IM-024 · Algebra foundations: letters, substitution and formulas

IGCSE Mathematics (0580) · HomiLabs: Maths · Ep 024

Set A · Fluency

1. For the expression $6x^2 - x + 9$, write down
   (a) the number of terms (b) the coefficient of x (c) the constant term.

2. Write in the shortest algebraic form: (a) $4 \times p \times 3 \times q$ (b) $m \times m \times 5$ (c) $y \div 8$

3. Find the value of $4b^2$ and of $(4b)^2$ when $b = -2$.

4. Find the value of each expression when $x = -5$: (a) $3 - x$ (b) $-x^2$ (c) x^3

5. Find the value of each expression when $p = 6$ and $q = -3$: (a) $2p + 5q$ (b) pq^2 (c) $(p + q)/(p - q)$

6. Write an expression for the number that is 7 less than three times n.

7. Use the formula $v = u + at$ to find v when $u = 9$, $a = -2$ and $t = 3.5$.

8. Adult tickets for a show cost a dollars and child tickets cost c dollars.
   (a) Write a formula for the total cost, T dollars, of 3 adult tickets and 4 child tickets.
   (b) Find T when $a = 12$ and $c = 7.5$.

Set B · Exam style

1. (Paper 1/2 · no calculator) (C) Find the value of $5x^2 - 2xy$ when $x = -3$ and $y = 4$. [2]

2. (Paper 1/2 · no calculator) (C) A taxi charges a fixed fee of 3.50 dollars plus 1.20 dollars for each kilometre.
   (a) Write a formula for the cost, C dollars, of a journey of k kilometres. [2]
   (b) Find the cost of a 15 km journey. [1]

3. (Paper 3/4 · calculator) (C) The time, T seconds, for one swing of a pendulum of length l metres is given by the formula $T = 2\pi\sqrt{(l/g)}$.
   Find T when $l = 0.85$ and $g = 9.81$. Give your answer correct to 3 significant figures. [2]

4. (Paper 1/2 · no calculator) (E) n is a positive whole number.
   (a) Explain why $2n$ is always an even number. [1]
   (b) Write an expression, in terms of n, for the product of the next two even numbers after $2n$. [2]
   (c) Find the value of this product when $n = 4$. [1]

Challenge

(E · links to Ep 20, surds) Find the exact value of $x^2 - 2x$ when $x = 1 + \sqrt{3}$. Show all your working.

Answers

Set A

1. (a) 3 terms (b) -1 (c) 9

2. (a) $12pq$ (b) $5m^2$ (c) $y/8$

3. $4b^2 = 4(-2)^2 = 16$; $(4b)^2 = (-8)^2 = 64$

4. (a) $3 - (-5) = 8$ (b) $-(-5)^2 = -25$ (c) $(-5)^3 = -125$

5. (a) $12 - 15 = -3$ (b) $6 \times 9 = 54$ (c) $3/9 = 1/3$

6. $3n - 7$

7. $v = 9 + (-2)(3.5) = 9 - 7 = 2$

8. (a) $T = 3a + 4c$ (b) $T = 36 + 30 = 66$

Set B

1. $5(-3)^2 - 2(-3)(4)$ M1; $= 45 + 24 = 69$ A1.

2. (a) $C = 3.5 + 1.2k$ (or $C = 3.50 + 1.20k$) B2 (B1 for $3.5 + 1.2k$ without "C =", or for one correct term).
   (b) $3.5 + 1.2 \times 15 = 3.5 + 18 = 21.50$ dollars B1.

3. $T = 2\pi\sqrt{(0.85/9.81)}$ M1; $= 1.8495\ldots = 1.85$ s A1.

4. (a) $2n = 2 \times$ (a whole number), so it is a multiple of 2, so it is even B1.
   (b) $(2n + 2)(2n + 4)$ B2 (B1 for $2n + 2$ and $2n + 4$ seen).
   (c) $10 \times 12 = 120$ B1.

Challenge

$x^2 = (1 + \sqrt{3})^2 = 1 + 2\sqrt{3} + 3 = 4 + 2\sqrt{3}$; $2x = 2 + 2\sqrt{3}$.
$x^2 - 2x = 4 + 2\sqrt{3} - 2 - 2\sqrt{3} = 2$.