Algebra 13 — Long Division

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ON THE LCHL PAST PAPERS · 2025 P1 Q1(c) (main sitting, 10 marks) · 2025 P1 Q3(c) (deferred, 10 marks) · 2024 P1 Q6(a) (main sitting, 8 marks) · 2024 P1 Q7(b)(ii) (deferred, 8 marks) · 2023 P1 Q1(c) (main sitting, 10 marks)

How to use this sheet: these are the exact questions worked in this tutorial, in order. Try each one yourself first — the time it is posed in the video is shown, so you can pause before Paul solves it. Final answers are at the back; the full method is in the video.

Worked examples (in the video)

Example 1. $x^3 + 6x^2 + kx + 6 = 0$, given $(x + 2)$ is a factor — find k, by root-substitution AND by long division *(worked 00:14–08:16)*.

Example 2. $x^2 + ax + b$ is a factor of $x^3 + qx^2 + Rx + s = 0$ — prove $R - b = a(q - a)$ and $s = b(q - a)$ *(worked 08:25–18:01)*.

Questions

Q1. $(x-2)$ is a factor of $2x^3 + x^2 + kx + 6 = 0$. Find k.

Posed at 18:09 in the tutorial.

Q2. $x^2 - 2tx + t^2 isafactorofx^3 + 3px + c = 0$. Prove $p = -t^2$ and $c = 2t^3$.

Posed at 18:09 in the tutorial.

Q3. $x^2 - px + qisafactorofx^3 + 3px^2 + 3qx + R = 0$. Show $q = -2p^2$ and $R = -8p^3$.

Posed at 18:09 in the tutorial.

Q4. $x^2 - px + 1isafactorofax^3 + bx + c = 0$ $(a \neq 0)$. Show $c^2 = a(a-b)$.

Posed at 18:09 (board) / 19:14 (worded) in the tutorial.

Answers

Final answers only — pause the video and check yourself; the worked method is in the tutorial.

Example 1. k = 11 (both methods)

Example 2. Full proof — watch the tutorial for the complete write-up.

Q1. $k = -13$

Q2. as stated

Q3. as stated

Q4. as stated

Overlaps with these tutorials

Algebra 11 — Solving Cubic Equations. Introduces long division gently; this video is the deep end (letter coefficients, quadratic divisors). Do Algebra 11 first.

Algebra 12 — Nature of Cubic Roots. Uses this division pipeline as one step in a larger argument.

Algebra 14 — Manipulation of Formula. The same multi-step manipulation discipline; the substitution technique reappears there.