O Level E Maths Tutorial 5: Algebraic expressions and formulae

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Syllabus :
• using letters to represent numbers
• interpreting notations:
- ab as $a \times b$
- $\frac{a}{b}$ as $a \div b$ or $a \times 1/b$
- a^2 as $a \times a$, a as $a \times a \times a$, a^2b as $a \times a \times b$, …
- 3y as y + y + y or 3 × y
- 3(x + y) as 3 × (x + y)
- (3 + y)/5 as (3 + y) ÷ 5 or 1/5 × (3 + y)

• evaluation of algebraic expressions and formulae

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1. Let a be 3 and b be 5. Find

(i) $2a$

(ii) $2a + 3b$

(iii) ab

(iv) a/b^2

• translation of simple real-world situations into algebraic expressions

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2. A class has 8 boys and 9 girls. Each boy spends x dollars. Each girl spends y dollars. Write down an expression for the total amount they spend.

• recognising and representing patterns/relationships by finding an algebraic expression for the nth term

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3. In the following sequence, write down an expression for the nth term.

(i) 2, 4, 6, 8, ….

(ii) $1, \frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \ldots$

• addition and subtraction of linear expressions

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4. (i) Add $(2x + 1)$ to $(3x – 4)$.

(ii) Subtract $(2x + 1)$ from $(3x – 4)$.

• simplification of linear expressions such as:

$-2(3x-5) + 4x$

$\frac{2x}{3} - \frac{3(x-5)}{2}$

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5. Simplify these expressions:

(i) $-2(3x-5) + 4x$

(ii) $\frac{2x}{3} - \frac{3(x-5)}{2}$

• use brackets and extract common factors

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6. Use a bracket and extract the common factor:

(i) $2x + 2y$

(ii) $2x + 4y$

(iii) $4x - 2y$

(iv) $3x + 9y$

• factorisation of linear expressions of the form $ax + bx + kay + kby$

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7. Factorise (extract common factor) for each of the following:

   (i) $x(a + b) + 2(a + b)$

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

   (iii) $ax + bx + kay + kby$

8. Factorise $6x^2 – y + 3xy – 2x$

[N21/I/21(a)]

• expansion of the product of algebraic expressions

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9. (i) $x(x + 2)$

   (ii) $3(x + 2)$

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

   (iv) $(x - 1)(x + 2)$

• changing the subject of a formula
• finding the value of an unknown quantity in a given formula

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10. $y = 2x + 1$

    Rearrange to make x the subject

11. $y = 2x + 1$

    Given that y is 9, find x.

• use of:
- $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $a^2 - b^2 = (a + b)(a - b)$

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12. Expand the following:

(i) $(x + 2)^2$

(ii) $(x - 2)^2$

(i) $(x + 2)(x - 2)$

• factorisation of quadratic expressions $ax^2 + bx + c$

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13. Factorise these:

(i) $y = x^2 + 2x + 1$

(ii) $y = x^2 + 3x + 2$

(iii) $y = x^2 - 3x + 2$

(iv) $y = x^2 - x - 2$

• multiplication and division of simple algebraic fractions such as:

$$\left(\frac{3a}{4a^2}\right)\left(\frac{5ab}{3}\right)$$

$$\left(\frac{3a}{4} \div \frac{9a^2}{10}\right)$$

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14. Simplify:

(a) $\left(\frac{3a}{4a^2}\right)\left(\frac{5ab}{3}\right)$

(b) $\left(\frac{3a}{4} \div \frac{9a^2}{10}\right)$

• addition and subtraction of algebraic fractions with linear or quadratic denominator such as:

$\frac{1}{x-2} - \frac{2}{x-3}$

$\frac{1}{x^2-9} + \frac{2}{x-3}$

$\frac{1}{x-3} + \frac{2}{(x-3)^2}$

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15. Simplify:

(a) $\frac{1}{x-2} - \frac{2}{x-3}$

(b) $\frac{1}{x^2-9} + \frac{2}{x-3}$

(c) $\frac{1}{x-3} + \frac{2}{(x-3)^2}$