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MATH

The Math Pathways Decision Guide

Five Models to Improve Gateway Math Throughput

A decision guide for academic leaders



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Two Decisions Shape Gateway Math Throughput

Gateway math throughput, the share of entering students who complete a college-level math course within their first year, rests on two structural decisions:

1. Which College-Level Math Course Each Program Requires

Each program should have one math course chosen on purpose because it fits the math the program and the work after it actually use, such as statistics for psychology, rather than broad guidance of "any course numbered 100 or above". That decision settles who takes college algebra. It belongs to students headed for calculus, either business calculus or trigonometry-based calculus, and it shouldn't be an exit course for everyone else.

2. How Students Who Need More Preparation Get Into That Course

This is the decision this guide covers. College algebra usually requires a placement test that leans on algebra (which is easy to forget), so students who drift into it often place into developmental algebra instead. That sequence is where many students stop. When a student has a poor experience in a gateway or developmental math course, the research is clear that many leave the institution, not just the course.

Five Models, One Goal

We work with institutions across five models, which differ in whether they keep a standalone developmental course, and if so, how many and for which pathway. Every model aims for each student in the right math course, at the right time, with the right support. In every model, the vast majority of students should start in a college-level course, with or without a corequisite.

How to Use This Guide:

Start with the five models at a glance. Read the one or two that match your state's policy and your faculty's position, then use the decision tree to confirm the fit.

The College-Level Pathways These Models Lead Into

Each model ends in one of the college-level pathways below. Which pathway a program uses is the first decision, made program by program.

Pathway	Who It Serves	Prerequisites and Support
College algebra to calculus	STEM programs, and business programs that require business calculus or a course such as finite math	A prerequisite sequence can make sense on the way to calculus. If a student isn't ready to start in college algebra, identify the algebra they're missing and close the gap with a corequisite, an embedded tutor, or a bootcamp
Quantitative reasoning	Students who aren't STEM-bound. Sometimes called liberal arts math or quantitative literacy	No prerequisite. The student takes the course on its own or with a corequisite
Statistics	Programs whose real need is statistical reasoning, such as psychology and social work	No prerequisite, and never college algebra first. The student takes the course on its own or with a corequisite
Technical math	Technical fields, through a technical math course that leads directly into them	The course on its own or with a corequisite, taken early enough to prepare students for the rest of their program
Math for elementary teachers	Education programs	The course directly, or with preparation first, depending on the model

In the models that follow, "non-STEM college math" means the quantitative reasoning or statistics course a program requires.

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The Five Models at a Glance

Model	Standalone Developmental Courses	Steer Toward It When	Central Trade-off
1. No developmental course, with a bootcamp	None	Your state doesn't allow standalone developmental courses, and you need an option for students for whom college algebra with a corequisite is still too much	A bootcamp helps only a small share of students, and getting them to sign up takes recruiting and incentives
2. No developmental course, with a non-STEM course first	None	Your state doesn't allow standalone developmental courses, and you'd rather offer a course than a bootcamp, using courses you already have	The college algebra corequisite has to make up the algebra the non-STEM course doesn't teach
3. One developmental course*	One, before both pathways	Faculty strongly want to keep standalone developmental math, and you have neither a state mandate nor full buy-in yet	Placement has to keep the course small, or it becomes the place most students start
4. Two developmental courses, one per pathway*	Two, one for each pathway	You're moving toward corequisites without full buy-in, and you can run a developmental course for each pathway	You create or manage two courses, with their enrollment and staffing, and still have to keep placement tight
5. One developmental course, for the STEM pathway only*	One, before college algebra	Standalone developmental courses are allowed, and faculty have a real concern about the STEM sequence	It keeps a standalone course that the data may show needs to go

*A Note on Standalone Developmental Courses

In the past, standalone developmental courses taken as prerequisites were considered the gold standard for preparing students for college-level math. Over the past decade, the evidence for a corequisite model has become overwhelming. However, some colleges still offer standalone developmental courses as part of the path into college-level math.

If you include them, use them only in rare circumstances, such as for students who have never taken algebra and need to complete college algebra for a STEM program. Even then, the data may not support a standalone course. Collect both quantitative and qualitative data on the throughput and student experience of any math sequence that includes a standalone developmental course. Unless that data shows higher throughput than a corequisite approach with added support, such as a bootcamp or embedded tutoring, we don't recommend keeping standalone developmental courses.

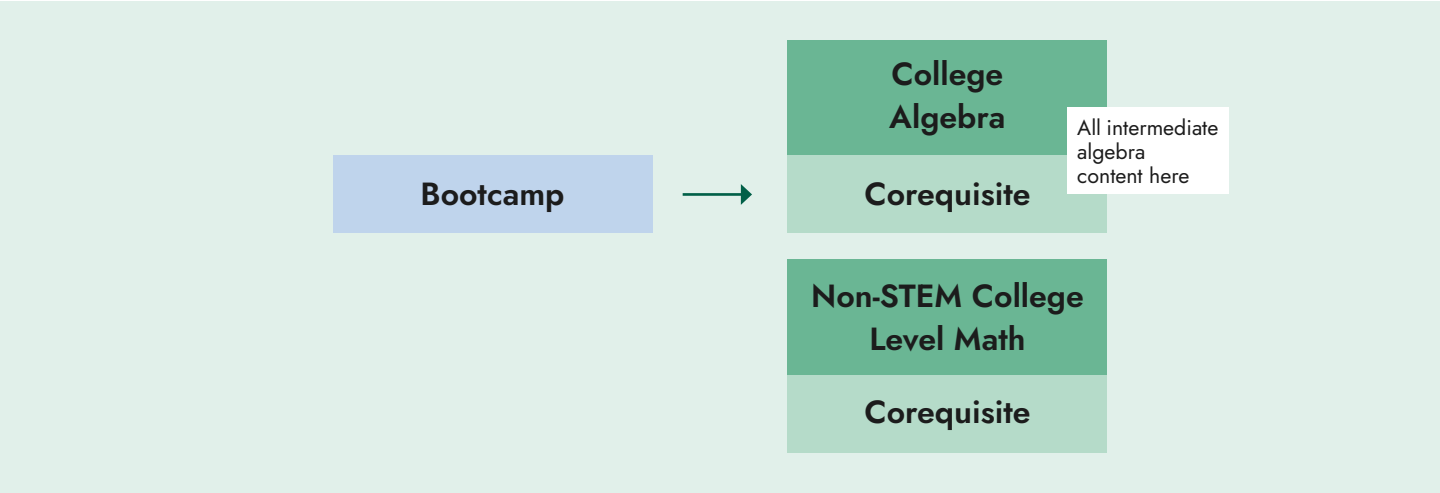
Three Rules Hold Across All Five Models:

1. Placement should put no more than 10 percent of all students in any standalone developmental course.

2. Intermediate algebra stops being a separate course. Its content moves into the college algebra corequisite or is shared between that corequisite and the course before it.

3. A standalone developmental course is a starting point, not an end point. Let throughput show whether it's helping the students it was built for.

Model 1: No Developmental Course, With a Bootcamp



How It Works:

Every student starts in a college-level course. Non-STEM students take the non-STEM college math course, with a corequisite if they need one. STEM students take college algebra, with a corequisite if they need one. Students for whom a corequisite college algebra course is still too much for one semester take a bootcamp first and then start college algebra with a corequisite. All intermediate algebra content lives in the college algebra corequisite.

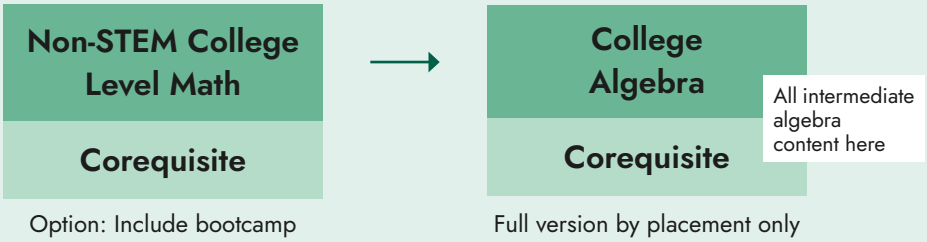
Steer toward it when your state doesn't allow standalone developmental courses, but you still need an option for students for whom college algebra with a corequisite is too much. The model carries support for both non-STEM and STEM students.

The Trade-off:

A bootcamp can be very successful, but it helps only a small share of students, because the hardest part is getting students to sign up. You'll invest time and money in recruiting and incentives, and only a small number of students will benefit. It's a lot of effort for a small group.

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Model 2: No Developmental Course, With a Non-Stem Course First



How It Works:

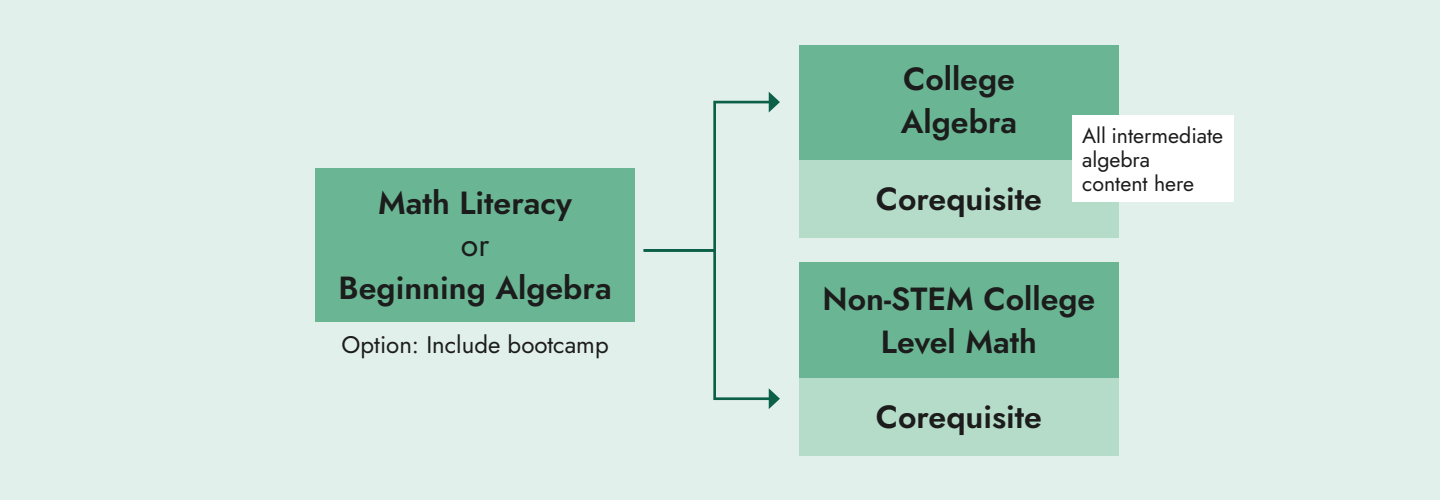
Every student starts in a college-level course. Non-STEM students take the non-STEM college math course, with a corequisite if they need one. STEM students whose placement shows they can start in college algebra take the full course, which is open by placement only. Other STEM students take the non-STEM college math course first, with a corequisite if needed, and then college algebra with a corequisite, which carries all the intermediate algebra content. A bootcamp can be added before the non-STEM course.

Steer toward it when your state doesn't allow standalone developmental courses, you have students for whom college algebra with a corequisite is still too difficult, and you want a course route for them rather than a bootcamp. It lets you use courses you already have. Students earn college credit every semester and never sit in a developmental course.

The Trade-off:

Students who come out of the non-STEM course gain confidence and get their footing in college-level math, but they don't get a substantial amount of algebra there. The college algebra corequisite has to be very well designed to make up those gaps.

Model 3: One Developmental Course



How It Works:

Students who need the most preparation take one standalone developmental course, either Math Literacy or Beginning Algebra, and it's probably a course you already have. From there they move into college algebra with a corequisite or the non-STEM college math course with a corequisite. Everyone else starts in a college-level course. All intermediate algebra content lives in the college algebra corequisite. A bootcamp can be added before the developmental course.

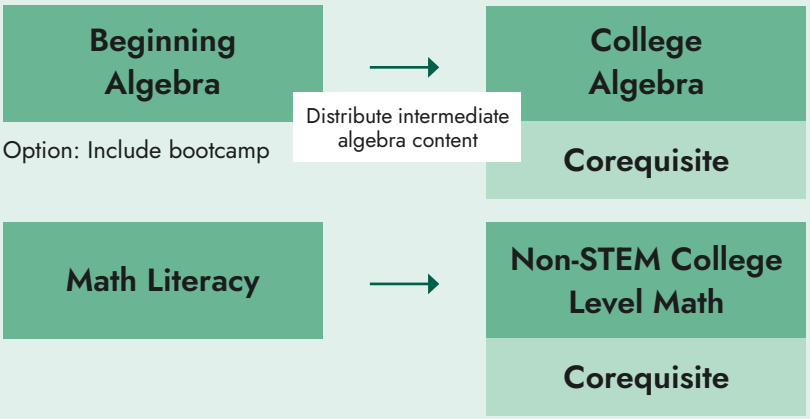
Steer toward it when faculty are strongly opposed to the change and still want standalone developmental math, and you don't have a state mandate or full buy-in yet. If you're trying to make a major move toward corequisites, it's a good step in the right direction. Plan for data collection on throughput rates, so that a data driven decision can be made on this approach's continuation.

The Trade-off:

You have to be careful with placement so the single course doesn't become the course most students start in. No more than 10 percent of students should be in it.

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Model 4: Two Developmental Courses, One per Pathway



How It Works:

Each pathway keeps its own standalone developmental course. Beginning Algebra leads into college algebra with a corequisite, and Math Literacy leads into the non-STEM college math course with a corequisite. Intermediate algebra content is shared between Beginning Algebra and the college algebra corequisite. A bootcamp can be added before Beginning Algebra.

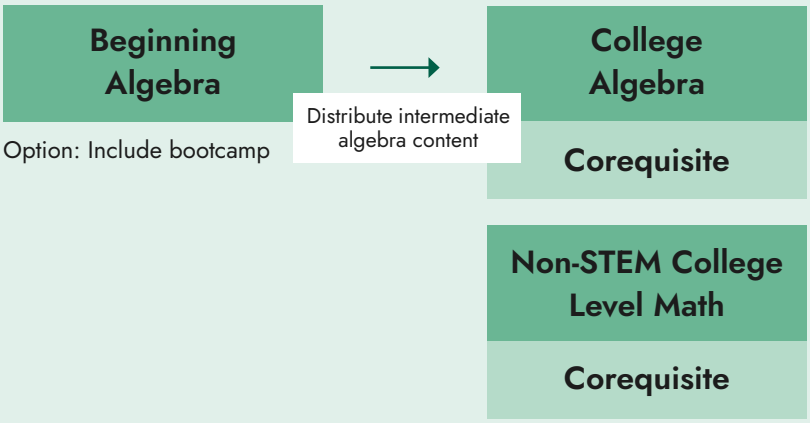
Steer toward it when you're moving toward corequisites and don't have all the necessary buy-in yet. Like Model 3, it preserves a developmental course, here one for each pathway. Plan for data collection on throughput rates, so that a data driven decision can be made on this approach's continuation.

The Trade-off:

You have to create two courses if you don't already have them, and manage the enrollment, staffing and everything else they need. Placement has to be just as careful, with no more than 10 percent of students in a standalone course. The vast majority should start in a college-level course, with or without a corequisite.

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Model 5: One Developmental Course, for the Stem Pathway Only



How It Works:

Only the STEM pathway keeps a standalone developmental course. STEM students take college algebra directly if placement shows they can, or with a corequisite where that's feasible, and otherwise take Beginning Algebra first. Intermediate algebra content is shared between Beginning Algebra and the college algebra corequisite. Non-STEM students start in the non-STEM college math course, with a corequisite if they need one, and have no developmental course in front of it. A bootcamp can be added before Beginning Algebra.

Steer toward it when your state allows standalone developmental courses and faculty have a real concern about the STEM sequence. It keeps an option for the students with the highest needs, and it can bring reluctant faculty on board by giving them a safer first step in the right direction.

The Trade-off:

You still have a standalone developmental course, and you have to make sure not too many students start in it. Treat it as a starting point in your pathways redesign, not an end point. Study the throughput data to see whether the course is helping the students with the highest needs succeed, and if it isn't, it may need to go.

How Each Model Serves Other Student Groups

The models shown describe the two main pathways. Other programs and student groups need a plan too, and most of the answers are the same in every model.

Group	Models 1 to 4	Model 5
Programs with their own math requirements	If students don't meet the bar the program sets, they take a bootcamp (Model 1), a bootcamp or the non-STEM college math course (Model 2), or a bootcamp, Math Literacy or Beginning Algebra (Models 3 and 4). Alternatively, the program adds its own math course, or adds a math corequisite to one of its own courses	Beginning Algebra or a bootcamp if students don't meet the program's bar, or the program adds its own math course or a math corequisite to one of its courses
Technical math	The course on its own or with a corequisite, taken early enough to prepare students for the rest of their program	
Math for elementary teachers	The course directly if placement shows a student can start in it. Otherwise a bootcamp first (Model 1), a bootcamp or the non-STEM college math course first (Model 2), or a bootcamp, Math Literacy or Beginning Algebra first (Models 3 and 4)	The course directly, or a bootcamp or Beginning Algebra first

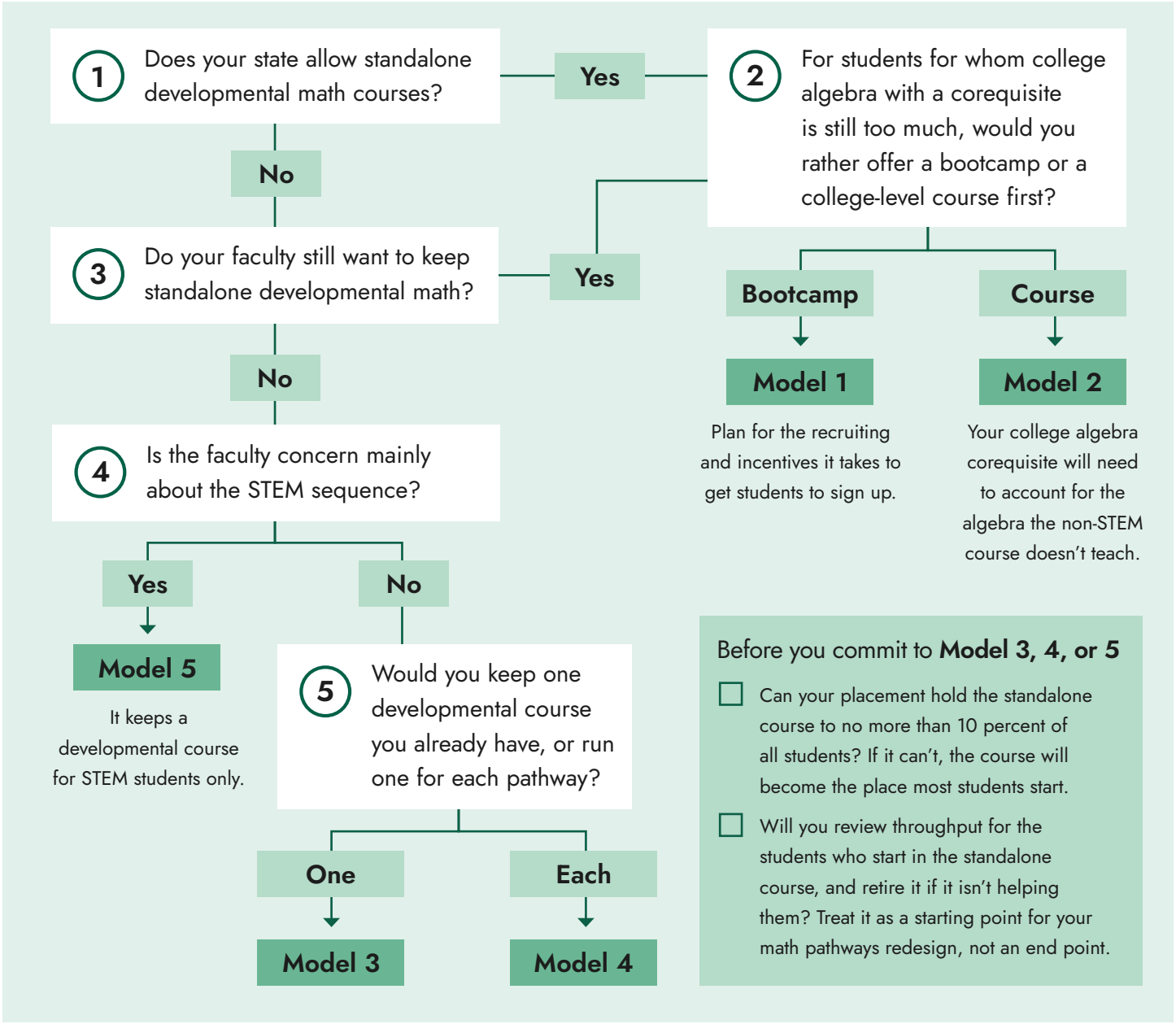
Group	Models 1 to 4	Model 5
Students who need the most support	Make sure pathways are in use, because they reduce the number of these students required to take college algebra. Enroll them in the math their program requires, usually non-STEM or technical math, with a corequisite. Embed tutors where possible, require tutoring, and refer students to adult basic education where it's available. Models 1 and 2 require a bootcamp. Models 3 and 4 use a bootcamp, Math Literacy or Beginning Algebra before college-level math, and Model 5 uses a bootcamp or Beginning Algebra	
High school students in a college agreement	Students take the college course only when placement shows they can start in it directly, because corequisites rarely fit high school schedules on the high school's own campus. A high school that uses the college's developmental math courses for seniors may need to realign those courses, and could use Math Literacy or Beginning Algebra in Models 3 and 4, or Beginning Algebra in Model 5	



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Which Model Fits Your Institution?

Questions 1 to 5 form a decision tree. Start at question 1 and follow your answers to a model. Then run the two checks below before you commit to any model that keeps a standalone developmental course.



Before you commit to **Model 3, 4, or 5**

- ☐ Can your placement hold the standalone course to no more than 10 percent of all students? If it can't, the course will become the place most students start.
- ☐ Will you review throughput for the students who start in the standalone course, and retire it if it isn't helping them? Treat it as a starting point for your math pathways redesign, not an end point.

Making the Model Work

Choosing a model is the design decision. Students only follow the math pathways created when they are built into every place they decide which math course to take.

Build It Into Every Decision Point

- Placement and registration
- Advising, and what students are told to take next
- The catalog, the website and even signage on campus

A model that exists only on paper puts students right back in college algebra.

Bring the Right People to the Table

- Someone from each major program area, such as nursing, engineering, the technical areas and the liberal arts
- The Chief Academic Officer (CAO), the math department and advising
- The registrar and whoever handles the catalog and curricular filings with your state, if you can
- Faculty from the disciplines math prepares students for, not only math faculty

Set a Launch Date and Hold to It

- If the courses already exist and the work is to use them differently, an institution can operationalize its pathways in less than twelve months.
- Pick the fall semester you'll launch in, and don't push it out when the work gets hard.

One question to ask your math department: How do students know which math class to take for their program, and when? If the answers start with "it depends," the work isn't finished.

One report to ask Institutional Research for: Pull reports on students from a couple of years ago who earned a D, F or W in your developmental or college algebra courses, and see what they did next. Many institutions find a fair share of them stopped out or dropped out.

Why the Structure Is an Equity Decision

When every student is routed through the algebra sequence as the supposedly safe route, students of color and Pell-eligible students are disproportionately placed into developmental sequences, where those exist, instead of directly into college-level courses. A default of "take whatever you want", or "start in algebra to be safe", widens equity gaps rather than closing them. That's why every model in this guide keeps the vast majority of students starting in a college-level course.



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What Math Pathways Looks Like at Scale

Rowan College at Burlington County, a community college in New Jersey, shows what this looks like at scale.

What the College Did

- Reviewed every academic program and reset the math course each one required
- Built a corequisite, which the college calls a clinic, for nearly every college-level math course
- Moved non-STEM students to guided self-placement and took the algebra and placement-test prerequisites off the non-STEM courses

How Long It Took

- One fall semester talking with every program
- The following winter and spring terms getting changes approved and programmed into the catalog and the student information system
- Training for advisors and staff, then launch at scale in fall 2024
- About a year in all, even with some new courses created along the way

What Changed

- Among students taking math in their first year, the share starting in a college-level course rose from about half to 73 percent.
- Pass rates rose from 57 to 71 percent in Introduction to Statistics and from 59 to 85 percent in Modern College Math.
- The share of all entering students completing college-level math in their first year rose from 33 to 39 percent.

More students were in the right course. Learn more about RCBC's gateway math redesign here.

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Glossary for Leaders

- **Bootcamp.** Preparation a student completes before starting a college-level course with a corequisite, for students for whom a corequisite course is still too much for one semester.
- **Corequisite.** Support a student takes alongside the college-level course rather than before it.
- **Standalone developmental course.** A math course a student takes before, rather than alongside, a college-level course.
- **Beginning Algebra**. The developmental course before college algebra in Models 3, 4 and 5. In Models 4 and 5 it shares intermediate algebra content with the college algebra corequisite. It includes traditional algebra topics of real numbers through factoring.
- **Math Literacy.** An applied developmental course before college-level math. In Model 3 it can lead into either pathway, and in Model 4 it leads into the non-STEM course. It focuses on using key concepts from beginning algebra in applied contexts related to non-STEM fields.
- **Intermediate algebra.** No longer a separate course in any of the five models. Its content moves into the college algebra corequisite or is shared with Beginning Algebra. It includes factoring, rationals, radicals, quadratics, and absolute value equations and inequalities.
- **Non-STEM college math.** The quantitative reasoning or statistics course a non-STEM program requires.
- **Technical math.** A college-level course that leads directly into technical fields, best taken early in the program.
- **Math for elementary teachers.** The college-level course for education programs.
- **Guided self-placement.** Students decide, with guidance, whether to add support to a course of their choosing.
- **Throughput.** The share of entering students who complete a college-level math course within their first year.



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Turning Your Model Into Practice

Choosing a model is the first half of the work. The second is building it into placement, advising, registration and the catalog so students follow it, and that's the "done with you" work we do alongside your team, rather than handing over a report and stepping away.

See how we approach gateway course redesign or get started with Almy Education to talk through which model fits your institution.

About Almy Education

Almy Education is led by a team that brings deep expertise in both subject matter and institutional change management. We've partnered with over 100 college and university clients to improve gateway course outcomes in math, English, and the sciences, including biology, chemistry, and anatomy and physiology.

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