Unit 11 · Algebraic Expression

HARDER PRACTICE QUESTIONS

Full marks 35

Write your answers on separate paper. Show your working, one step a line. Keep each sign with its term, and check a product or a quotient by putting a number in place of the letter.

1 Spot the errors [4]

Nishma worked out these four. Each answer is wrong. Find the right answer, and say what went wrong.

i. $(x + 5)^2 = x^2 + 25$

ii. $(2x - 3)(x + 4) = 2x^2 - 12$

iii. $(a - 4)^2 = a^2 - 8a - 16$

iv. Dividing $x^2 + 5x + 6$ by $x + 2$, she wrote $x^2 + 5x + 6 - (x^2 + 2x) = 7x + 6$.

2 Fill in the boxes [4]

Copy each line and write the numbers that go in the boxes.

a. $(x + \square)(x + 3) = x^2 + 8x + \square$

b. $(2x - \square)^2 = 4x^2 - \square x + 9$

c. $(x + 4)(x - \square) = x^2 + x - \square$

d. $(3a + \square)^2 = 9a^2 + 30a + \square$

3 A shortcut, and its uses [4]

The unit showed that $(a + b)^2 - (a - b)^2 = 4ab$.

i. Use it to find $53^2 - 47^2$ without squaring either number.

ii. Use it to find $10.5^2 - 9.5^2$.

iii. If $(a + b)^2 = 49$ and $(a - b)^2 = 9$, find ab.

iv. Write 60 as $(a + b)^2 - (a - b)^2$, with a and b whole numbers, in two different ways. Work out both squares each time to check.

4 Think: the number trick [4]

Rohan says: "Think of a number. Add 5 to it. Multiply that by the number that is 5 less than your number. Add 25. You get the square of your number, every time."

i. Try the trick with 12.

ii. Call the number x. Write the trick as an expression and simplify it to show that Rohan is right.

iii. Change the trick to use 3 in place of 5. What must be added at the end?

iv. Use the trick to find 107×93 in your head.

5 Does it divide exactly? [4]

i. Divide $x^2 + 7x + 12$ by $x + 3$. Is there a remainder?

ii. Divide $x^2 + x - 5$ by $x - 2$. Write the quotient and the remainder.

iii. Check your answer to ii by putting $x = 10$ in the dividend, the divisor, the quotient and the remainder.

iv. What number must k be for $x^2 + x - k$ to be divided by $x - 2$ exactly?

6 A box from a sheet of tin [4]

A sheet of tin is $(x + 8)$ cm long and $(x + 6)$ cm broad. A square of side 3 cm is cut from each corner, and the sides are folded up to make an open box 3 cm high.

i. Write the length and breadth of the box's base.
ii. Find the volume of the box as an expression.
iii. Find the volume when $x = 10$, and check it with the box's real edges.
iv. How much tin is left in the box? Write it as an expression, and find its value when $x = 10$.

7 Always bigger? [4]

i. Expand $(x + 1)(x + 5)$ and $(x + 3)^2$.
ii. Which is bigger, and by how much? Does the answer depend on x?
iii. Compare $(x + 2)(x + 4)$ with $(x + 3)^2$ in the same way.
iv. What number must be added to $(x + 2)(x + 8)$ to make it the square of a binomial? Name the binomial.

8 A pattern with cubes [4]

i. Find the product $(x + 1)(x^2 - x + 1)$.
ii. Find the product $(x - 1)(x^2 + x + 1)$.
iii. Put $x = 10$ in both. Which two multiplications of whole numbers do you get, and what are their answers?
iv. Use the same idea to find 21×381. (Hint: take $x = 20$.)

9 Make your own [3]

i. Write two binomials whose product has no term in x.
ii. Write a trinomial that $x + 2$ divides exactly, and say how you made it.
iii. Write the square of a binomial whose middle term is $12x$.