CHAPTER-20

SUBSTITUTION

STUDY NOTE

What is substitution?

- Substitution is where we replace letters in a formula with their values.
- This allows you to find one other value that is in the formula.

How do we substitute?

- Write down the FORMULA if not clearly stated in question
- SUBSTITUTE the numbers given – use ( ) around negative numbers
- SIMPLIFY if you can
- REARRANGE if necessary – it is usually easier to substitute first
- Do the CALCULATION

1. *Find the value of the expression* $2x(x+3y)$ *when* $x = 2$ *and* $y = -4$

$2 \times 2 \times (2 + 3 \times (-4))$ — 1 – *Substitute the numbers given, use () around negatives*
$= 2 \times 2 \times (2 - 12)$ — *You don't need all these lines of working but we've included*
$= 2 \times 2 \times (-10)$ — *them here to remind you of order of operations*
$= -40$ — *Use a calculator if allowed*

2. *The formula* $P = 2l + 2w$ *is used to find the perimeter,* P *of a rectangle of length* l *and width* w
Given that a rectangle has a perimeter of 20 *cm and a width of* 4 *cm, find its length.*

$20 = 2 \times l + 2 \times 4$ — 1 – *Substitute the numbers given, no negatives*
$20 = 2l + 8$ — 2 – *Simplify*
$2l = 12$ — 3, 4 – *Rearrange and do the calculation*
$l = 6$
Length is 6 *cm*

Mathematical brackets are symbols, such as parentheses, that are most often used to create groups or clarify the order that operations are to be done in an algebraic expression. Some bracket symbols, however, have multiple special uses in mathematics.

Brackets and Grouping

Often, you will see mathematical brackets used for **grouping**. These brackets can include:

- ( )
- [ ]
- { }

When used for grouping, brackets always come in pairs. There will be an **opening bracket** and a **closing bracket**.

Brackets are used to provide clarity in the **order of operations**, the order in which several operations should be done in a mathematical expression.

Expanding brackets

Expanding brackets means multiplying everything inside the bracket by the letter or number outside the bracket. For example, in the expression 3(m+7) both m and 7 must be multiplied by 3:

$3(m+7)=3\times m+3\times 7=3m+21$.

Expanding brackets involves using the skills of simplifying algebra. Remember that $2\times a=2a$ and $a\times a=a2$.

Example

Expand 4(3n+y).

$4(3n+y) = 4\times3n+4\times y = 12n+4y$

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