## Higher Check In - 6.01 Algebraic expressions

1. Simplify $2x^2 + 3xy + 4x^2 - yx$.

2. Factorise $3x^2 - 12$.

3. Multiply out the brackets and simplify $4(3 - 2x) - 2(x - 3)^2$.

4. Simplify $5x^{-2}y^{\frac{1}{3}} \times 3x^4 y$.

5. Expand the brackets and simplify $(2x + 3)(3x - 1)(x + 2)$.

6. Show that $\dfrac{x^2 + 2x}{x^2 + x - 2} + \dfrac{x}{x - 1} \equiv \dfrac{2x}{x - 1}$.

7. Sue says that the area of the trapezium can be given by the expression $x^2 + 6x + 8$.
   Ambia says that the area can be written as $(x + 3)^2 - 1$. Show that both Sue and Ambia are correct.
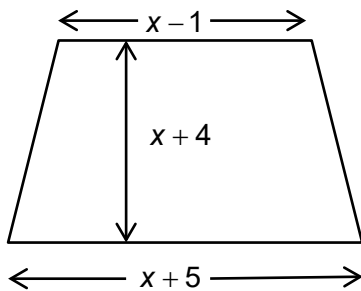
8. Explain, using algebra, why the sum of two consecutive odd numbers is always even.

9. The area of the rectangle below is given by the expression $2x^2 + 13x - 24$ cm².
   The width is given by $2x - 3$ cm². Write an expression for the length.

$2x - 3$ cm²

10. A particle travels $(x + 3)$ m at a speed of 2 m/s and $(x - 5)$ m at a speed of 3 m/s.
    Write a simplified expression for the total time taken.

Extension

Match each quadratic expression with its factorised form and completed square form. There is one blank space in each column for you to fill in the missing expression to complete each set.

$x^2 + 13x + 36$	$(x-11)(x-7)$	$(x-3)^2 - 36$
$x^2 - 14x - 32$	$(x+6)(x+8)$	$(x-8)^2 - 36$
$x^2 - 18x + 77$	$(x+2)(x+6)$	$\left(x+\dfrac{5}{2}\right)^2 - \dfrac{289}{4}$
$x^2 - 3x - 28$	$(x+7)(x-12)$	
$x^2 + 14x + 48$	$(x+9)(x+4)$	$(x+4)^2 - 4$
$x^2 + 5x - 66$	$(x-2)(x-14)$	$(x-7)^2 - 81$
	$(x+3)(x-9)$	$\left(x-\dfrac{3}{2}\right)^2 - \dfrac{121}{4}$
$x^2 - 6x - 27$	$(x-7)(x+4)$	$\left(x+\dfrac{13}{2}\right)^2 - \dfrac{25}{4}$
$x^2 - 16x + 28$	$(x-16)(x+2)$	$(x+7)^2 - 1$
$x^2 - 5x - 84$		$(x-9)^2 - 4$

Answers

1. $6x^2 + 2xy$

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

3. $-2x^2 + 4x - 6$

4. $15x^2 y^{\frac{4}{3}}$

5. $6x^3 + 19x^2 + 11x - 6$

6. $\dfrac{x(x+2)}{(x+2)(x-1)} + \dfrac{x}{x-1} \equiv \dfrac{x}{x-1} + \dfrac{x}{x-1}$

   $$\equiv \dfrac{2x}{x-1}$$

7. Area of a trapezium is given by the formula $A = \dfrac{1}{2}(a+b)h$

   so the area is given by $A = \dfrac{1}{2}(x+5+x-1)(x+4) = \dfrac{1}{2}(2x+4)(x+4)$

   $$= (x+2)(x+4)$$
   $$= x^2 + 6x + 8$$

   After completing the square, this can also be written as $(x+3)^2 - 1$ so both Sue and Ambia are correct.

8. Two consecutive odd numbers can be denoted by $2n+1$ and $2n+3$.

   $2n + 1 + 2n + 3 = 4n + 4$

   This can be factorised to give $4(n+1)$ which will be a multiple of 4 for any whole number *n*.

9. $x + 8$ cm

10. $\dfrac{x+3}{2} + \dfrac{x-5}{3} = \dfrac{3(x+3)+2(x-5)}{6} = \dfrac{5x-1}{6}$ seconds

Extension

$x^2 + 13x + 36$	$(x+9)(x+4)$	$\left(x + \dfrac{13}{2}\right)^2 - \dfrac{25}{4}$
$x^2 - 14x - 32$	$(x-16)(x+2)$	$(x-7)^2 - 81$
$x^2 - 18x + 77$	$(x-11)(x-7)$	$(x-9)^2 - 4$
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$x^2 + 14x + 48$	$(x+6)(x+8)$	$(x+7)^2 - 1$
$x^2 + 5x - 66$	$(x+11)(x-6)$	$\left(x + \dfrac{5}{2}\right)^2 - \dfrac{289}{4}$
$x^2 + 8x + 12$	$(x+2)(x+6)$	$(x+4)^2 - 4$
$x^2 - 6x - 27$	$(x+3)(x-9)$	$(x-3)^2 - 36$
$x^2 - 16x + 28$	$(x-2)(x-14)$	$(x-8)^2 - 36$
$x^2 - 5x - 84$	$(x+7)(x-12)$	$\left(x - \dfrac{5}{2}\right)^2 - \dfrac{361}{4}$

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AO1	1	Simplify an algebraic expression			
AO1	2	Factorise a quadratic expression			
AO1	3	Expand brackets and collect like terms			
AO1	4	Simplify a product of two algebraic expressions involving indices			
AO1	5	Expand three brackets and simplify			
AO2	6	Add two algebraic fractions and simplify			
AO2	7	Translate a word problem into two equivalent expressions for area by expanding brackets and completing the square			
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