

Fall 2019 Calculus Progression Study

Introduction

This report includes two studies that intend to answer the following questions:

1. How do students place in corequisite Pre-Calculus with Support and at what placement level?
2. What does progression through the Calculus sequence look like for first-time **corequisite** Pre-Calculus students?
 - a. How does it compare depending on students' placement scores?
3. What does progression through the Calculus sequence look like for **all** fall 2019 first-time Pre-Calculus students?
 - a. How does it compare depending on instruction method (corequisite, regular/traditional, and online/traditional)?

Study 1

The purpose of study 1 is twofold:

1. Examine fall 2019 corequisite students' **placement** into Pre-Calculus with Support
2. Examine fall 2019 corequisite students' **progression** through the Calculus sequence (MATH075/175 → MATH190 → MATH191)
 - a. Compare the progression of two groups of students:
 - i. Students who received a placement score that only gives them the option to enroll in Pre-Calculus with Support (score of 2035 or lower) versus
 - ii. Students who received a placement score that gives them the option to enroll in either regular Pre-Calculus or Pre-Calculus with Support (score of 2040 or higher)

Note: This study only includes students who took the Pre-Calculus with Support course (MATH075/175). Students who enrolled in regular Pre-Calculus (MATH175) sections were not included.

Table 1: Fall 2019 corequisite Pre-Calculus with Support students

Fall 2019 Course	Last Prior Course	Count	Category
MATH075/175	none	164	Directly Placed into MATH075/175
MATH075/175	Basic-skills course	9	Directly Placed into MATH075/175
MATH075/175	College-level course	23	Directly Placed into MATH075/175
MATH075/175	Transfer-level (excluding MATH175)	57	Progressed from previous course
MATH075/175	MATH175	7	Progressed from previous course
Total		260	

To summarize the categorizations:

1. If a student took a transfer-level course prior to fall 2019, they are categorized as “progressed from previous course”.
2. If a student’s last prior course is a basic skills or college-level course, they are categorized as “directly placed into MATH075/175” since they did not actually progress through the sequence to get to MATH075/175.
3. If a student has no prior course, they are categorized as “directly placed into MATH075/175”.

Table 2 below shows the placement scores of the 164 students with no prior math course. The majority of students (60%) received a score of 2025 which is considered the “open to all” placement score. Ninety-two percent of students with no prior math course at Citrus College received a score of 2035 or lower. In the old math sequence prior to AB705 legislation, these students would not have been eligible to enroll in Pre-Calculus. However, with the implementation of corequisite transfer-level courses with support, these students had the opportunity to enroll in a transfer-level course as their first math course at Citrus College.

There were 7 students who received a 2040 score which is the regular Pre-Calculus (MATH175) placement score. And there were 6 students who received a 2050 score which is the Calculus I (MATH190) placement score. With a score of 2040 or higher these 13 students had to option enrolled in regular Pre-Calculus but chose to enroll in corequisite Pre-Calculus with Support.

Table 2: Placement score of students with no prior math course

Placement Score	Count	Percent
2025 (entry-level placement; eligible for MATH075/175)	98	60%
2030 (eligible for MATH075/175)	18	11%
2033 (eligible for MATH075/175)	12	7%
2035 (eligible for MATH075/175)	23	14%
2040 (eligible for MATH075/175 or MATH175)	7	4%
2050 (eligible for MATH075/175 or MATH175)	6	4%
Total	164	100%

Table 3: Fall 2019 Calculus Progression of Students Grouped by Placement Score

Placement Score	Corequisite Pre-Calculus (MATH075/175)				Calculus I (MATH190)				Calculus II (MATH191)			
	Cohort Enrollment Count	Course Enrollment Percent	Success Count	Success Percent	Cohort Enrollment Count	Course Enrollment Percent	Success Count	Success Percent	Cohort Enrollment Count	Course Enrollment Percent	Success Count	Success Percent
placed at 2035 or lower	151	92%	72	48%	62	86%	43	69%	29	67%	17	59%
placed at 2040 or higher	13	8%	10	77%	7	70%	6	86%	6	100%	5	83%
Total	164	100%	82	50%	69	84%	49	71%	35	71%	22	63%

Persistence Rates:

Placed 2035 or lower

- **41%** (62/151) of the MATH075/175 cohort placed 2035 or lower persisted to MATH190
- **19%** (29/151) of the MATH075/175 cohort placed 2035 or lower persisted to MATH191

Placed 2040 or higher

- **54%** (7/13) of the MATH075/175 cohort placed 2040 or higher persisted to MATH190
- **46%** (6/13) of the MATH075/175 cohort placed 2040 or higher persisted to MATH191

Total

- **42%** (69/164) of the total MATH075/175 cohort persisted to MATH190
- **21%** (35/164) of the total MATH075/175 cohort persisted to MATH191

The data in Table 3 includes students’ who took Pre-Calculus with Support for the first time and compares the Calculus progression of students’ who placed at 2035 or lower versus those who placed at 2040 or higher. A placement score of 2035 or lower would place students in the corequisite Pre-Calculus course (MATH075/175). A placement score of 2040 or higher would allow students to take the regular MATH175 course. However, the 13 students in this cohort decided to take the corequisite Pre-Calculus with Support course.

An explanation of the numbers in Table 3:

1. MATH075/175 Cohort Enrollment and Percentage – This represents the 164 students that directly placed in corequisite Pre-Calculus (MATH075/175). This is the “starting cohort”.
2. MATH075/175 Course Success Count and Percentage – This is the count and percent of students enrolled in MATH075/175 who successfully completed the course.

3. MATH190 Cohort Enrollment and Percentage – This shows the count and percentage of successful MATH075/175 students that enrolled in MATH190. For example, 86% (62/72) of students that placed at 2035 or lower successfully passed corequisite Pre-Calculus (MATH075/175) and progressed through the sequence, enrolling in MATH190.
4. MATH190 Course Success Count and Percentage – This is the count and percent of students enrolled in MATH190 who successfully completed the course.
5. MATH191 Cohort Enrollment and Percentage – This shows the count and percentage of successful MATH075/175 students that enrolled in MATH191. For example, 67% (29/43) of students that placed at 2035 or lower successfully passed Calculus I (MATH190) and progressed through the sequence, enrolling in Calculus II (MATH191).
6. MATH191 Course Success Count and Percentage – This is the count and percent of students enrolled in Calculus II (MATH191) who successfully completed the course.

Below are some observations:

- Students placed at 2035 or lower had lower success rates in all three calculus courses compared to students placed at 2040 or higher.
- Students who placed at 2035 or lower and successfully passed Pre-Calculus progressed to Calculus I at a higher rate (86%, 62/72) than students placed at 2040 or higher (70%, 7/10). However, students who placed at 2035 or lower and successfully passed Calculus I progressed to Calculus II at a lower rate (67%, 29/43) than students placed at 2040 or higher (100%, 6/6).
- When examining the Calculus progression of both starting cohorts, students who placed at 2040 or higher persisted through the calculus sequence (i.e. from 075/175 → 190 → 191) at higher rate (46%, 6/13) than students placed at 2035 or lower (19%, 29/151).
- It is important to note that the two groups have uneven sample sizes. Only 8% of the cohort (13/151) placed at 2040 or higher.

The data in Table 4 is comparing students’ success through the Calculus sequence based on their placement score.

Table 4: Fall 2019 Calculus Progression of Students by Placement Score

Placement Score	Corequisite Pre-Calculus (MATH075/175)				Calculus I (MATH190)				Calculus II (MATH191)			
	Cohort Enrollment Count	Enrollment Percent	Course Success Count	Success Percent	Cohort Enrollment Count	Enrollment Percent	Course Success Count	Success Percent	Cohort Enrollment Count	Enrollment Percent	Course Success Count	Success Percent
2025	98	60%	43	44%	36	84%	24	67%	16	67%	11	69%
2030	18	11%	11	61%	9	82%	7	78%	4	57%	3	75%
2033	12	7%	4	33%	4	100%	3	75%	2	67%	1	50%
2035	23	14%	14	61%	13	93%	9	69%	7	78%	2	29%
2040	7	4%	6	86%	4	67%	4	100%	4	100%	3	75%
2050	6	4%	4	67%	3	75%	2	67%	2	100%	2	100%
Total	164	100%	82	50%	69	84%	49	71%	35	71%	22	63%

Study 2

For study 1 only corequisite students' progress was examined. In a follow-up study the scope was expanded to include all first-time Pre-Calculus students in fall 2019. Therefore, for the study 2 the purpose was to:

1. Examine **first-time Pre-Calculus students'** progression through the Calculus sequence (MATH075/175 or MATH175 → MATH190 → MATH191)
 - a. *Note:* This study only includes first-time Pre-Calculus takers in fall 2019. In other words, students included have not taken any prior math course at Citrus College.
2. Compare students' progression by Pre-Calculus instruction method. In fall 2019 there were three Pre-Calculus instruction methods:
 - a. **Corequisite** instruction (7 sections)
 - b. **Traditional** instruction of regular Pre-Calculus without corequisite support (4 sections)
 - c. **Online** instruction of regular Pre-Calculus without corequisite support (3 sections)

Table 5: Fall 2019 Pre-Calculus students

Instruction Method	No Prior Math	Has Prior Math	Total
Corequisite Math	164 (63%)	96 (37%)	260 (100%)
Traditional Regular Math	27 (28%)	68 (72%)	95 (100%)
Online Regular Math	29 (26%)	81 (74%)	110 (100%)
Total	220 (47%)	245 (53%)	465 (100%)

Table 5 displays the total fall 2019 Pre-Calculus (MATH075/175 or MATH175) enrollment disaggregated by instruction method. Out of the total 465 students enrolled, a little less than half (47%) were first-time MATH175 takers. When comparing by instruction method the majority of students in corequisite sections (63%) are enrolled in Pre-Calculus for the first time. In contrast, for students enrolled in regular Pre-Calculus without corequisite support, only 26% of students in online sections and 28% of students in traditional sections are first-time Pre-Calculus takers.

The large percentage of first-time Pre-Calculus takers in corequisite sections may speak to the original intention of AB705 which provides access to transfer-level coursework in mathematics to all students with the purpose of maximizing completion within a one-year timeframe.

The following data only includes students in the highlighted column in Table 5. These are students who have not taken any prior math course.

Table 6: Fall 2019 Calculus Progression of Students* by Instruction Method

Pre-Calculus Instruction Method	Pre-Calculus (MATH175)				Calculus I (MATH190)				Calculus II (MATH191)			
	Cohort Enrollment Count	Enrollment Percent	Course Success Count	Success Percent	Cohort Enrollment Count	Enrollment Percent	Course Success Count	Success Percent	Cohort Enrollment Count	Enrollment Percent	Course Success Count	Success Percent
Corequisite Instruction	164	75%	82	50%	69	84%	49	71%	35	71%	22	63%
Regular/Traditional Instruction	27	12%	11	41%	10	91%	8	80%	6	75%	6	100%
Regular/Online Instruction	29	13%	18	62%	6	33%	5	83%	3	60%	3	100%
Total	220	100%	111	50%	85	77%	62	73%	44	71%	31	70%

*Note: Only students with no prior Citrus College math course enrollment were included. In other words, the data in this table examines first-time Pre-Calculus takers.

Persistence Rates:

Corequisite Instruction

- **42%** (69/164) of the MATH075/175 cohort placed 2035 or lower persisted to MATH190
- **21%** (35/164) of the MATH075/175 cohort placed 2035 or lower persisted to MATH191

Regular/Traditional Instruction

- **37%** (10/27) of the MATH075/175 cohort placed 2040 or higher persisted to MATH190
- **22%** (6/27) of the MATH075/175 cohort placed 2040 or higher persisted to MATH191

Regular/Online Instruction

- **21%** (6/29) of the total MATH075/175 cohort persisted to MATH190
- **10%** (3/29) of the total MATH075/175 cohort persisted to MATH191

The data in Table 6 is comparing the Calculus progression of first-time Pre-Calculus by course instruction method.

An explanation of the numbers in Table 6:

1. MATH175 Cohort Enrollment and Percentage – This is the 220 students who enrolled in Pre-Calculus (MATH175) in fall 2019 and have no prior math enrollment at Citrus College. This is the “starting cohort”.
2. MATH175 Course Success Count and Percentage – This is the count and percent of students enrolled in MATH175 who successfully completed the course.

3. MATH190 Cohort Enrollment and Percentage – This shows the count and percentage of successful MATH075/175 students that enrolled in MATH190. For example, 84% (69/82) of students that successfully passed corequisite Pre-Calculus (MATH075/175) progressed through the sequence and enrolled in MATH190.
4. MATH190 Course Success Count and Percentage – This is the count and percentage of MATH190 takers who successfully completed the course.
5. MATH191 Cohort Enrollment and Percentage – This shows the count and percentage of successful MATH075/175 students that enrolled in MATH191. For example, 71% (35/49) of students that successfully passed corequisite Pre-Calculus (MATH075/175) continued through the Calculus sequence and enrolled in MATH191.
6. MATH191 Course Success Count and Percentage – This is the count and percentage of MATH191 takers who successfully completed the course.

Below are some observations:

- Students enrolled in online instruction of regular Pre-Calculus had the highest success rates in all three calculus courses.
- Students enrolled in traditional instruction and who successfully passed Pre-Calculus progressed to Calculus I at the highest rate (91%, 10/11). Similarly, students enrolled in traditional instruction and who successfully passed Calculus I progressed to Calculus II at the highest rate (75%, 6/8).
- When examining the Calculus progression of all three starting cohorts, students enrolled in traditional instruction persisted through the calculus sequence (i.e. from 075/175 or 175 →190→191) at the highest rate (22%, 6/27). Corequisite students had a similar persistence rate (21%, 35/164) through the Calculus sequence.