**Handout**

**Module 2**

**CHAPTER12. ALGEBRAIC EXPRESSIONS**

## 1. FINDING THE VALUE OF AN ALGEBRAIC EXPRESSION:

We know that the value of an algebraic expression depends on the values of the variables forming the expression. There are a number of situations in which we need to find the value of an expression, such as when we wish to check whether a particular value of a variable satisfies a given equation or not.

We find values of expressions, also, when we use formulas from geometry and from everyday mathematics. For example, the area of a square is $l^2$, where $l$ is the length of a side of the square. If $l$ = 5 cm., the area is $5^2$ $cm^2$ or 25 $cm^2$; if the side is 10 cm, the area is $10^2$ $cm^2$ or 100 $cm^2$ and so on. We shall see more such examples in the next section.

As for an example:

Find the value of the following expressions for $a = 3$, $b = 2$.

(i) $a + b$ (ii) $7a – 4b$ (iii) $a^2 + 2ab + b^2$

(iv) $a^3 – b^3$

**Solution**: Substituting $a = 3$ and $b = 2$ in

(i) $a + b$, we get

$a + b = 3 + 2 = 5$

(ii) $7a – 4b$, we get

$$7a – 4b = 7 \times 3 – 4 \times 2 = 21 – 8 = 13.$$

(iii) $a^2 + 2ab + b^2$, we get

$$a^2 + 2ab + b^2 = 3^2 + 2 \times 3 \times 2 + 2^2 = 9 + 2 \times 6 + 4$$
$$=9 + 12 + 4 = 25$$

(iv) $a^3 – b^3$, we get

$$a^3 – b^3 = 3^3 – 2^3 = 3 \times 3 \times 3 – 2 \times 2 \times 2 = 9 \times 3 – 4 \times 2$$
$$= 27 – 8 = 19$$

## 2. USING ALGEBRAIC EXPRESSIONS – FORMULAE AND RULES:

We have seen earlier also that formulas and rules in mathematics can be written in a concise and general form using algebraic expressions. We see below several examples.

- **Perimeter formulas**

1. The perimeter of an equilateral triangle = 3 × the length of its side. If we denote the length of the side of the equilateral triangle by $l$, then **the perimeter of the equilateral triangle = 3*l***
2. Similarly, **the perimeter of a square = 4*l***

   where $l$ = the length of the side of the square.
3. **Perimeter of a regular pentagon = 5*l***

   where $l$ = the length of the side of the pentagon and so on.

- **Area formulas**

1. If we denote the length of a square by $l$, then the area of the square = $l^2$
2. If we denote the length of a rectangle by $l$ and its breadth by $b$, then the area of the rectangle = $l \times b = lb$.
3. Similarly, if $b$ stands for the base and $h$ for the height of a triangle, then the area of the

   triangle = b x h/2

Once a formula, that is, the algebraic expression for a given quantity is known, the value of the quantity can be computed as required.

For example, for a square of length 3 cm, the perimeter is obtained by putting the value $l$ = 3 cm in the expression of the perimeter of a square, i.e., 4$l$.
The perimeter of the given square = (4 × 3) cm = 12 cm.
Similarly, the area of the square is obtained by putting in the value of $l$(= 3 cm) in the expression for the area of a square, that is, $l^2$; Area of the given square = $(3)^2$ $cm^2$ = 9 $cm^2$.

- **Rules for number patterns**

Study the following statements:

1. If a natural number is denoted by $n$, its successor is ($n$ + 1). We can check this for any natural number. For example, if $n$ = 10, its successor is $n$ + 1=11, which is known.
2. If a natural number is denoted by $n$, 2$n$ is an even number and (2$n$ + 1) an odd number. Let us check it for any number, say, 15; 2$n$ = 2 × $n$ = 2 × 15 = 30 is indeed an even number and 2$n$ + 1 = 2 × 15 + 1 = 30 + 1 = 31 is indeed an odd number.

- **Pattern in geometry**

What is the number of diagonals we can draw from one vertex of a quadrilateral?

Check it, it is one.

From one vertex of a pentagon? Check it, it is 2.

From one vertex of a hexagon? It is 3.

The number of diagonals we can draw from one vertex of a polygon of $n$ sides is $(n - 3)$. Check it for a heptagon (7 sides) and octagon (8 sides) by drawing figures. What is the number for a triangle (3 sides)? Observe that the diagonals drawn from any one vertex divide the polygon in as many non-overlapping triangles as the number of diagonals that can be drawn from the vertex plus one.

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