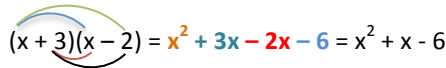
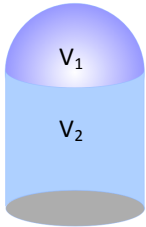


# National 5 Learning Checklist – Expressions & Formulae

Topic	Skills	Extra Study / Notes			
<b>Rounding</b>					
Round to decimal places	e.g. 25.1241 → 25.1 <i>to 1 d.p.</i> 34.676 → 34.68 <i>to 2 d.p.</i>				
Round to Significant Figures	e.g. 1276 → 1300 <i>to 2 sig. figs.</i> 0.06356 → 0.064 <i>to 2 sig. figs.</i> 37,684 → 37,700 <i>to 3 sig. figs.</i> 0.005832 → 0.00583 <i>to 3 sig. figs.</i>				
<b>Surds</b>					
Simplifying	Learn Square Numbers: 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169. Use square numbers as factors: e.g. $\sqrt{50} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$				
Add/Subtract	e.g. $\sqrt{50} + \sqrt{8} = \sqrt{25} \times \sqrt{2} + \sqrt{4} \times \sqrt{2} = 5\sqrt{2} + 2\sqrt{2} = 7\sqrt{2}$				
Multiply/Divide	e.g. $\sqrt{5} \times \sqrt{15} = \sqrt{5 \times 15} = \sqrt{75} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$ $\frac{\sqrt{48}}{\sqrt{3}} = \sqrt{\frac{48}{3}} = \sqrt{16} = 4$				
Rationalise Denominator	Remove surd from denominator. e.g. $\frac{1}{\sqrt{3}} = \frac{1 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{\sqrt{3}}{\sqrt{9}} = \frac{\sqrt{3}}{3}$				
<b>Indices</b>					
Use Laws of Indices	1. $a^x \times a^y = a^{x+y}$ e.g. $a^2 \times a^3 = a^{2+3} = a^5$ 2. $a^x \div a^y = a^{x-y}$ $a^7 \div a^4 = a^{7-4} = a^3$ 3. $(a^x)^y = a^{xy}$ $(a^4)^5 = a^{4 \times 5} = a^{20}$ 4. $\frac{1}{a^x} = a^{-x}$ $\frac{1}{a^3} = a^{-3}$ 5. $a^0 = 1$ $a^0 = 1$				
Scientific Notation / Standard Form	The first number is always between 1 and 10. e.g. 54,600 = $5.46 \times 10^4$ 0.000978 = $9.78 \times 10^{-4}$ $(1.3 \times 10^5) \times (8 \times 10^3) = 10.4 \times 10^8 = 1.04 \times 10^9$				
Evaluate using indices	e.g. $27^{\frac{2}{3}} = \sqrt[3]{27^2} = 3^2 = 9$				
<b>Algebra</b>					
Expand Single Bracket	$3(x + 4) = 3x + 12$				
Expand Two Brackets	Use <b>FOIL</b> (Firsts Outsides Insides Lasts) or another suitable method  $(x + 3)(x - 2) = x^2 + 3x - 2x - 6 = x^2 + x - 6$				
	Know that every term in the first bracket must multiply every term in the second. e.g. $(x + 2)(x^2 - 3x - 4) = x^3 - 3x^2 - 4x + 2x^2 - 6x - 8 = x^3 - x^2 - 10x - 8$				
Simplify Expression	Put together the terms that are the same: e.g. $x^2 + 4x + 3 - 2x + 8 = x^2 + 2x + 11$ $a \times a \times a = a^3$				
Factorise – Common Factor	Take the factors each term has in common outside the bracket: e.g. $4x^2 + 8x = 4x(x + 2)$ <b>NB:</b> Always look for a common factor first.				

Algebra Contd.					
Factorise – Difference of Two Squares	Always takes the same form, one square number take away another. Easy to factorise: e.g. $x^2 - 9 = (x + 3)(x - 3)$ $5x^2 - 125 = 5(x^2 - 25)$ (Common factor first) $= 5(x + 5)(x - 5)$				
Factorise – Trinomial (simple)	Use any appropriate method to factorise: e.g. Opposite of FOIL: • Factors of first term are <b>F</b> irsts in brackets. • <b>L</b> asts multiply to give last term and add to give middle term. $x^2 - x - 6 = (x - 3)(x + 2)$				
Factorise – Trinomial (hard)	This is more difficult. Use suitable method. Using opposite of FOIL above with trial and error. <b>NB:</b> The Outsides add Insides give a check of the correct answer: e.g. $3x^2 - 13x - 10$ $= (3x - 5)(x + 2)$ Check: $3x \times 2 + (-5) \times x = 6x - 5x = -x$ ✗ $= (3x + 2)(x - 5)$ Check: $3x \times (-5) + 2 \times x = -15x + 2x = -13x$ ✓ If the answer is wrong, score out and try alternative factors or positions. Keep a note of the factors you have tried.				
Complete the Square	e.g. $x^2 + 8x - 13 = (x + 4)^2 - 13 - 16 = (x + 4)^2 - 29$				
Algebraic Fractions					
Simplifying Algebraic Fractions	<b>Step 1:</b> Factorise expression <b>Step 2:</b> Look for common factors. <b>Step 3:</b> Cancel and simplify $\frac{6x^2 - 12x}{x^2 + x - 6} = \frac{6x(x-2)}{(x+3)(x-2)} = \frac{6x}{x+3}$				
Add and Subtract Fractions	Find a common denominator. This can be done either by working out the lowest common denominator, or by using <b>Smile</b> and <b>Kiss</b> $\frac{5a}{b} + \frac{3d}{2c} = \frac{10ac}{2bc} + \frac{12bd}{2bc} = \frac{10ac + 12bd}{2bc} = \frac{5ac + 6bd}{bc}$				
Multiply Fractions	Multiply top with top, bottom with bottom: $\frac{3a}{7c} \times \frac{4b}{5d} = \frac{12ab}{35cd}$				
Divide Fractions	Invert second fraction and multiply: $\frac{6x^2}{7y} \div \frac{4x}{3z} = \frac{6x^2}{7y} \times \frac{3z}{4x} = \frac{18x^2z}{28xy} = \frac{2xz}{14y}$				
Volumes					
Volume of a prism	$V = \text{Area of base} \times \text{height}$				
Volume of a cylinder	$V = \pi r^2 h$				
Volume of a cone	$V = \frac{1}{3} \pi r^2 h$				
Volume of a sphere	$V = \frac{4}{3} \pi r^3$				
Rearrange each of the formulae to find an unknown	e.g. Cylinder has volume $400\text{cm}^3$ and radius 6cm, find the height $V = \pi r^2 h$ $h = \frac{400}{\pi \times 6^2}$ $\frac{V}{\pi r^2} = h$ $h = \dots$				

Volumes Contd.				
Volume of composite shapes	<p>These are two of the above combined: Label them <math>V_1</math> and <math>V_2</math></p> <p>e.g.</p>  <p> <math>V_1 = \frac{4}{3}\pi r^3 \div 2</math>  <math>V_1 = \dots</math>  <math>V_2 = \pi r^2 h</math>  <math>V_2 = \dots</math> </p>			
Gradient				
Find the gradient of a line joining two points	<p>Know that gradient is represented by the letter <b><math>m</math></b></p> <p><b>Step 1:</b> Select two coordinates</p> <p><b>Step 2:</b> Label them <math>(x_1, y_1)</math> <math>(x_2, y_2)</math></p> <p><b>Step 3:</b> Substitute them into gradient formula</p> <p>e.g. <math>(-4, 4), (12, -28)</math></p> $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(-28) - 4}{12 - (-4)} = \frac{-32}{16} = -2$			
Circles				
Length of Arc	<p>This finds the length of the arc of a sector of a circle:</p> $LOA = \frac{angle}{360} \times \pi d \quad \text{or} \quad \frac{LOA}{\pi d} = \frac{angle}{360}$ <p>For harder questions rearrange formula to find angle</p>			
Area of Sector	$AOS = \frac{angle}{360} \times \pi r^2 \quad \text{or} \quad \frac{AOS}{\pi r^2} = \frac{angle}{360}$ <p>For harder questions rearrange formula to find angle</p>			