Unit 11 · Algebraic Expression

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 35

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Spot the errors

ANSWER U · 4

i. $x^2 + 10x + 25$. She left out the two rectangles, $2 \times x \times 5 = 10x$.

ii. $2x^2 + 5x - 12$. She multiplied only first by first and last by last. The middle products are $8x$ and $-3x$, which make $5x$.

iii. $a^2 - 8a + 16$. The last term is $(-4)^2 = +16$: a square is never negative.

iv. $3x + 6$. Subtracting $x^2 + 2x$ changes both signs: $5x - 2x = 3x$. She added $2x$. (The division then gives $x + 3$, with no remainder.)

MARKING SCHEME

✓ i. $x^2 + 10x + 25$.

✓ ii. $2x^2 + 5x - 12$.

✓ iii. $a^2 - 8a + 16$.

✓ iv. $3x + 6$: change every sign when subtracting.

2 Fill in the boxes

ANSWER A · 4

a. **5** and **15**: $3 + 5 = 8$, and $5 \times 3 = 15$.

b. **3** and **12**: $9 = 3^2$, and $2 \times 2x \times 3 = 12x$.

c. **3** and **12**: $4x - 3x = x$, and $4 \times 3 = 12$.

d. **5** and **25**: $2 \times 3a \times 5 = 30a$, and $5^2 = 25$.

MARKING SCHEME

✓ a. 5 and 15.

✓ b. 3 and 12.

✓ c. 3 and 12.

✓ d. 5 and 25.

3 A shortcut, and its uses

ANSWER A · 4

i. $53 = 50 + 3$ and $47 = 50 - 3$, so the answer is $4 \times 50 \times 3 = \mathbf{600}$.

ii. $10.5 = 10 + 0.5$ and $9.5 = 10 - 0.5$: $4 \times 10 \times 0.5 = \mathbf{20}$.

iii. $4ab = 49 - 9 = 40$, so $\boldsymbol{ab = 10}$.

iv. $4ab = 60$, so $ab = 15$: $a = 15$, $b = 1$ gives $\mathbf{16^2 - 14^2 = 256 - 196 = 60}$, and $a = 5$, $b = 3$ gives $\mathbf{8^2 - 2^2 = 64 - 4 = 60}$.

MARKING SCHEME

✓ i. 600.

✓ ii. 20.

✓ iii. $ab = 10$.

✓ iv. Two pairs with $ab = 15$: $16^2 - 14^2$ and $8^2 - 2^2$.

4 Think: the number trick

ANSWER

i. $12 + 5 = 17$ and $12 - 5 = 7$: $17 \times 7 + 25 = 119 + 25 = \mathbf{144} = 12^2$.

ii. $(x + 5)(x - 5) + 25 = x^2 - 5x + 5x - 25 + 25 = x^2$. The two middle products cancel, and the 25 puts back what $5 \times (-5)$ took away.

iii. $(x + 3)(x - 3) = x^2 - 9$, so add **9**.

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iv. $107 \times 93 = (100 + 7)(100 - 7) = 100^2 - 49 = \mathbf{9{,}951}$. HA · 4

MARKING SCHEME

✓ i. 144.

✓ ii. $(x + 5)(x - 5) + 25 = x^2$.

✓ iii. Add 9.

✓ iv. 9,951.

5 Does it divide exactly?

ANSWER A · 4

i. Quotient x **+ 4**, **no remainder**: $(x + 3)(x + 4) = x^2 + 7x + 12$.

ii. $x^2 \div x = x$; $x^2 + x - 5 - (x^2 - 2x) = 3x - 5$; $3x \div x = 3$; $3x - 5 - (3x - 6) = 1$. Quotient x **+ 3**, remainder **1**.

iii. Dividend $100 + 10 - 5 = 105$, divisor 8, quotient 13: $8 \times 13 + 1 = 105$ ✓.

iv. The division is the same as in ii until the last step: $3x - k - (3x - 6) = 6 - k$. For no remainder, k **= 6**. Check: $(x - 2)(x + 3) = x^2 + x - 6$ ✓.

MARKING SCHEME

✓ i. $x + 4$, no remainder.

✓ ii. Quotient $x + 3$, remainder 1.

✓ iii. $8 \times 13 + 1 = 105$.

✓ iv. $k = 6$.

6 A box from a sheet of tin

ANSWER A · 4

i. Each side loses 3 cm at both ends: length $x + 8 - 6 =$ **$(x + 2)$ cm**, breadth $x + 6 - 6 = x$ **cm**.

ii. $V = (x + 2) \times x \times 3 =$ **$(3x^2 + 6x)$ cm^3**.

iii. $3 \times 100 + 60 =$ **360 cm^3**. The box is 12 cm × 10 cm × 3 cm, and $12 \times 10 \times 3 = 360$ ✓.

iv. The sheet less the four corners: $(x + 8)(x + 6) - 4 \times 9 = x^2 + 14x + 48 - 36 =$ **$(x^2 + 14x + 12)$ cm^2**. At $x = 10$: $100 + 140 + 12 =$ **252 cm^2** ($18 \times 16 - 36 = 252$ ✓).

MARKING SCHEME

✓ i. $(x + 2)$ cm and x cm.

✓ ii. $3x^2 + 6x$.

✓ iii. 360 cm^3, checked.

✓ iv. $x^2 + 14x + 12$, 252 cm^2.

7 Always bigger?

ANSWER HA · 4

i. $(x + 1)(x + 5) = x^2 + 6x + 5$ and $(x + 3)^2 = x^2 + 6x + 9$.

ii. **$(x + 3)^2$ is bigger by 4**, for **every** x: the x^2 and $6x$ are the same, and 9 is 4 more than 5. (With $x = 7$: $8 \times 12 = 96$, $10^2 = 100$.)

iii. $(x + 2)(x + 4) = x^2 + 6x + 8$: **1 less** than $(x + 3)^2$. Two numbers 1 either side of a middle number multiply to its square less 1; 2 either side, less 4.

iv. **9**: $(x + 2)(x + 8) = x^2 + 10x + 16$, and $(x + 5)^2 = x^2 + 10x + 25$, which is 9 more. So $x^2 + 10x + 16 + 9 =$ **$(x + 5)^2$**: 2 and 8 are 3 either side of 5, and $3^2 = 9$.

MARKING SCHEME

✓ i. $x^2 + 6x + 5$ and $x^2 + 6x + 9$.

✓ ii. $(x + 3)^2$, by 4, whatever x is.

✓ iii. 1 less.

✓ iv. Add 9, to make $(x + 5)^2$.

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8 A pattern with cubes

ANSWER A · 4

i. $x^3 - x^2 + x + x^2 - x + 1 = \mathbf{x^3 + 1}$.

ii. $x^3 + x^2 + x - x^2 - x - 1 = \mathbf{x^3 - 1}$.

iii. $\mathbf{11 \times 91 = 1001}$ and $\mathbf{9 \times 111 = 999}$.

iv. $21 \times 381 = (20 + 1)(20^2 - 20 + 1) = 20^3 + 1 = \mathbf{8{,}001}$.

MARKING SCHEME

✓ i. $x^3 + 1$.

✓ ii. $x^3 - 1$.

✓ iii. 1,001 and 999.

✓ iv. 8,001.

9 Make your own

ANSWER A · 3

For example:

i. $(x + 4)(x - 4) = x^2 - 16$: the products $-4x$ and $4x$ cancel.

ii. Multiply $x + 2$ by any binomial: $(x + 2)(x + 5) = x^2 + 7x + 10$.

iii. $(x + 6)^2 = x^2 + 12x + 36$, or $(2x + 3)^2 = 4x^2 + 12x + 9$.

Any correct answers are right.

MARKING SCHEME

✓ i. A product with no x term.

✓ ii. A trinomial made by multiplying by $x + 2$.

✓ iii. A square with middle term $12x$.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	4	23	8	**35**

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