



Michigan's College Algebra/Preparation for Calculus Pathway

In early 2016, recognizing that successful implementation of the mathematics recommendation in the Michigan Transfer Agreement (MTA) would be critical to improving statewide transfer and credential completion, the Michigan Community College Association (MCCA) and the Michigan Association of State Universities (MASU) established The Right Math at the Right Time (RM@RT) initiative to strengthen the implementation of three primary mathematics pathways (quantitative reasoning, introductory statistics and preparation for calculus) across Michigan's two- and four-year public postsecondary institutions. In undertaking this work, Michigan joins a national network of colleges, supported by the Charles A. Dana Center at the University of Texas at Austin, who are building and strengthening mathematics pathways to promote student success and completion.

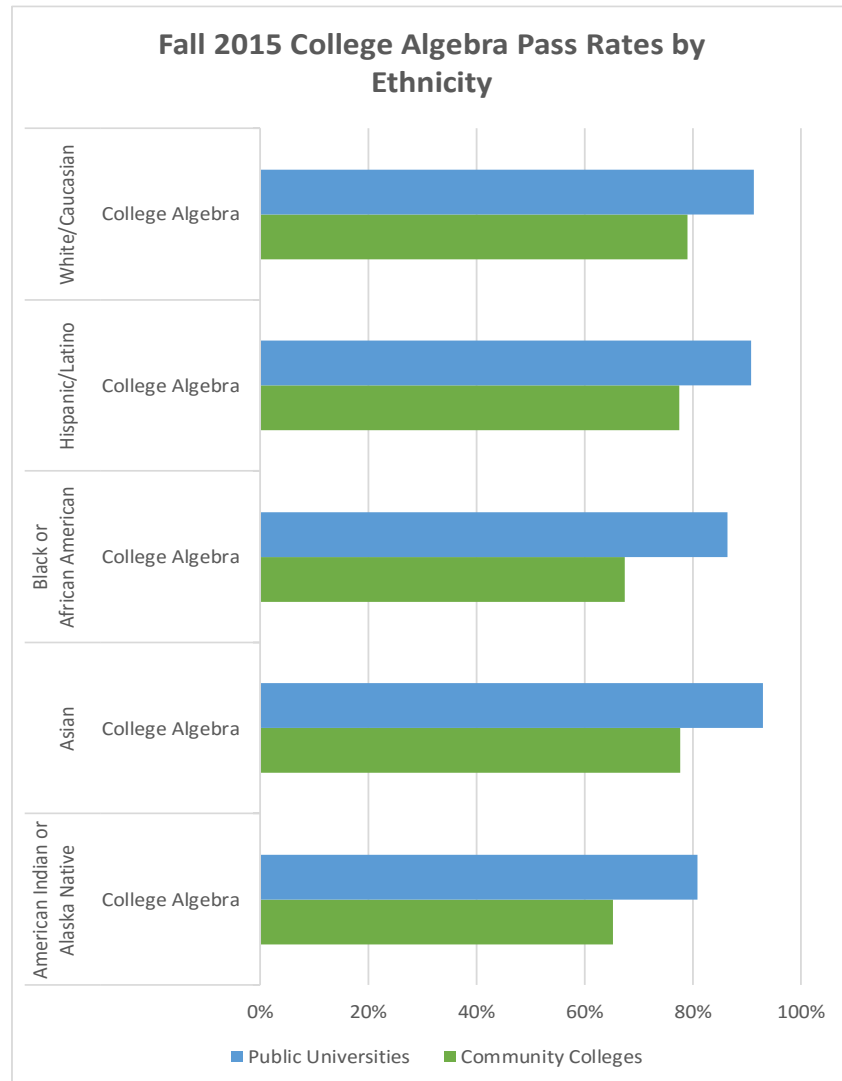
The Michigan RM@RT Steering Committee members represent community colleges and universities, the Michigan Department of Education and state mathematics associations. The 2016 report, [The Right Math at the Right Time: Addressing Mathematics Challenges Facing Michigan Colleges and Universities](#), outlines a structure to help Michigan colleges and universities review and revise mathematics curricula to meet the needs of students and employers, design new, high-quality mathematics learning experiences, align learning outcomes for developmental and gateway mathematics courses and enable students who transfer to apply their math credits to their program of study.

According to a 2015 report from the Committee on the Undergraduate Program in Mathematics (CUPM) of the Mathematical Association of America (MAA), students preparing for careers in science, technology, engineering and math (STEM) fields need a strong foundation in college algebra and trigonometry. Mathematics courses for STEM majors should provide opportunities for students to demonstrate competence in strategic thinking, written and oral communication and qualitative reasoning, along with relevant mathematical content.

In 2017, the RM@RT Steering Committee established a working group of mathematics faculty from two- and four-year institutions to recommend a set of learning outcomes for entry-level, college-level courses designed to prepare students for calculus, including college algebra and precalculus. Colleges and universities are currently reviewing the recommendations with the intent to *adopt* the learning outcomes in their own courses, *accept* courses with those learning outcomes in transfer and *apply* the courses to the appropriate programs of study.

College Algebra Achievement Gaps

Research from Michigan's Center for Educational Performance and Information (CEPI) indicates significant achievement gaps in college algebra for students attending community colleges. These gaps are especially pronounced for students of color and may limit the ability of these students to transfer and progress into STEM fields.



RM@RT Preparation for Calculus Outcomes

The RM@RT Preparation for Calculus workgroup identified a minimum skill level and a set of learning outcomes for college algebra and trigonometry courses that meet the MTA mathematics requirement.

Skill Level: To be successful in a college algebra or precalculus course, students will be expected to apply advanced algebra skills similar to those taught in [high school algebra II in the Michigan Merit Curriculum](#) or in intermediate algebra. Institutions should establish their own guidelines for determining if a student can succeed in a one-semester precalculus course or should be placed into a two-course college algebra/trigonometry sequence to prepare for calculus.

Outcomes: The MAA's Committee on the Undergraduate Program in Mathematics (CUPM) outlined these suggested course objectives for college algebra and trigonometry in its 2015 [report](#) (Table 1).

- Demonstrate knowledge of functions, including absolute values, polynomials (including polynomials of degree greater than 2 and the fundamental theorem of algebra), rational functions, logarithms, exponential functions, and inverse functions.
- Apply algebraic techniques in solving linear, quadratic, logarithmic, and exponential equations.
- Analyze equations of circles and properties of circles such as angle measure in both radians and degrees.
- Evaluate cosine, sine, and tangent for common angles (in all quadrants).
- Sketch trigonometric functions and state their domains.
- Recall and apply basic trigonometric identities such as the double angle, half-angle, and addition formulas.
- Graph functions by transformation rather than by plotting points.
- Topics such as sequences and series may also be included.

Read more in the [White Paper on RM@RT Strategy I](#).

MICHIGAN'S MATHEMATICS PATHWAYS: PREPARATION FOR CALCULUS

College Algebra Course Transfer Patterns

Once colleges and universities adopt the learning outcomes, they are encouraged to accept courses from other institutions and post equivalencies to the [Michigan Transfer Network](#) (MTN). The RM@RT Steering Committee will periodically review these equivalencies to monitor progress toward accepting courses for transfer. This chart indicates current equivalencies listed in the MTN as of March 2018. Green boxes indicate direct equivalencies between courses identified as college algebra by both entities, yellow indicate that the university offers general or departmental credit only and orange identifies where the university offers credit for a different course than the identified college algebra course. Blank boxes indicate no information was available about the course in the MTN.

In some cases, most notably at Ferris State, Oakland and Wayne State Universities, students completing college algebra plus an additional course in trigonometry at the community college can receive credit for the university's precalculus course—this is not indicated here. St. Clair County Community College and Oakland University do not offer a college algebra course and the University of Michigan-Ann Arbor does not post course equivalency information in the Michigan Transfer Network.

College Algebra	University	Central Michigan University	Eastern Michigan University	Ferris State University	Grand Valley State University	Lake Superior State University	Michigan State University	Michigan Technological University	Northern Michigan University	Oakland University	Saginaw Valley State University	University of Michigan-Ann Arbor	University of Michigan-Dearborn	University of Michigan-Flint	Wayne State University	Western Michigan University
Community College	COURSE	MTH 107	MATH 105	MATH 116	MTH 122	MATH 111	MTH 103	MA 1030	MA 111	N/A	MATH 120A		MATH 104	MTH 111	MAT 1050	MATH 1110
Alpena Community College	MTH 121	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 103		MATH 120A		MATH 104	MTH 111	GEN CR	MATH 1160
Bay College	MATH 110	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111					MTH 111	GEN CR	GEN CR
Delta College	MTH 122W	MTH 107	MATH 105				MTH 103							MTH 111	GEN CR	
Glen Oaks Community College	MATH 151	MTH 107	MATH 105		MTH 122	MATH 111	MTH 103		MA 111				MATH 104	MTH 111	GEN CR	GEN CR
Gogebic Community College	MTH 110	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A			MTH 111	GEN CR	MATH 1180
Grand Rapids Community College	MA 110	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	GEN CR	GEN CR
Henry Ford College	MATH 115	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	GEN CR	GEN CR
Jackson College	MAT 139	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111				MATH 104	MTH 111	GEN CR	MATH 1110
Kalamazoo Valley Community College	MATH 150	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	GEN CR	MATH 1110
Kellogg Community College	MATH 125	MTH 107	MATH 104	MATH 115	MTH 122	MATH 111	MTH 103	GEN CR	MA 111		MATH 120A		MATH 104	MTH 111	GEN CR	MATH 1110
Kirtland Community College	MTH 13000	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103		MA 111		MATH 120A			MTH 111		MATH 1180
Lake Michigan College	MATH 128	MATH 130	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 132A		MATH 104	GEN CR	GEN CR	MATH 1180
Lansing Community College	MATH 120	GEN CR	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030			MATH 120A		MATH 104	MTH 111	MAT 1500	GEN CR
Macomb Community College	MATH 1415	MTH 107	MATH 105		MTH 122	GEN CR	MTH 103	MA 1030			MATH 120A		MATH 104	MTH 111	GEN CR	GEN CR
Mid Michigan Community College	MAT 107	MTH 107	MATH 105	MATH 115	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A			MTH 111		GEN CR
Monroe County Community College	MATH 157	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	MAT 1500	GEN CR
Montcalm Community College	MATH 159	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A			MTH 111	GEN CR	MATH 1180
Mott Community College	MATH 130	MTH 107	MATH 105	GEN CR		MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	GEN CR	GEN CR
Muskegon Community College	MATH 109	MTH 107	MATH 118	GEN CR	GEN CR	MATH 111	MTH 110	GEN CR	MA 103	MTH 1221	MATH 120B		MATH 104	MTH 111		MATH 1160
North Central Michigan College	MATH 130	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 105	MTH 111	GEN CR	GEN CR
Northwestern Michigan College	MTH 121	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	GEN CR	GEN CR
Oakland Community College	MAT 1540	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	GEN CR	GEN CR
Schoolcraft College	MATH 126	MTH 107	MATH 105	GEN CR	MTH 110	MATH 111	MTH 103		MA 111		MATH 140		MATH 104	MTH 111	MAT 1500	GEN CR
Southwestern Michigan College	MATH 127	MTH 107	MATH 105	MATH 115	MTH 122		MTH 103							MTH 111		MATH 1110
St. Clair County Community College	N/A															
Washtenaw Community College	MTH 176	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	GEN CR	GEN CR
Wayne County Community College District	MAT 155	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111	MTH 103	MA 1030	MA 111		MATH 120A		MATH 104	MTH 111	MAT 1500	GEN CR
West Shore Community College	MTH 151	MTH 107	MATH 105	GEN CR	MTH 122	MATH 111		MA 1030	MA 111		MATH 120A			MTH 111	MAT 1800	MATH 1180

College Algebra in Bachelor's Degree Pathways

A recent Michigan study sponsored by the Charles A. Dana Center at the University of Texas at Austin looked at minimum mathematics requirements in popular bachelor's degree programs at Michigan public universities. The findings suggest that mathematics skill levels and content associated with preparation for calculus are required in STEM fields such as Biology and Mechanical Engineering, as well as in Accounting, Business Administration and Marketing in over half of the universities offering these programs.

In 2018, MCCA and MASU will begin the process of creating multi-institutional associate to bachelor's degree transfer pathways in the top majors in the state. This research will inform discipline faculty as they select appropriate math pathways for programs of study in their disciplines and ensure articulated courses for transfer students. Read more about Michigan's Transfer Initiative [here](#).

University	Biology	Mechanical Engineering (Pre-Engineering)	Accounting	Business Administration	Marketing
Central Michigan University -- Mt. Pleasant	CAL	CAL	CAL	CAL	QR
Eastern Michigan University -- Ypsilanti	CAL or STAT	CAL	*	QR	*
Ferris State University -- Big Rapids	CA	QR	QR	QR	QR
Grand Valley State University -- Allendale	CAL or STAT	CAL	CA	QR	CA
Lake Superior State University -- Sault Ste. Marie	CA	CAL	CA	CA	CA
Michigan State University -- East Lansing	CAL	CAL	CAL	CAL	CAL
Michigan Technological University -- Houghton	CAL	CAL	CA	CA	CA
Northern Michigan University -- Marquette	QR	N/A	CA	QR	CA
Oakland University -- Rochester	CA	CAL	QR	QR	QR
Saginaw Valley State University -- Saginaw	QR	CAL	CA	CA	CA
University of Michigan -- Ann Arbor	CAL or STAT	CAL	N/A	CAL	N/A
University of Michigan -- Dearborn	CA	CAL	CA	CA	CA
University of Michigan -- Flint	CA	CAL	N/A	CAL	QR
Wayne State University -- Detroit	CA or STAT	CAL	STAT	STAT	STAT
Western Michigan University -- Kalamazoo	CAL	CAL	QR	CA	QR
CA= College Algebra					
CAL=Calculus					
QR=Quantitative Reasoning					
STAT=Statistics					
N/A= Program Not Offered					
NR= No Required Math Course					
* = Business Math/Specific to Institution					