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JC MATHEMATICS (H2) STUDY TIPS

STRATEGIC FRACTIONAL
FACTORIZATION IN SIGMA
NOTATION SIMPLIFICATION

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JC_H2Maths_042



Quick Practice

Without using GC, evaluate $2 \times 4 + 3 \times 5 + 4 \times 6 + \dots + 18 \times 20$.

$$\begin{aligned}
 &= \sum_{r=1}^{17} (r+1)(r+3) \\
 &= \sum_{r=1}^{17} (r^2 + 4r + 3) \\
 &= \sum_{r=1}^{17} r^2 + 4 \sum_{r=1}^{17} r + 17(3) \quad \sum r = \frac{n(n+1)}{2} \\
 &= \frac{1}{6}(17)(18)(34+1) + 4 \left(\frac{1}{2} \right) (17)(17+1) + 51 \\
 &= 2448 \quad \sum r^2 = \frac{1}{6}n(n+1)(2n+1)
 \end{aligned}$$

Example 3

Simplify $\sum_{r=1}^n r(4-9r)$.

$$\begin{aligned}
 &= \sum_{r=1}^n (4r - 9r^2) \\
 &= 4 \sum_{r=1}^n r - 9 \sum_{r=1}^n r^2 \\
 &= 4 \left(\frac{1}{2} \right) n(n+1) - 9 \left(\frac{1}{6} \right) n(n+1)(2n+1) \\
 * &= \frac{1}{2} n(n+1) [4 - 3(2n+1)] \\
 &= \frac{1}{2} n(n+1)(1-6n)
 \end{aligned}$$



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Explanation

In general algebraic simplification of series, a key strategy during factorization is pulling out a strategic common fractional factor alongside the common algebraic terms.

When a sum involves multiple terms with different denominators, factoring out the greatest common fraction or the lowest common multiple of the denominators clears all fractions from the remaining expression.

This ensures that the terms left inside the final bracket contain only whole-number coefficients.

Removing fractional parts from the bracket early on prevents messy fractional arithmetic during the final expansion and leaves a highly polished, factored result.

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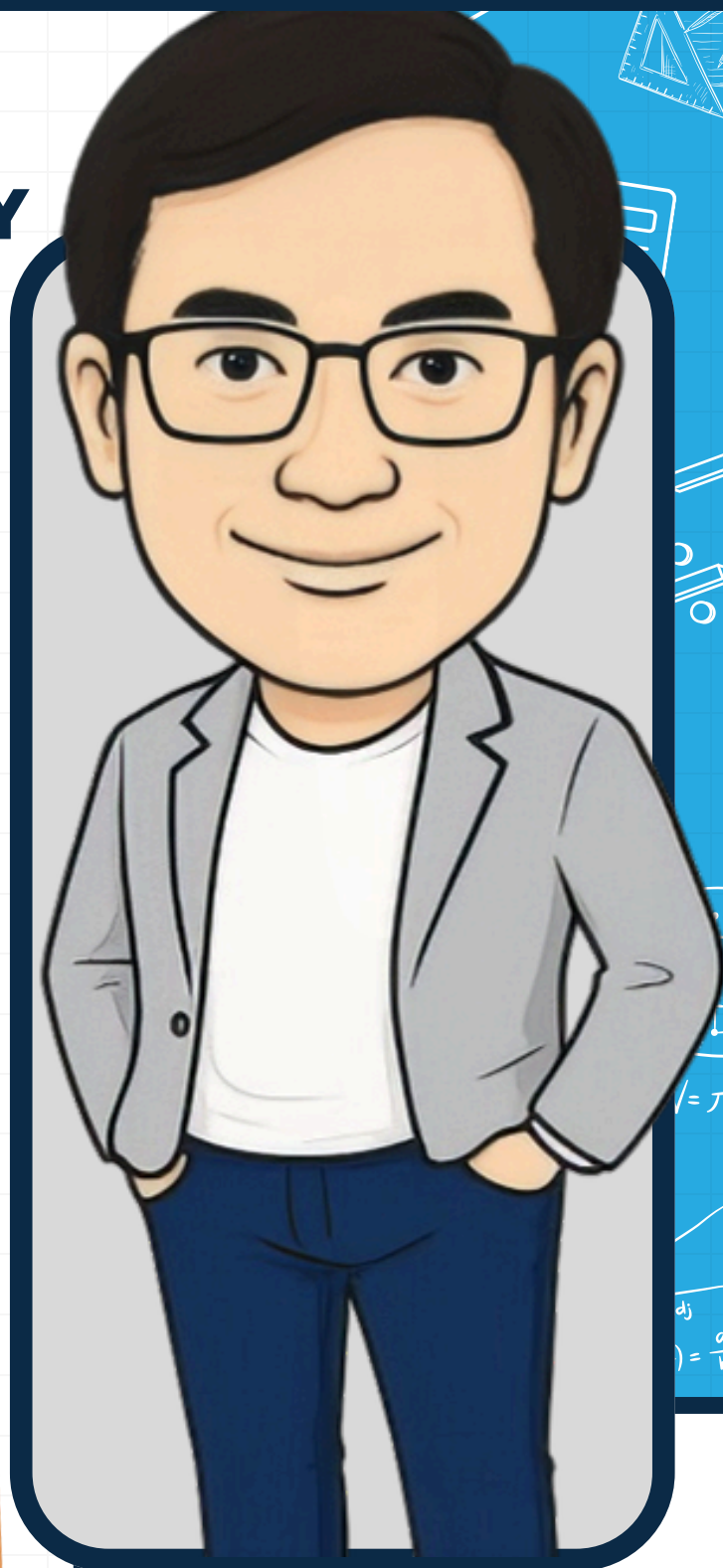
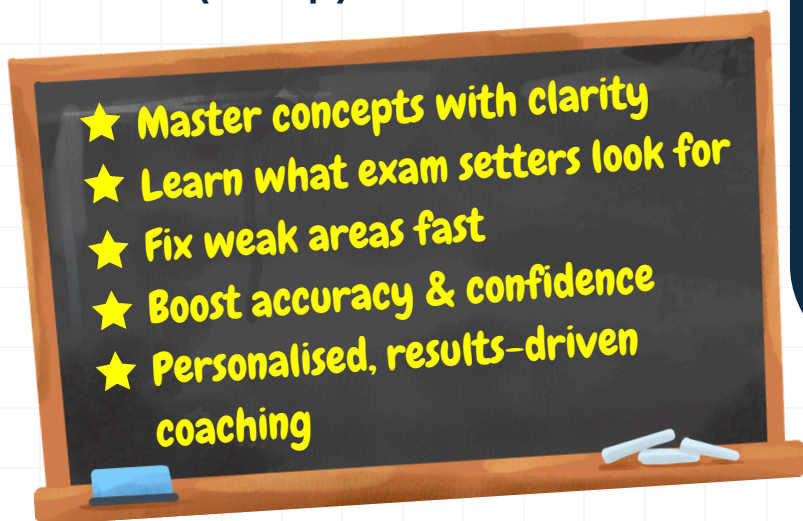
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