# Algebra 23 — Iterative Equations

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**How to use this worksheet:** 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.

## Formula used

$$3^{n+1} = 3 \cdot 3^{n}$$

*The first rule of powers, page 21 of the log tables — the engine for splitting shifted terms like U(n+1) into multiples of $3^n$ and $2^n$.*

## Worked examples (in the video)

**Example 1.** $U_n = 2\cdot 3^n - 5\cdot 2^n$ — verify $U_3 - 5U_2 + 6U_1 = 0$, then the general recurrence *(worked 00:00–11:15)*.

**Example 2.** $U_{n+2} = U_{n+1} - 3U_n$, find $U_6$ given $U_1 = -2$, $U_2 = -4$ *(worked 11:36–17:56)*.

## Questions

**Q1.** $U_n = 600 \cdot 2^n - 7 \cdot 5^n$. Verify that $U_{n+2} - 7 \cdot U_{n+1} + 10 \cdot U_n = 0$.

*Posed at 18:05 in the tutorial.*

**Q2.** $U_n = (n - 20) \cdot 2^n$. Verify that $U_{n+2} - 4 \cdot U_{n+1} + 4 \cdot U_n = 0$.

*Posed at 18:05 in the tutorial.*

**Q3.** $U_{n+2} = 2 \cdot \frac{U_n}{U_{n+1}}$, with $U_1 = 8, U_2 = -4$. Find $U_5$.

*Posed at 18:05 in the tutorial.*

## Answers

*You can find the final answers to these questions below — pause the video and check yourself; the worked method is in the tutorial.*

**Example 1.** All three parts verify — full working in the video

**Example 2.** $U_6 = -34$

**Q1.** $0 = 0$ ✓ TRUE

**Q2.** $0 = 0$ ✓ TRUE

**Q3.** $U_5 = -4$

## Overlaps with these tutorials

**Algebra 21 — Binomial Theorem.** The T(r+1) indexing convention is the same notational mindset as $U_{n+1}$ here.

**Algebra 22 — Abstract Inequalities.** 'Verify that' questions reuse its proof template: manipulate until a known truth appears.

**Sequences and Series — recurrence relations.** Iterative equations are the algebra-strand preview of that strand's main machinery.