Complex Numbers: Weekly Planning for Teachers (Online)

Chapter 12, Complex Numbers · November 2026 · draft for review · both weeks written

How the chapter runs

This plan covers Chapter 12, Complex Numbers, taught online after Chapter 10 (Chapter 11 is not part of this course, and nothing in this chapter needs 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 2 weeks (10 lessons): 7 teaching lessons, a review day, the chapter check and a buffer lesson at the end.

In Chapter 10, $x^2 = -16$ had no solution. In this chapter it has two. Students meet i, the number whose square is −1, and use it to take the square root of a negative number and to solve $x^2 = k$ when k is negative. They find any power of i from the cycle i, −1, −i, 1; read the real and imaginary parts of a + bi and place it on the complex plane; add, subtract and multiply complex numbers; use the conjugate to make a product real and to find the distance from 0; and divide by multiplying the top and the bottom by the conjugate of the bottom. The book's square roots of a complex number, its rules for conjugates and cube roots of 1, its equations with i in them and its proof that √2 is irrational are on the advanced route. There are no units in this chapter.

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 7 skills for every student; the chapter is mastered when all of them are. The advanced route has four optional skills (square roots of a complex number, rules for conjugates and the cube roots of 1, equations and expressions with i in them, and why √2 is irrational), proposed and still to be written. The complex plane is not a separate lesson: placing a + bi on it is part of CN04, and the distance from 0 is part of CN06.

Week	Focus	Lessons
1	Meet i, and the complex numbers	CN01, CN02, CN03, CN04, CN05
2	Conjugates, division, review and the chapter check	CN06, CN07, MX24, CH12, BUF12

Numbering. Skills are numbered CN01 to CN11 (complex numbers); QE stays Chapter 10, IN Chapter 9, GL Chapter 8, PR Chapter 7, RP Chapter 6, SY Chapter 5, MV Chapter 4, LE Chapter 3 and EX Chapter 2. The review day is MX24, after Chapter 10's MX21 to MX23: it practises every skill at once and has no mastery check of its own, so it is not a skill. CH12 is the chapter check and BUF12 the buffer lesson. Warm-up questions are numbered 1201 and up, practice-set exercises 301 and up.

Answers. Answers are typed. A complex number goes in one box as a + bi: 3 - 2i, -4i, 5, or -1/29 + 17/29 i (the i and √ keys are under the box, with a "Reads as" preview). The answer must be finished: an answer with the right value that still has i^2 in it, or a fraction not yet split into a + bi, is told what is left to do. The roots of an equation go in one box, in any order: ±4i, or 2i√3, -2i√3. On the complex plane students click to place a number. Wrong answers that match a common mistake are named: i^2 taken as 1, the i dropped from a square root, only one root, a real part combined with an imaginary part, the sign of only the first part changed after a minus, the parts swapped on the plane, and the conjugate of the wrong number.

The book. The lessons follow the book's sections in order. One worked answer in the book is wrong (the division on p. 348): the lessons use the corrected answer, $(3 - i)/(-2 - 5i) = -1/29 + 17/29\,i$.

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: which power of i, which part is real, which conjugate)	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 2 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 two weeks

Week 1: Meet i, and the complex numbers

Monday students meet i, the number whose square is −1: $i^2 = -1$, so $(3i)^2 = -9$, and a real number times i is imaginary (0 is both real and imaginary). Tuesday gives $x^2 = -16$ its two roots, $\pm 4i$: put x^2 on its own first, then $\sqrt{-16} = 4i$, never −4. Wednesday is the powers of i: they go round in fours (i, −1, −i, 1), so the remainder after dividing the exponent by 4 decides the value. Thursday names the two parts of a + bi, places the number on the complex plane (the real part across, the imaginary part up) and adds and subtracts part by part. Friday multiplies like two binomials, four products, then replaces i^2 by −1.

Day	Lesson	Warm-up	Exit	Watch for
Mon	CN01 Meet i “Meet i”	squares, cubes & square roots (PRE13, earlier work); signed-number arithmetic (PRE01, earlier work); multiply monomials & powers of products (EX05, Chapter 2)	CN01 check (4 of 5)	Taking i^2 as 1: $(3i)^2 = 9$. Squaring the i but not the number: $(3i)^2 = 3i^2 = -3$, or $(5i)^4 = 5$
Tue	CN02 Square roots of negative numbers “Square Roots of Negative Numbers”	plus or minus: $x^2 = k$ (QE02, Chapter 10); zero product: a product is 0 only when a factor is 0 (QE03, Chapter 10); CN01	CN02 check (4 of 5)	Dropping the i: $x^2 = -16$, so $x = \pm 4$. Stopping at “no solution”: $x^2 = -16$ has no real solution, but two imaginary ones
Wed	CN03 Powers of i “Powers of i”	multiply powers of the same base (EX04, Chapter 2); negative exponents (EX07, Chapter 2); CN01	CN03 check (5 of 6)	Reading the cycle from the wrong place: remainder 1 taken as −1, or remainder 3 as 1. Thinking an exponent that is a multiple of 4 gives i (or 0): $i^{100} = 1$
Thu	CN04 Complex numbers: plot, add and subtract “Complex Numbers”	combine like terms (EX03, Chapter 2); subtract an expression (EX09, Chapter 2); plot and read points (GL02, Chapter 8)	CN04 check (5 of 6)	Giving the imaginary part with its i, or without its sign: the imaginary part of $3 - 2i$ as $-2i$ or 2. Combining a real part with an imaginary part: $(2i + 1) + (3 - 7i) = 5 - 6i$
Fri	CN05 Multiply complex numbers “Multiply Complex Numbers”	multiply two binomials (QE04, Chapter 10); CN03; CN04	CN05 check (4 of 5)	Taking i^2 as +1 after expanding: $(4 + i)(-2 + 3i) = -5 + 10i$. Multiplying only first by first and last by last: $(4 + i)(-2 + 3i) = -8 + 3i^2 = -11$

Week 2: Conjugates, division, review and the chapter check

Conjugates on Monday (change the sign of the imaginary part only; a number times its conjugate is $a^2 + b^2$, a real number, and on the complex plane its square root is the distance from 0), division on Tuesday (multiply the top and the bottom by the conjugate of the bottom, then split the answer into a + bi), 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	CN06 Conjugates and the distance from 0 “Conjugates”	the distance between two points (GL03, Chapter 8); CN05	CN06 check (4 of 5)	Changing the sign of the real part too (or only the real part): the conjugate of 3 − 2i written −3 + 2i or −3 − 2i. Getting $a^2 - b^2$ for a number times its conjugate: (7 − 3i)(7 + 3i) = 49 − 9 = 40
Tue	CN07 Divide complex numbers “Divide Complex Numbers”	fractions, decimals & reciprocals (PRE02, earlier work); CN06	CN07 check (4 of 5)	Multiplying only the bottom by the conjugate, not the top. Multiplying by the conjugate of the top, or by the bottom itself
Wed	MX24 Chapter review (CN01 to CN07: every skill of the chapter). A review of the whole chapter in no particular order, like tomorrow’s chapter check “Which Skill? Chapter Review”	CN02; CN03; CN05	Hardest practice question; retakes	Doing well when the skill is announced, but stalling or guessing when it is not: using the conjugate to multiply, or the powers of i where i^2 is all that is needed
Thu	CH12 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	BUF12 Buffer lesson: warm-up, your review list from the chapter check, retakes	CN03; CN05; CN07	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; 7 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
CN01-V1	Meet i	Monday, week 1: Meet i	1:19
CN02-V1	Square Roots of Negative Numbers	Tuesday, week 1: Square Roots of Negative Numbers	1:29
CN03-V1	Powers of i	Wednesday, week 1: Powers of i	1:33
CN04-V1	Complex Numbers	Thursday, week 1: Complex Numbers	1:45
CN05-V1	Multiply Complex Numbers	Friday, week 1: Multiply Complex Numbers	1:28
CN06-V1	Conjugates	Monday, week 2: Conjugates	1:50
CN07-V1	Divide Complex Numbers	Tuesday, week 2: Divide Complex Numbers	1:22

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 absorbs one day of delay; beyond that, shorten the chapter review (MX24) to half a lesson and keep the chapter check. The mastery checks never get cut. A student stuck on multiplying (CN05) usually needs multiplying two binomials again (QE04, Chapter 10): four products, then replace i^2 by -1. One stuck on dividing (CN07) needs the conjugate again (CN06): a number times its conjugate is $a^2 + b^2$. One stuck on the powers of i (CN03) needs the cycle written out: i, −1, −i, 1, and the remainder after dividing by 4.

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 2 pages: 10 lessons (CN01, CN02, CN03, CN04, CN05, CN06, CN07, MX24, CH12, BUF12), each with warm-up, lesson, practice and its mastery check or exit question, and a class view	Ready (prototype)
7 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 four skills (square roots of negative numbers, powers of i, multiplying, dividing), and five exercise exemplars	Ready (draft)
Advanced skills CN08 to CN11	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