Quadratic Equations, Part 2: Weekly Planning for Teachers (Online)

Chapter 13, Quadratic Equations, Part 2 · November 2026 · draft for review · all three weeks written

How the chapter runs

This plan covers Chapter 13, Quadratic Equations, Part 2, taught online after Chapter 12 (Chapter 11 is not part of this course: the lessons work without it): 13-year-olds with five maths lessons a week of about 55 minutes, each student working on a device in the course pages. It takes 3 weeks (15 lessons): 11 teaching lessons (the quadratic formula over two days), a mixed-practice day, a chapter review, the chapter check and a buffer lesson.

In Chapter 10, quadratics were solved by factoring. Most don't factor. In this chapter students solve every quadratic by completing the square: add the right number to both sides, and the quadratic becomes a perfect square, which is easy to undo. Done once and for all, completing the square gives the quadratic formula. The discriminant, $b^2 - 4ac$, tells the kind of roots before solving; the sum and product of the roots, and conjugate roots, answer questions without solving at all.

Every day is a normal lesson. Monday to Friday, each lesson teaches one skill with the same 55-minute plan. The skill's mastery check is the last part of that lesson, and the page marks it straight away.

Below the pass mark is "not yet", never a fail. The student practises that skill again, then retakes the check with new questions at the end of a later lesson. The review day and the buffer lesson have time for retakes built in.

Two routes. The mandatory route is 10 skills for every student; the chapter is mastered when all of them are. The advanced route has five optional skills (perfect squares when the coefficient of x^2 isn't 1, the smallest value of a quadratic, complex coefficients, more from the roots, and substitutions), proposed and not written yet.

Week	Focus	Lessons
1	Completing the square	QF01, QF02, QF03, QF04, QF05
2	The quadratic formula	QF06, MX25, QF07, QF08
3	Conjugate roots, fractions, review and the chapter check	QF09, QF10, MX26, CH13, BUF13

Numbering. Skills are numbered QF01 to QF15 (the quadratic formula and completing the square); CN stays Chapter 12, QE Chapter 10, IN Chapter 9, LE Chapter 3 and EX Chapter 2. The mixed-practice day is MX25 and the chapter review MX26, after Chapter 12's MX24; the chapter check is CH13 and the buffer lesson BUF13.

Answers. Answers are typed. The roots of an equation go in one box, in any order, with ± where it fits: $-3 \pm 2\sqrt{3}$, $(5 \pm \sqrt{17})/4$, $-1 \pm 2i\sqrt{3}$, or 8, -12 (the ±, √ and i keys are under the box, with a "Reads as" preview). Any equal form of a root is right: $-2 \pm \sqrt{(11/3)}$ and $-2 \pm \sqrt{33}/3$ both count, since the course does not teach rationalising. On Friday of week 1 (Tidy the Roots) the tidy form is the goal: no square factor under a root, and no factor shared by every term and the bottom. The box names the usual mistakes on its own: the i dropped, one root of a pair, the number in the bracket with the wrong sign or not moved across.

The book. The lessons follow the book's sections in order, with one lesson of the course's own, Tidy the Roots (Friday of week 1). One worked answer in the book is wrong: on p. 371 the double root of Problem 13.11 is 12/5, not −12/5. From the starred Section 13.4, conjugate roots and fractions that hide a quadratic are part of the mandatory route, because the review problems need them.

What you do

- In each lesson: lead the Learn part with the class, then walk round while students practise. There is nothing to prepare, print or mark.

- After each lesson, five minutes in the class view: who is “not yet” on today’s check, and the mistakes each student makes most often (see The class view after each lesson).
- Use what you see there in the next lesson’s warm-up.

A normal lesson

Every lesson, Monday to Friday, follows the same four parts, so students know what to expect and you never plan from scratch.

Minutes	Part	Students	You
0 to 8	Warm-up	Answer one or two quick questions on earlier skills, in the page	Read the answers out in a minute. Add the mistake the class view showed most often yesterday, if there was one
8 to 20	Learn	Open the day’s lesson and follow it together: the narrated video (a minute or two), the explanation, and the activity (step-by-step problems: what goes on both sides, which sign goes in the bracket, which number to divide by)	Lead it from the front on your own screen. Ask “what is i^2 here?” and “is it written as a + bi yet?” more than “what is the answer?”
20 to 45	Practise	Work through the practice, easiest first. Each answer gets instant feedback that names the mistake. Hints are there when stuck. Students who finish early do the two extra exercises	Walk round. Look for the mistakes listed in the day’s plan and stop the class if you see one several times
45 to 55	Exit	If the skill finishes today: its mastery check (about 10 minutes), plus any retakes. Otherwise: redo, without hints, the hardest practice question they got right	Make sure everyone submits before the bell. The page marks the checks and gives every student different questions

A student who finishes the practice early may take the mastery check before the Exit.

Mastery checks and retakes

1. **Check at the end of the skill.** On the day a skill finishes, its mastery check takes the last 10 minutes of the lesson. The page builds a new set of questions for every student and every attempt, so there is nothing to copy.
2. **The page marks it.** Students see their score, which rows they missed and why, straight away. A row counts only when it is exactly right and finished. The result appears in the class view at the same moment.
3. **Below the pass mark: “not yet”.** The student practises that skill again (the lesson’s practice and its extra exercises), then retakes the check at the end of a later lesson, with new questions. The review day (Wednesday of week 2) ends with retakes, and in week 2 every check of the chapter can be retaken on the week 2 page.
4. **The chapter check has no pass mark.** On Thursday of week 3 it shows, skill by skill, what each student still knows. Every skill a student misses goes on their review list for Friday’s buffer lesson.

Some students cannot get online at home. Let them practise and retake in a lunchtime or after-school session on the school’s devices.

The three weeks

Week 1: Completing the square

Monday students undo the square of a binomial: $(z + 3)^2 = 12$ gives $z + 3 = \pm 2\sqrt{3}$, so $z = -3 \pm 2\sqrt{3}$, and a negative square gives imaginary roots. Tuesday they make $x^2 + bx$ a perfect square by adding $(b/2)^2$, with odd and fraction coefficients. Wednesday they put the two together to solve any quadratic by completing the square (the video shows al-Khwarizmi's picture of it). Thursday the coefficient of x^2 isn't 1: divide by it first, or factor it out and remember it. Friday they tidy roots: square factors out of a root, the i out of the root of a negative number, and every term divided. Five skills, five mastery checks.

Day	Lesson	Warm-up	Exit	Watch for
Mon	QF01 Undo the square "Undo the Square"	plus or minus: $x^2 = k$ (QE02, Chapter 10); square roots of negative numbers (CN02, an earlier chapter); multiply two binomials (QE04, Chapter 10)	QF01 check (4 of 5)	Expanding the square first, which gives a quadratic that doesn't factor: $(z + 3)^2 - 12 = 0$ becomes $z^2 + 6z - 3 = 0$. Keeping only the positive square root: $z + 3 = 2\sqrt{3}$, so $z = -3 + 2\sqrt{3}$ only
Tue	QF02 Make a perfect square "Make a Perfect Square"	multiply two binomials (QE04, Chapter 10); fractions, decimals & reciprocals (PRE02, earlier work); QF01	QF02 check (5 of 6)	Adding half the coefficient instead of its square: $x^2 + 6x + 3$. Squaring the whole coefficient instead of half of it: $x^2 + 6x + 36$
Wed	QF03 Complete the square "Complete the Square"	QF02; QF01	QF03 check (4 of 5)	Adding $(b/2)^2$ to one side only. Writing $x^2 + bx$ as $(x + b/2)^2$ without adding $(b/2)^2$: $x^2 + 2x - 7 = 0$ becomes $(x + 1)^2 = 7$
Thu	QF04 Complete the square when a isn't 1 "When a Isn't 1"	tidy up first; double roots and missing terms (QE06, Chapter 10); fractions, decimals & reciprocals (PRE02, earlier work); QF03	QF04 check (3 of 4)	Completing the square while x^2 still has a coefficient: $3x^2 + 12x + 36$. Dividing only some terms by the coefficient of x^2: $3x^2 + 12x + 1 = 0$ becomes $x^2 + 4x + 1 = 0$
Fri	QF05 Tidy the roots "Tidy the Roots"	simplify an algebraic fraction (EX13, Chapter 2); QF04	QF05 check (5 of 6)	Leaving a square factor under the root, or taking out the wrong one: $\sqrt{12}$ left as it is, or written $4\sqrt{3}$ or $3\sqrt{2}$. Dividing only the first term by the bottom: $(-4 \pm 2\sqrt{5})/2 = -2 \pm 2\sqrt{5}$

Week 2: The quadratic formula

Monday and Tuesday the quadratic formula, from completing the square once and for all, for whole, irrational, complex and double roots. Wednesday is mixed practice in choosing a method. Thursday the discriminant, $b^2 - 4ac$, tells the kind of roots without solving; Friday the sum and product of the roots, from the formula.

Day	Lesson	Warm-up	Exit	Watch for
Mon	QF06 The quadratic formula (part 1 of 2) “The Quadratic Formula”	meet the quadratic (QE01, Chapter 10); QF04	Hardest practice question (check on Tuesday, week 2)	Reading a, b and c before the equation is in standard form: c = 96 for $r^2 + 4r = 96$. Losing the sign of b: −b taken as −5 for $x^2 - 5x + 6$
Tue	QF06 The quadratic formula (part 2 of 2) “The Quadratic Formula”	QF05; QF06	QF06 check (4 of 5)	Reading a, b and c before the equation is in standard form: c = 96 for $r^2 + 4r = 96$. Losing the sign of b: −b taken as −5 for $x^2 - 5x + 6$
Wed	MX25 Mixed practice: which method? (QF01 to QF06: undo the square, factor, complete the square or the formula). Undo a square, factor, complete the square or use the formula? The formula works on every quadratic, but it isn’t always the quickest “Which Method?”	QF01; QF06	Hardest practice question; retakes	Reaching for the formula every time, even for $(x - 3)^2 = 7$ or $x^2 - 5x + 6 = 0$, and making slips a quicker method avoids
Thu	QF07 The discriminant “The Discriminant”	solve a linear inequality (IN06, Chapter 9); QF06	QF07 check (4 of 5)	Thinking a negative discriminant means no solution: it means no real solution, two complex ones. Judging the roots from the sign of b or c instead of from $b^2 - 4ac$
Fri	QF08 Sum and product, again “Sum and Product, Again”	use the roots without finding them (QE13, Chapter 10); QF06	QF08 check (3 of 4)	Taking the sum as b/a, without the minus sign. Forgetting to divide by a: the product of the roots of $6x^2 + cx + 4$ taken as 4

Week 3: Conjugate roots, fractions, review and the chapter check

Monday conjugate roots: a quadratic with real coefficients and a root that isn’t real has its conjugate as the other root, and one root gives the whole quadratic. Tuesday fractions that hide a quadratic. Then the review, the chapter check and the buffer lesson.

Day	Lesson	Warm-up	Exit	Watch for
Mon	QF09 Conjugate roots “Conjugate Roots”	conjugates and the distance from 0 (CN06, an earlier chapter); QF08	QF09 check (3 of 4)	Changing the sign of the real part too: the partner of 2 − 3i taken as −2 + 3i. Using the rule when the coefficients aren’t real (or, for √, aren’t rational)
Tue	QF10 Fractions that hide a quadratic “Fractions That Hide a Quadratic”	clear fractions with the LCD (LE12, Chapter 3); QF06	QF10 check (3 of 4)	Multiplying only some terms by the denominators: the right side (or one fraction) left as it was. Keeping a value that makes a denominator 0

Day	Lesson	Warm-up	Exit	Watch for
Wed	MX26 Chapter review (QF01 to QF10: every skill of the chapter). A review of the whole chapter in no particular order, like tomorrow's chapter check "Which Skill? Chapter Review"	QF01; QF07; QF08	Hardest practice question; retakes	Doing well when the skill is announced, but stalling or guessing when it is not
Thu	CH13 Chapter check: one or two questions from every mandatory skill, mixed (whole lesson)	None	None: the check is the whole lesson	Shows what each student still knows weeks later, skill by skill; it makes each student's review list for Friday
Fri	BUF13 Buffer lesson: warm-up, your review list from the chapter check, retakes	QF03; QF06; QF09	Retakes	Teach again any skill where many students missed the chapter check; then review lists and retakes

The lesson videos

Each teaching lesson opens its Learn part with a short narrated video; 11 videos in all. Every video has captions, a storyboard (one picture for each step, to print for students) and a teacher script (what to say and write on the board), so a class without screens can follow the same lesson. All of them are in Lesson videos on the course home.

Video	Title	Lesson	Length
QF01-V1	Undo the Square	Monday, week 1: Undo the Square	1:23
QF02-V1	Make a Perfect Square	Tuesday, week 1: Make a Perfect Square	1:20
QF03-V1	Complete the Square	Wednesday, week 1: Complete the Square	1:38
QF04-V1	When a Isn't 1	Thursday, week 1: When a Isn't 1	1:32
QF05-V1	Tidy the Roots	Friday, week 1: Tidy the Roots	1:20
QF06-V1	The Quadratic Formula	Monday, week 2: The Quadratic Formula	1:46
QF06-V2	Every Kind of Root	Tuesday, week 2: The Quadratic Formula	1:42
QF07-V1	The Discriminant	Thursday, week 2: The Discriminant	1:37
QF08-V1	Sum and Product, Again	Friday, week 2: Sum and Product, Again	1:30
QF09-V1	Conjugate Roots	Monday, week 3: Conjugate Roots	1:40
QF10-V1	Fractions That Hide a Quadratic	Tuesday, week 3: Fractions That Hide a Quadratic	1:42

The class view after each lesson

This replaces marking. Five minutes after each lesson, open the class view at the bottom of the week's page. It is shown to teachers who can edit the course, and lists every student's progress, lesson by lesson, live.

Look at	What it tells you	What to do
Who is "not yet" on today's check	Who needs to practise that skill again and retake	Next lesson, check that their retake happened
How many are "not yet"	Whether the skill landed	Half the class or more: teach it again the next day (see If the class is behind or ahead)

Look at	What it tells you	What to do
“Watch for”: each student’s most frequent mistakes	What the class misunderstood, by the mistake behind it	Put one question on it in the next warm-up
Last active, and students two or more lessons behind	Who is falling away from the class	Pair them with a classmate during practice

If the class is behind or ahead

Let the check results decide, not the calendar.

Behind. If half the class or more is “not yet” on a skill, teach it again the next day before moving on, and shift the plan by a day. The buffer lesson absorbs one day of delay; beyond that, shorten the chapter review (MX26) to half a lesson and keep the chapter check. The mastery checks never get cut. A student stuck on completing the square (QF03) usually needs the two halves of it again: making a perfect square (QF02), half then square, and undoing a square (QF01), ± then move the number. One stuck when a isn’t 1 (QF04) needs tidying a quadratic again (QE06, Chapter 10): divide every term. One stuck on tidying roots (QF05) needs the square numbers written out: 4, 9, 16, 25, 36, 49, 64, 81, 100.

Ahead. If most students pass first time, use the buffer lesson for the advanced skills, when they are written. A class that is clearly fast can run the review day as half a lesson.

Individual students. Nobody waits for the class and nobody is dragged along with it. A student who is behind practises and retakes with new questions; one who is ahead does the extra exercises and, when they are written, the advanced skills. If a student is two or more lessons behind, pair them with a classmate during practice.

Materials status for the pilot

This plan describes the full chapter online. All content is a draft waiting for review by the maths expert.

Material	Status
Skill graph for the chapter, with the mandatory and advanced routes	Ready
Week 1 to week 3 pages: 15 lessons (QF01, QF02, QF03, QF04, QF05, QF06P1, QF06P2, MX25, QF07, QF08, QF09, QF10, MX26, CH13, BUF13), each with warm-up, lesson, practice and its mastery check or exit question, and a class view	Ready (prototype)
11 lesson videos, one for each teaching lesson (the mixed practice and review days have none), each with captions, a storyboard and a teacher script	Ready (draft)
Practice sets: 32 more exercises for the four skills students find hardest (completing the square, completing the square when the coefficient of x^2 isn’t 1, the quadratic formula, and fractions that hide a quadratic), and seven exercise exemplars from the three weeks	Ready (draft)
Advanced skills QF11 to QF15	Proposed, not written yet
Catch-up practice set automatically as homework, with the retake opening once it is done	Designed, not built yet
Sign-in for a whole class through the school	Part of the production platform