangle always add up to 180° (degrees). Secondly, the area of a triangle is always $\frac{1}{2} \times$ base $\times$ height.

5 An *equilateral* triangle has three sides that have the same length. It also has three angles that are the same size. An *isosceles* triangle has two sides that are equal and two angles that are equal. A *scalene* triangle has no equal sides or angles.

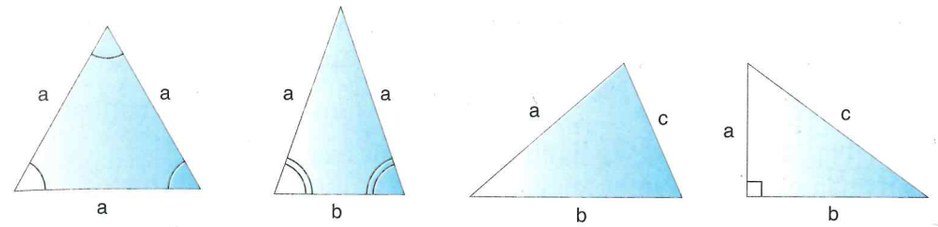


Figure 3

The most important kind of triangle is the *right-angled triangle*. It gets its name from the 90° (or *right*) angle, which all of these triangles have. This kind of triangle has one of the most well-known rules in science – Pythagoras's Theorem.

Pythagoras was a Greek philosopher and mathematician, who lived from about 582 to 500 BC. He worked with a group of other mathematicians and developed his theorem which states: *the square on the hypotenuse is equal to the sum of the squares on the other two sides.* The hypotenuse is the side opposite the right angle. In the right-angled triangle in Figure 3, we could state the theorem as $a^2 + b^2 = c^2$. We can see the theorem in operation in Figure 4.

If $a = 3$, $a^2 = 9$
If $b = 4$, $b^2 = 16$
therefore $c^2 = 25$
therefore $c = \sqrt{25}$
therefore $c = 5$

Figure 4

A. Choose the best answer in each case.

1. What is the area of a triangle with a base of 16 cm and a height of 9 cm?
   a. 8 cm^2
   b. 17 cm
   c. 17 cm^2
   d. 72 cm^2
2. Which kind of triangle has no equal angles?
   a. equilateral
   b. isosceles
   c. scalene
   d. right-angled
3. What is each angle in an equilateral triangle?
   a. 30°
   b. 60°
   c. 90°
   d. 180°
4. In the right-angled triangle in Figure 3, the *hypotenuse* is:
   a. the horizontal line
   b. the vertical line
   c. the diagonal line
   d. the right angle
5. If a right-angled triangle has a base of 4 and a height of 5, what is the hypotenuse?
   a. $\sqrt{41}$
   b. $\sqrt{20}$
   c. 41
   d. $\sqrt{9}$

B. Study the following example sentences.

Using relative pronouns

There are two rules **that** apply to all triangles.
It gets its name from the right angle, **which** all of these triangles have.
Pythagoras was a Greek philosopher and mathematician **who** lived from about 582 to 500 BC.

C. Put a suitable relative pronoun in each space.

1. We need a new engineer _____ understands the mechanics of car safety in our section.
2. His book is about geology, _____ is a new subject at the college.
3. The subject _____ I like the most is biochemistry.
4. The Bridge of Sighs is the most beautiful bridge _____ I have ever seen.

CD 1-18

Section 3 Listening

A. Listen and complete the summary of the reading text in Section 2. Write one word in each space.

There are several kinds of _____: equilateral, isosceles, scalene and right-_____ triangles. However, for all triangles, the internal _____ add up to 180° and the area is $\frac{1}{2}$ base times _____. Pythagoras developed a theorem for right-angled triangles which states: the square on the _____ is equal to the sum of the squares on the other two sides.

CD 1-19,20

B. Listen to the conversation. The man doesn't understand two expressions in mathematics. Circle these two expressions.

addition	multiplication	subtraction
division	square root	geometry
formula	squared	trigonometry

CD 1-21,20

C. Listen again and complete the summary. Write one word, letter or number in each space.

When you see a small number _____ above the line after a letter or _____, it means squared. For example, A^2 means A _____. In other words, you must _____ A by itself. So if A is 2, A squared is _____. The opposite of squared is the square _____. The sign for this looks like a check with a line _____ the letter or number. So $\sqrt{A}$ means the square root of _____. If A is 16, the square root is _____.