Mathematics Algebra Revision Booklet

Year 7

Thomas Whitham Sixth Form

S J Cooper

- Collection of like terms

- Multiplication

- Solving equations

- Substituting into formulae

- Construction of equations

- Sequences, Number patterns

- Coordinates

- Drawing straight line graphs

- Removal of brackets

1. <u>Collection of like terms</u>

   <u>Examples</u>

   $$7a + 3a = 10a$$
   $$7a - 3a = 4a$$
   $$2a + 3b - a + 5b = a + 8b$$
   $$4x + y - 2x + 3y = 2x + 4y$$

2. <u>Multiplication</u>

   <u>Examples</u>

   $$2 \times a = 2a$$
   $$a \times a = a^2$$
   $$2a \times 3b = 6ab$$
   $$x \times x \times x = x^3$$
   $$4y \times 6y = 24y^2$$

3. <u>Solving equations</u>

   <u>Example</u> $x + 7 = 12$
                  $x = 5$

   <u>Example</u> $5a = 20$
                  $a = 4$

   <u>Example</u> $5x = 2$
                  $x = \dfrac{2}{5}$

   <u>Example</u> $2x + 1 = 7$ {letters on one side, numbers on the other}

                  $2x = 7 - 1$ {take 1 from each side}

                  $2x = 6$ {divide both sides by 2}

                  $x = 3$

   <u>Example</u> $2y + 4y + 6 - 3 = 15$

                          {firstly collect together like terms}

                  $6y + 3 = 15$

                  $6y = 15 - 3$ {take 3 from each side}

                  $6y = 12$ {divide both sides by 6}

                  $y = 2$

Example $6x - 5 = 2x + 7$ {firstly collect together like terms}

$6x - 2x = 7 + 5$ {take 2x from each side and add 5 to each side}

$4x = 12$ {divide both sides by 4}
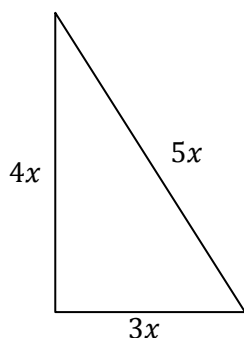
$x = 3$

4. Substituting into formulae

Example   The formula $P = 2l + 2b$ gives the perimeter of a rectangle of length l

and breadth b. Calculate the perimeter if the length $l = 5$cm and the

breadth $b = 2$cm.

$P = 2l + 2b$ if $l = 5$ and $b = 2$

$2l = 10$ and $2b = 4$

$\therefore$ $P = 10 + 4 = 14$cm

Example

(i)   Find a formula for the perimeter, P of the triangle.

(ii)   Find the perimeter if $x = 3$cm

(i) $P = 4x + 3x + 5x$ $\therefore P = 12x$

(ii)   If $x = 3$ $P = 12 \times 3 = 36$cm

Example   What number is

(i)   5 less than x?   Answer = $x - 5$

(ii) p more than 5?   Answer = $p + 5$

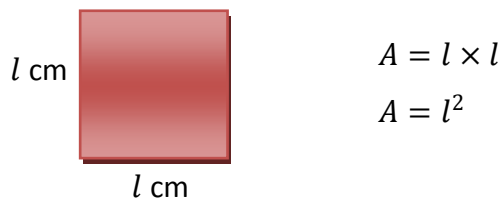(iii)   4 times as big as y?   Answer = $4y$

5. Constructing equations

Example   If G is the number of girls in a class and B is the number of boys, write

down a formula for the total number, T,of children in the class.

$\therefore$ $T = G + B$

Example

The Side of a square is $l$cm long. Write down a formula for A, the area of the square.

l cm

l cm

$A = l \times l$

$A = l^2$

6. Construction and solution of equations

Example

I think of a number, multiply by 4 and subtract 8. The result is 20. What is the number?

Let the number be x

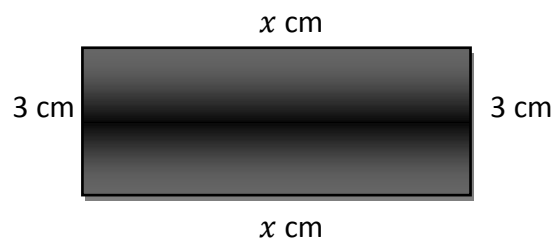Then $4x - 8 = 20$ {multiply by 4 and subtract 8}

$\therefore$ $4x = 20 + 8$

$\therefore$ $4x = 28$

$\therefore$ $x = 7$

$\therefore$ The number first thought of is 7.

Example   The sides of a rectangle are x cm and 3 cm. Its perimeter is 24cm. Find x.

x cm

3 cm   3 cm

x cm

$\therefore$ The perimeter is $x + 3 + x + 3 = 24$

$$2x + 6 = 24$$
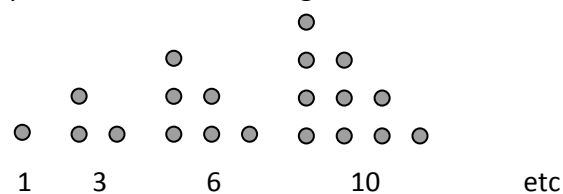
$$2x = 24 - 6$$

$$2x = 18$$

$$x = 9$$

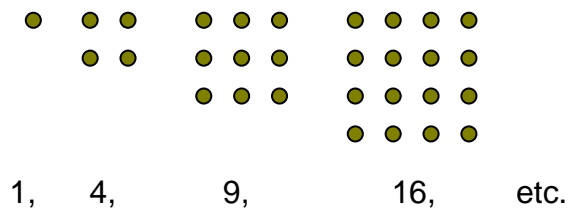7. Sequences, Number patterns

The following sequence illustrates triangular numbers

1   3   6   10   etc

The following sequence illustrates Square numbers

1,   4,   9,   16,   etc.

The following sequence are odd numbers   1, 3, 5, 7, 9, 11, 13, ...

The following sequence are even numbers   2, 4, 6, 8, 10, 12, 14, ...

The following sequence are powers of 2   2, 4, 8, 16, 32, 64, 128, ...

Example   Consider the following sequence

          1, 4, 7, 10, ...

(i)   What is the 5th term?

(ii)   What is the 10th term?

(iii)   Describe the sequence in words.

(i)   Next one in the sequence is the 5th term which is 13

(ii)   The 10th term in the sequence is 28

(iii)   To obtain the next term in the sequence add 3 to the last number in the sequence.

Example   Find the first 5 terms for the sequence $V_n = 7n - 3$

$$V_1 = 7(1) - 3 = 4$$
$$V_2 = 7(2) - 3 = 11$$
$$V_3 = 7(3) - 3 = 18$$
$$V_4 = 7(4) - 3 = 25$$
$$V_5 = 7(5) - 3 = 32$$

$\therefore$ 4, 11, 18, 25, 32

Example   Find the first 4 terms for the sequence $V_n = n \times (n + 2)$

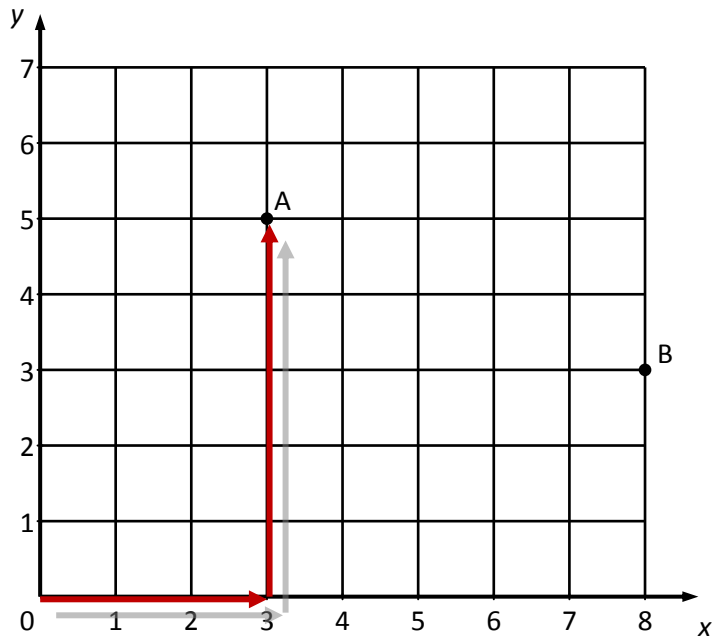$$V_1 = 1 \times (1 + 2) = 1 \times 3 = 3$$
$$V_2 = 2 \times (2 + 2) = 2 \times 4 = 8$$
$$V_3 = 3 \times (3 + 2) = 3 \times 5 = 15$$
$$V_4 = 4 \times (4 + 2) = 4 \times 6 = 24$$
$$V_5 = 5 \times (5 + 2) = 5 \times 7 = 35$$

$\therefore$ 3, 8, 15, 24, 35
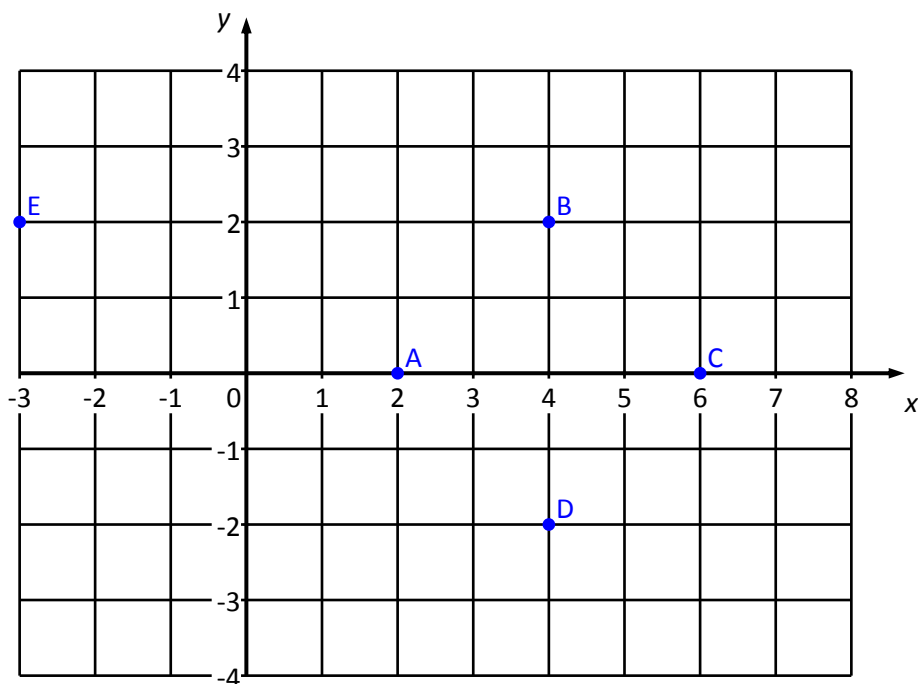
8. <u>Coordinates</u>

The numbers (3, 5) is referred to as the <u>coordinate</u> of A

The first number, 3, is called the x-coordinate of A.

The second number, 5, is called the y-coordinate of A.

The coordinate of point B is given by (8, 3)

The <u>origin</u> is the coordinate (0, 0)

<u>Negative coordinates</u>

The y-coordinate of point D is written −2 and is called "negative 2"

The x-coordinate of point E is written −3 and is called "negative 3"

9. <u>Drawing straight line graphs</u>

<u>Example</u>

a) Copy and complete the table below for the equation $y = 4x - 1$

x	1	2	3	4
y				

b) Draw the graph of $y = 4x - 1$

a)

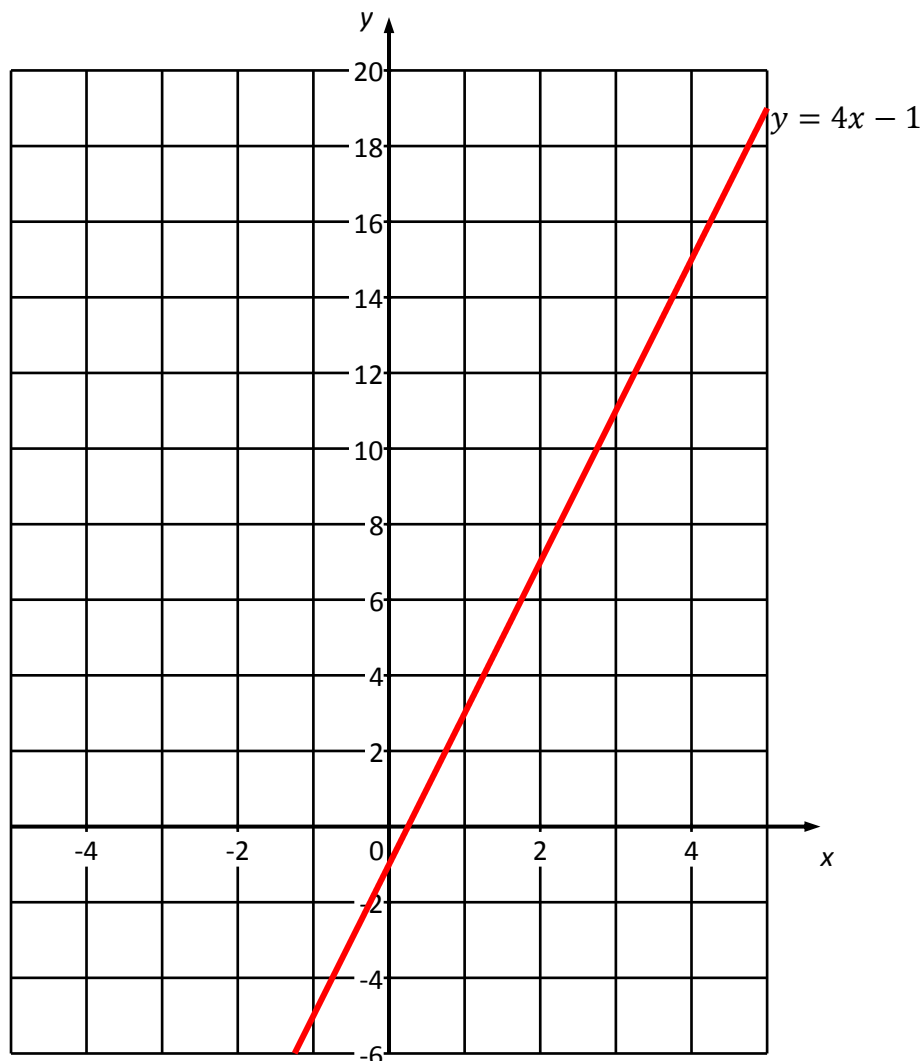| x	1	2	3	4
y	3	7	11	15

$y = 4(1) - 1$

$y = 4(2) - 1$

$y = 4(3) - 1$

$y = 4(4) - 1$

b)

10. <u>Removal of brackets</u>

<u>Example</u>   Remove the bracket $4(a+7)$

This can be attempted in the same way that you perform multiplication as shown below

	a	7
4	4a	28

Hence $4(a+7) = \underline{4a+28}$

<u>Example</u>   Remove the brackets for each of the following and simplify where

possible

(i) $3(2x-5)$

(ii) $7(3x+2)$

(iii) $x(3x+2)$

(iv) $2p(5q-3p+1)$

Alternatively we can make use of the fact that when removing any bracket we multiply

everything inside the bracket by the quantity outside the bracket.

(i) $3(2x-5) = \underline{6x-15}$

(ii) $7(3x+2) = \underline{21x+14}$

(iii) $x(3x+2) = \underline{3x^2 + 2x}$

(iv) $2p(5q-3p+1) = \underline{10pq - 6p^2 + 2p}$