Quadratic Equations, Part 1: Weekly Planning for Teachers (Online)

Chapter 10, Quadratic Equations, Part 1 · November 2026 · draft for review · all four weeks written

How the chapter runs

This plan covers Chapter 10, Quadratic Equations, Part 1, taught online after Chapter 9: 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 4 weeks (20 lessons): 15 teaching lessons (factoring $ax^2 + bx + c$ runs over two days), two mixed practice days, a review day, the chapter check and a buffer lesson at the end.

Until now the letter has never been squared. In this chapter it is. A quadratic equation can have two roots, one or none, and nearly everything rests on one fact: a product is 0 only when one of its factors is 0. Students write quadratics in standard form and check roots; solve $x^2 = k$ with both signs; multiply two binomials and undo it by factoring $x^2 + bx + c$ and $ax^2 + bx + c$; tidy an equation up before factoring; find which k makes a quadratic factor; solve word problems that lead to a quadratic; use the sum and product of the roots without finding them; and solve quadratics in disguise by a substitution. The book's optional section on equations with fractions and extraneous roots is on the advanced route. All units are metric, and money is in euros.

Every day is a normal lesson. Monday to Friday, each lesson teaches one skill (or half of a harder one) with the same 55-minute plan. When a skill is finished, its mastery check is the last part of that lesson. The page marks the check 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 mixed days and the buffer lesson have time for retakes built in.

Two routes. The mandatory route is 14 skills for every student; the chapter is mastered when all of them are. The advanced route has five optional skills (fractions with factors and extraneous roots, factoring with two letters, square roots in equations, three factors, and puzzles with roots and coefficients), proposed and still to be written. Quadratics in disguise (QE14) comes from the book's starred section but is mandatory: it is how the chapter's ideas are used again later.

Week	Focus	Lessons
1	Products that make zero	QE01, QE02, QE03, QE04, QE05
2	Factoring any quadratic	QE06, QE07, MX21, QE08
3	Which k, word problems, and the roots' sum and product	QE09, QE10, QE11, QE12, QE13
4	Disguises, review and the chapter check	QE14, MX22, MX23, CH10, BUF10

Numbering. Skills are numbered QE01 to QE19 (quadratic equations); IN stays Chapter 9, GL Chapter 8, PR Chapter 7, RP Chapter 6, SY Chapter 5, MV Chapter 4, LE Chapter 3 and EX Chapter 2. Mixed practice and review days are numbered MX21 to MX23, after Chapter 9's MX19 and MX20: they practise several skills at once and have no mastery check of their own, so they are not skills. CH10 is the chapter check and BUF10 the buffer lesson. The two days of QE08 are QE08P1 and QE08P2. Warm-up questions are numbered 901 and up, practice-set exercises 301 and up.

Answers. Answers are typed. The roots of an equation go in one box, in any order: 3, -5, or x = 3 or x = -5, ±4, ±2√5 (the ± and √ keys are under the box), or "no solution"; a double root may be typed once, and any equal form of a square root is right (√20 or 2√5). Expansions and factorizations are typed as expressions: x^2 + 6x - 40 (or with the ² key), (2y + 7)(y - 5). Wrong answers that match a common mistake are named: roots with the wrong signs, the root 0 lost by dividing by x, the negative square root forgotten, a root upside down (6 for 1/6), and brackets whose cross products don't give the middle term, each told what the brackets multiply to.

Metric units only. Where units appear they are metric: lengths in centimetres and areas in square centimetres (the book's boat problem, on the advanced route, is in km/h). Money is in euros, as in the earlier chapters. Real people in the book's problems are replaced by invented names.

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: standard form first, which two numbers, which bracket gives which root)	Lead it from the front on your own screen. Ask "is there 0 on one side?" and "how can you check that root?" 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 mixed practice and review days (Wednesday of week 2, Tuesday and Wednesday of week 4) end with retakes, and in week 4 every check of the chapter can be retaken on the week 4 page.
4. **The chapter check has no pass mark.** On Thursday of week 4 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 four weeks

Week 1: Products that make zero

Monday students meet the quadratic: standard form $ax^2 + bx + c = 0$, the sign that belongs to each coefficient, and checking a root by substituting it in brackets. Tuesday is $x^2 = k$: isolate x^2 first, then two roots, plus and minus, or no solution when k is negative. Wednesday is the key idea of the chapter: a product is 0 only when one of its factors is 0, so each factor gives a root (and dividing by x loses the root 0). Thursday multiplies two binomials, each term by each term, four products, and Friday undoes it: factoring $x^2 + bx + c$ with two numbers whose product is c and whose sum is b.

Day	Lesson	Warm-up	Exit	Watch for
Mon	QE01 Meet the quadratic “Meet the Quadratic”	check a solution by substitution (LE02, Chapter 3); combine like terms (EX03, Chapter 2)	QE01 check (5 of 6)	Reading b and c without their signs: $x^2 - 5x + 6$ gives b = 5. Reading the coefficients before putting the equation in standard form (terms on both sides, or not in order)
Tue	QE02 Plus or minus: $x^2 = k$ “Plus or Minus”	squares, cubes & square roots (PRE13, earlier work); powers, roots and reciprocals of positive numbers (IN04, an earlier chapter); QE01	QE02 check (4 of 5)	Forgetting the negative root: $x^2 = 16$, so x = 4. Taking the square root before x^2 is on its own: $2x^2 = 576$, so $2x = \pm 24$ and $x = \pm 12$
Wed	QE03 Zero product: a product is 0 only when a factor is 0 “Zero Product”	factor out the greatest common factor (EX10, Chapter 2); solve any linear equation (LE13, Chapter 3)	QE03 check (5 of 6)	Taking the roots with the signs in the brackets: $(x - 3)(x + 9) = 0$, so $x = -3$ or x = 9. Dividing both sides by x and losing the root 0: $x^2 = 6x$, so x = 6
Thu	QE04 Multiply two binomials “Each by Each”	expand a product (EX08, Chapter 2); signed-number arithmetic (PRE01, earlier work)	QE04 check (4 of 5)	Multiplying only first by first and last by last: $(x + 5)(x + 3) = x^2 + 15$. Losing a sign: $(x - 5)(-x + 5) = x^2 + 10x + 25$
Fri	QE05 Factor $x^2 + bx + c$ “The Sum and Product Game”	QE04; QE03	QE05 check (5 of 6)	The right numbers with the wrong signs: $x^2 + 8x + 15 = (x - 3)(x - 5)$. Matching the sum to c and the product to b

Week 2: Factoring any quadratic

Tidying up on Monday (0 on one side, the x^2 term positive, divide by a common number; double roots and a missing linear term), the factored form on Tuesday (look for a common factor before expanding, never cancel a factor that can be 0, and the sign of a product from its factors), mixed practice on Wednesday (which first: standard form, $x^2 = k$, expand or factor?), then factoring $ax^2 + bx + c$ over Thursday and Friday (the brackets start with the factors of a, the pairs in both orders, fewest choices first, the big numbers meet for a big middle term), with the mastery check on Friday.

Day	Lesson	Warm-up	Exit	Watch for
Mon	QE06 Tidy up first; double roots and missing terms “Tidy Up First”	QE05; clear fractions with the LCD (LE12, Chapter 3)	QE06 check (5 of 6)	Factoring when the other side is not 0: $t^2 - 5t = 14$ as $t(t - 5) = 14$, so $t = 14$ or $t = 19$. Multiplying (or dividing) only some of the terms when tidying up
Tue	QE07 Use the factored form: common factors first “Look Before You Expand”	factor out a common bracket (EX11, Chapter 2); QE06	QE07 check (3 of 4)	Cancelling a common factor from both sides and losing its root. Taking out the common factor wrongly: $(3r - 2)(2r - 5) + (r - 7)(3r - 2) = (3r - 2)(2r - 5)(r - 7)$
Wed	MX21 Which first? Mixed practice (QE01 to QE07: standard form, $x^2 = k$, the zero product, expanding, factoring $x^2 + bx + c$, tidying up and common factors). Take a square root, factor out x, play the sum and product game, tidy up, or take out a common factor? Before each task, name the first move “Which First?”	QE02; QE03; QE04	Hardest practice question; retakes	Using a method where it doesn’t apply when the task doesn’t name it: taking a square root when there is a linear term, or the zero product when the other side isn’t 0
Thu	QE08 Factor $ax^2 + bx + c$ (part 1 of 2) “Factor $ax^2 + bx + c$”	QE04; QE05	Hardest practice question (check on Friday, week 2)	Treating $(2y + 7)(y - 5)$ and $(2y - 5)(y + 7)$ as the same: the order of the numbers matters. Making the linear coefficient from the wrong pairs: $P \cdot Q + R \cdot S$ instead of $P \cdot S + Q \cdot R$
Fri	QE08 Factor $ax^2 + bx + c$ (part 2 of 2) “Factor $ax^2 + bx + c$”	QE08	QE08 check (4 of 5)	Treating $(2y + 7)(y - 5)$ and $(2y - 5)(y + 7)$ as the same: the order of the numbers matters. Making the linear coefficient from the wrong pairs: $P \cdot Q + R \cdot S$ instead of $P \cdot S + Q \cdot R$

Week 3: Which k, word problems, and the roots' sum and product

Which k makes a quadratic factor on Monday (every factor pair, both orders, and the negative twins), word problems on Tuesday (name the unknown, keep the roots that fit the story, answer the question asked), the sum −b and product c of the roots of $x^2 + bx + c$ on Wednesday (and building a quadratic from its roots), the sum −b/a and product c/a for any quadratic on Thursday (standard form first), and on Friday answers about the roots without finding them: rewrite with r + s and rs.

Day	Lesson	Warm-up	Exit	Watch for
Mon	QE09 Which k makes it factor? "Which k Makes It Factor?"	QE08	QE09 check (3 of 4)	Listing only the positive values of k, forgetting the negative pairs. Treating (x + 1)(2x + 5) and (x + 5)(2x + 1) as the same, and missing a value
Tue	QE10 Quadratic word problems "Quadratic Word Problems"	build the equation (LE19, Chapter 3); QE06	QE10 check (3 of 4)	Keeping a root that doesn't fit the story (a negative length, or a negative number when the problem says positive). Dropping a root that does fit: both prices work
Wed	QE11 Sum and product of the roots of $x^2 + bx + c$ "Sum and Product"	eliminate by adding or subtracting (SY05, Chapter 5); QE05	QE11 check (4 of 5)	Taking the sum of the roots to be b instead of −b. Building the quadratic as (x + r)(x + s) from the roots r and s
Thu	QE12 Sum −b/a and product c/a "Divide by a"	QE11; QE08	QE12 check (4 of 5)	Forgetting to divide by a: the sum of the roots of $5x^2 + 59x − 12 = 0$ is −59. Reading the coefficients before putting the equation in standard form: $35x^2 − 18x = 60$ with product 60/35
Fri	QE13 Use the roots without finding them "Without Finding the Roots"	QE12; QE04	QE13 check (3 of 4)	Expanding (r − 1)(s − 1) as rs + 1 or rs − 1, losing the r and s terms. A sign slip with −(r + s) when r + s is negative

Week 4: Disguises, review and the chapter check

Quadratics in disguise on Monday (a new letter such as $u = t^2$, solve, then go back, and a square is never negative), mixed practice on Tuesday (which method?), a review of the whole chapter on Wednesday, the chapter check on Thursday and the buffer lesson on Friday.

Day	Lesson	Warm-up	Exit	Watch for
Mon	QE14 Quadratics in disguise "Quadratics in Disguise"	QE06; QE02	QE14 check (3 of 4)	Stopping at the new letter: giving $t^2 = 2$ or 9 ($u = 2$ or 9) as the answer. Taking only the positive root when going back: $t^2 = 9$, so $t = 3$
Tue	MX22 Which method? Mixed practice (QE08 to QE14: factoring $ax^2 + bx + c$, which k, word problems, the sum and product of the roots, and disguises). Factor, read the sum and product, build from the roots, list the brackets, or substitute? Before each task, name the method "Which Method?"	QE08; QE12; QE14	Hardest practice question; retakes	Solving for the roots when only their sum or product is asked, or using −b and c when a is not 1

Day	Lesson	Warm-up	Exit	Watch for
Wed	MX23 Chapter review (QE01 to QE14: every skill of the chapter). A review of the whole chapter in no particular order, like tomorrow's chapter check "Which Skill? Chapter Review"	QE03; QE06; QE11	Hardest practice question; retakes	Doing well when the skill is announced, but stalling or guessing when it is not
Thu	CH10 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	BUF10 Buffer lesson: warm-up, your review list from the chapter check, retakes	QE05; QE08; QE12	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; 15 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
QE01-V1	Meet the Quadratic	Monday, week 1: Meet the Quadratic	1:42
QE02-V1	Plus or Minus	Tuesday, week 1: Plus or Minus	1:25
QE03-V1	Zero Product	Wednesday, week 1: Zero Product	1:35
QE04-V1	Each by Each	Thursday, week 1: Each by Each	1:33
QE05-V1	The Sum and Product Game	Friday, week 1: The Sum and Product Game	1:32
QE06-V1	Tidy Up First	Monday, week 2: Tidy Up First	1:39
QE07-V1	Look Before You Expand	Tuesday, week 2: Look Before You Expand	1:36
QE08-V1	Factor $ax^2 + bx + c$, Part 1	Thursday, week 2: Factor $ax^2 + bx + c$	1:50
QE08-V2	Factor $ax^2 + bx + c$, Part 2	Friday, week 2: Factor $ax^2 + bx + c$	1:41
QE09-V1	Which k Makes It Factor?	Monday, week 3: Which k Makes It Factor?	1:36
QE10-V1	Quadratic Word Problems	Tuesday, week 3: Quadratic Word Problems	1:54
QE11-V1	Sum and Product	Wednesday, week 3: Sum and Product	1:53
QE12-V1	Divide by a	Thursday, week 3: Divide by a	1:29
QE13-V1	Without Finding the Roots	Friday, week 3: Without Finding the Roots	1:34
QE14-V1	Quadratics in Disguise	Monday, week 4: Quadratics in Disguise	1:49

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)
“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 in week 4 absorbs one day of delay; beyond that, shorten the chapter review (MX23) to half a lesson and keep the chapter check. The mastery checks never get cut. A student stuck on factoring $x^2 + bx + c$ (QE05) usually needs multiplying two binomials again (QE04): four products, then add the cross products. One stuck on $ax^2 + bx + c$ (QE08) needs the cross products again: check the middle term of each try. One stuck on the sum and product (QE11, QE12) needs the factored form again: roots r and s come from $(x - r)(x - s)$.

Ahead. If most students pass first time, use the buffer lesson for the advanced skills. A class that is clearly fast can run a mixed practice 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 4 pages: 20 lessons (QE01, QE02, QE03, QE04, QE05, QE06, QE07, MX21, QE08P1, QE08P2, QE09, QE10, QE11, QE12, QE13, QE14, MX22, MX23, CH10, BUF10), each with warm-up, lesson, practice and its mastery check or exit question, and a class view	Ready (prototype)
15 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 hardest skills (tidying up first, factoring $ax^2 + bx + c$, word problems, the roots without finding them), and five exercise exemplars	Ready (draft)
Advanced skills QE15 to QE19	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