



## TRIPLE BRACKETS

### EXPANDING

## NO CALCULATOR

Ref: G233. **1R1**

<b>A1</b> Expand and simplify $x(x + 2)(x + 3)$	<b>A2</b> Expand and simplify $(x + 1)(x + 3)(x - 4)$	<b>A3</b> Expand and simplify $(x + 3)(x - 4)(x - 2)$
<b>B1</b> Expand and simplify $(x + 4)^3$	<b>B2</b> Expand and simplify $(x + 5)^2(x + 3)$	<b>B3</b> Expand and simplify $(x - 3)(x - 1)^2$
<b>C1</b> Expand and simplify $(2x + 1)(x + 2)(x + 3)$	<b>C2</b> Expand and simplify $(3x - 1)(x + 3)(x - 3)$	<b>C3</b> Expand and simplify $(2x - 3)^2(4 - x)$
<b>D1</b> If $(x + k)^2(x + 2) = x^3 + 14x^2 + 60x + 72$ Find the value of $k$ .	<b>D2</b> If $(x + p)(x + q)(x + 5) = x^3 + 8x^2 - 3x - 90$ Find the values of $p$ and $q$ .	<b>D3</b> If $(ax + b)^2(x + c) = 4x^3 + dx^2 - 55x - 100$ Find the values of the integers $a$ , $b$ , $c$ and $d$ .



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<p><b>A1</b> Expand and simplify</p> $x(x+2)(x+3) = x[x^2 + 5x + 6]$ $= x^3 + 5x^2 + 6x$	<p><b>A2</b> Expand and simplify</p> $(x+1)(x+3)(x-4)$ $= (x+1)[x^2 - x - 12]$ $= x^3 - x^2 - 12x + x^2 - x - 12$ $= x^3 - 13x - 12$	<p><b>A3</b> Expand and simplify</p> $(x+3)(x-4)(x-2)$ $= (x+3)[x^2 - 6x + 8]$ $= x^3 - 6x^2 + 8x + 3x^2 - 18x + 24$ $= x^3 - 3x^2 - 10x + 24$
<p><b>B1</b> Expand and simplify</p> $(x+4)^3 = (x+4)[x^2 + 8x + 16]$ $= x^3 + 8x^2 + 16x + 4x^2 + 32x + 64$ $= x^3 + 12x^2 + 48x + 64$	<p><b>B2</b> Expand and simplify</p> $(x+5)^2(x+3)$ $= [x^2 + 10x + 25](x+3)$ $= x^3 + 10x^2 + 25x + 3x^2 + 30x + 75$ $= x^3 + 13x^2 + 55x + 75$	<p><b>B3</b> Expand and simplify</p> $(x-3)(x-1)^2 = (x-3)[x^2 - 2x + 1]$ $= x^3 - 2x^2 + x - 3x^2 + 6x - 3$ $= x^3 - 5x^2 + 7x - 3$
<p><b>C1</b> Expand and simplify</p> $(2x+1)(x+2)(x+3)$ $= (2x+1)[x^2 + 5x + 6]$ $= 2x^3 + 10x^2 + 12x + x^2 + 5x + 6$ $= 2x^3 + 11x^2 + 17x + 6$	<p><b>C2</b> Expand and simplify</p> $(3x-1)(x+3)(x-3) = (3x-1)[x^2 - 9]$ $= 3x^3 - 27x - x^2 + 9$ $= 3x^3 - x^2 - 27x + 9$	<p><b>C3</b> Expand and simplify</p> $(2x-3)^2(4-x)$ $= [4x^2 - 12x + 9](4-x)$ $= 16x^2 - 48x + 36 - 4x^3 + 12x^2 - 9x$ $= -4x^3 + 28x^2 - 57x + 36$
<p><b>D1</b> If</p> $(x+k)^2(x+2) = x^3 + 14x^2 + 60x + 72$ <p>Multiplying the last terms of each bracket gives <math>2k^2</math>, so</p> $2k^2 = 72$ $\Rightarrow k = 6$	<p><b>D2</b> If</p> $(x+p)(x+q)(x+5) = x^3 + 8x^2 - 3x - 90$ <p>Expanding and comparing coefficients gives</p> $5pq = -90 \quad p+q+5 = 8$ <p>So <math>p = 6 \quad q = -3</math> (or swap <math>p</math> and <math>q</math>)</p>	<p><b>D3</b> If</p> $(ax+b)^2(x+c) = 4x^3 + dx^2 - 55x - 100$ <p>Expand and compare coefficients, then work out in the order of <math>a, b, c</math> and then <math>d</math></p> $a = 2, b = 5, c = -4, d = 4$