A Study of College Readiness for College Algebra

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Abstract

In this paper, we undertake a comparative study of students' performance in College Algebra for Fall 2007 and Fall 2008. We used assessment results for the 2007 semester to make schedule shifts in 2008 so as to address areas of weakest performance. In addition, we went from the traditional mode of teaching and learning in 2007 to the blended format of face-to-face lecture with web-based homework in 2008. Students' grades during this transition were examined to measure the combined effect of the adjustments and learning enhancement. Our results show that students' performance improved significantly in 2008 when the curriculum developments were implanted. However, we identified some topics that continued to pose a challenge. In order to check the validity of our placement criteria, we also analyzed correlations between students' performance in College Algebra and four factors, namely, cumulative college GPA, high school GPA, SAT scores in mathematics and ACT scores in mathematics. There was a correlation between performance in College Algebra and each of the four factors that we considered. Cumulative college GPA, followed by high school GPA, exhibited the strongest correlation. Standardized test scores showed low correlations with success rates in College Algebra. Results of our study are consistent with reports of other recent studies including those of Gore (2006), and Stumpf & Stanley (2002).We proffer suggestions regarding curriculum development in College Algebra as well as placement criteria for the course.

Introduction

College readiness is a continuing topic of interest for high school students, educators, and parents in today's changing academic terrain. Loosely defined, college readiness is a proficiency level which, when attained, equips the student to begin college-level studies without remediation. Although college entry requirements are non-uniform across the United States, school districts and states dictate minimum standards that are aligned with some reference beacon such as the success rate of students in an area-specific college course at the freshman level. For instance, in the State of Florida, a student must satisfy the general studies (GS) as well as the Gordon Rule (GR) requirements in order to receive a baccalaureate degree. Those GS/GR requirements in the area of mathematics dictate that the student must show proficiency in two courses at or above College Algebra level. For a variety of reasons, the most popular choice for students to satisfy one of the two GS/GR requirements in mathematics is

College Algebra. It is, thus, reasonable to associate the students' performance in College Algebra with their college readiness in the area of mathematics. However, as reported in *ENLACE Florida* (2009), the success rate of the students in College Algebra among the institutions in the State University System of Florida has been lower than desirable. In order to rectify this situation, colleges often turn to two natural areas of concern: the teaching and learning of College Algebra; and students' readiness to take the course on graduating from high school.

On the one hand, many institutions of higher learning have focused on improving the teaching and learning of College Algebra. In this regard, new teaching methods coupled with the use of emerging instructional technologies have been utilized, so have assessment rubrics that are deployed to measure success. It is to be noted that while some studies have attributed improved success rates to these new initiatives, other reports such as that of Li, Uvah, Amin, & Hemasinha (2009) show that similar initiatives have not recorded significant improvements. See also Barnes, Cerrito, & Levi (2004), Hauk & Segalla (2005), O'Callaghan (1998), Smith & Ferguson (2005), and Stephens & Konvalina (1999). In order to improve the teaching and learning of general studies courses, hence the retention and graduation rates, we in the Department of Mathematics and Statistics at the University of West Florida (UWF) have performed a series of assessments on GR/GS courses as reported in Li (2008) and Li (2009). Since the curriculum in College Algebra is dictated by a system-wide list of topics to be covered, curriculum development in this course has been restricted to shifts in focus by means of time spent on targeted topics and method of delivery. Aside from experimenting with a few sections of fully online classes, we recently implemented a blended learning approach by means of a web-based homework system with face-to-face instruction in sections of College Algebra during Fall 2008 as a direct reaction to results of assessments. Among other things, our analyses documented in Li et al. (2009) showed that there was no significant improvement in students' performance in College Algebra classes during the transition in mode of delivery. Furthermore, the overall performance of students in the online classes was worse than that of the face-to-face classes with or without the web-based homework platform.

Recent studies indicate that universities and colleges are also investigating the issue of college readiness with the goal of addressing the lackluster performance in college mathematics courses. See, for instance, Allen & Sconing (2005), Conley (2007), Greene & Foster (2003), Greene & Winters (2005), and *The nation's report card* by Shettle et al. (2007). In order to be considered "college ready", students must overcome three crucial hurdles, namely: graduating from high school; taking certain specified courses in high school that colleges require for the acquisition of necessary skills; and demonstrating basic literacy skills. Research has shown that many first year students find the nature of college courses to be fundamentally different from that of their high school courses. Conley (2007) has also reported that, in some instances, high school teachers select course content based largely on their skills and personal interests, rather than on what students need in order to succeed in college. These, among other traits, are known to account for students' poor performance in college mathematics. In fact, the Florida Department of Education, FDOE (2007), has published a set of college readiness criteria that is directly linked to the state academic standards with the belief that students who achieve at specified levels would be prepared for college mathematics courses without a need for remedial curriculum. However, despite increased requirements for high school graduation, almost one-third of the nation's college freshmen are said to be unprepared for college-level mathematics. It is noteworthy that remediation is particularly high among students from low income families, Hispanics, and African Americans. Similarly, Long, Iatarola, & Conger (2009) have asserted that female students are also less likely than their male counterparts to be ready for college-level mathematics.

In this article, we identify the content areas of College Algebra in which students at UWF have performed well and those in which students' performance has continued to be poor. We analyze data from Fall 2007 and Fall 2008 as well as scores on the standardized ACT and SAT tests that were used to place students in College Algebra at UWF during the period in question. For the group of students under study, we analyze their high school grade point averages (GPA) and college GPA where these exist, to investigate correlations with their performance in College Algebra. Since we adjusted our curriculum for College Algebra in Fall 2008 based on our assessment of students' performance in 2007, we also analyze the impact of this adjustment. Among other things, our analyses show (a) an improvement in students' learning and success after the curriculum shift, (b) various *degrees* of correlation between performance on the standardized tests, high school GPA, and college GPA on the one hand, and success in College Algebra, hence in college readiness for mathematics, on the other hand. While suitable substitutes (such as placement tests) for admitting students into beginning mathematics courses may not be uniformly attractive, our analyses show that raising the cut-off points on the standardized tests scores for placement does not necessarily translate into higher success rates in College Algebra. We show that high school records and cumulative college grade point averages are more reliable indicators of performance in College Algebra than standardized tests. Since most of the students at UWF graduate from local area high schools, the results of this study provide invaluable information regarding college readiness for mathematics, for high school graduates in the Northwest Florida region. Not only could these results enhance further development of the College Algebra curriculum, they may also be useful to universities and colleges, especially institutions whose admission criteria are similar to UWF's in a regional, comprehensive setting. We proffer suggestions for college readiness and curriculum development in mathematics based on our analyses and cumulative experiences in dealing with these and similar issues.

Student Performance in College Algebra

Prior to the assessment period of interest, the department decided that qualitative reasoning and problem-solving were the appropriate domains for assessing GS/GR mathematics. Consequently, we set student learning outcomes (SLO) for College Algebra within those domains and have continued to use them as our measurable course objectives for several years. The following are the SLO:

On successful completion of College Algebra, student will be able to:

1. Identify (algebraic and transcendental) functions and their properties;
2. Analyze and graph polynomial, rational, radical, exponential, and logarithmic functions;
3. Perform operations on algebraic and transcendental functions;
4. Solve exponential and logarithmic equations, and systems of linear equations; and
5. Solve problems involving application of algebraic and transcendental functions.

A Coordinator of Lower Division Courses oversees the GS/GR curriculum in the department. The coordinator helps to maintain quality through uniformity in the teaching and learning of this important GS/GR course. All sections of the course have the same syllabus with clearly specified weekly topics as well as scheduled homework assignments. Similar-strength hourly tests are given within a specified week for all sections and a uniform, comprehensive final examination is given at the end of the semester. During the period under study, the 40 problems on the uniform final examination were carefully chosen based on the SLO. Course instructors jointly graded the examinations such that one instructor graded designated problems for all sections in order to enhance uniformity. We assessed students' qualitative reasoning and problem-solving ability using the data from the comprehensive final examination exclusively.

Student Performance in Content Areas

In Fall 2007, there were 397 students who took the College Algebra final examination. In order to investigate areas of proficiency and deficiency in student performance, we mapped each problem on the examinations to the learning outcome that the problem helped to measure. Table I shows the examination problem numbers and their corresponding SLO (as above). We identified examination questions for which more than 40% of students' responses were incorrect and those for which at least 80% of the responses were correct. Question numbers and their material content for which more than 40% of the students provided incorrect responses are shown in Table II. Furthermore, students performed well in several content areas as shown in Table III.

A department committee consisting of two faculty members collected and compiled the assessment results from Fall 2007. Based on those results, the committee recommended that instructors spend more time with the students on the topics related to the questions with high incorrect responses (identified in Table II). It was also recommended to review the formulation of related examination questions for clarity and precision. On accepting the committee recommendation with further faculty input, the department decided to adjust the course syllabus, weekly schedule of topics covered, and homework assignments for 2008. In particular, one more lecture time was added to each of the following topics: domain and range of functions, sketching graphs, exponential functions, and logarithmic functions. These lecture times were recovered from topics on which the 2007 group showed high proficiency: equations of lines, quadratic functions, and system of linear equations. In addition, all sections of College Algebra were taught with the help of web-based software for homework. The 2008 assessment data and the students' comments showed that these measures enhanced students' learning. The committee monitored the implementation across semesters to perform quality control on the adjustment measures themselves.

In Fall 2008, 448 students in College Algebra classes took the final examination. As before, the 40 problems were chosen to correspond to the SLO as shown in Table IV below. Results of the final examination showed that students performed poorly on the content areas shown in Table V. From the two-year data (Table II and Table V), it is clear that the students performed poorly on the some topics before and after the curriculum adjustment and delivery enhancement. Notably, the following topics continued to present problems:

1. Finding the domain and range of functions, especially rational and piece-wise functions;
2. Composite of functions and their operations;
3. Sketching graphs of piece-wise functions and rational functions;
4. Identifying zeros with multiplicities, of polynomials and using this information to graph;
5. Logarithmic and exponential functions; and
6. Solving logarithm and/or exponential equations.

Although the number of lectures was increased for topics such as domain and range, sketching graphs, as well as exponential and logarithmic functions, we observed from the data that there were only modest gains in students' performance on these topics.

ACT and SAT Scores vs. Students' Performance in College Algebra.

Mathematics scores for the SAT and ACT tests constitute the primary tools for placing students in College Algebra at UWF. It is, therefore, pertinent to examine the relation between students' performance in College Algebra and their respective SAT and ACT scores. Typically, students have either an SAT score of at least 520 or an ACT score of at least 22 in mathematics to be placed in the course. A second group of students to be found in College Algebra classes may have had SAT or ACT scores that were below the published cut-off points for placement in the course. Such students usually take the Intermediate Algebra course, a stepping-stone to College Algebra as well as other GS/GR courses. Students who take the Intermediate Algebra course receive generic GS credit but such credit does not count towards the GR requirement. A third group of students in College Algebra may not have SAT or ACT scores on record at UWF. The vast majority in this small group may register for the course without showing evidence that they satisfy the above criteria because they are advanced students (usually juniors or seniors) who transferred to UWF from two-year colleges with sufficient general education hours to be exempted from UWF guidelines for placement in lower division courses. In the sequel, we examine the passing rates in College Algebra during Fall 2007 and Fall 2008. We compare students' performance for the two semesters in question, by whole group and by subgroups with respect to placement tests scores as identified above. Since most majors require a grade of at least C in College Algebra, we classify grades of A, B, and C as passing grades. Accordingly, grades of less than C (i.e., C-, D, F) and early withdrawal (W) are classified as failing grades for our purposes in this study.

Of the 502 students who registered for College Algebra in Fall 2007, 464 had either SAT or ACT scores in mathematics. These scores ranged from 410 to 710 for the SAT, and from 12 to 34 for the ACT. In Fall 2008, the number of students who registered for College Algebra was 536, of which 501 had SAT or SAT scores for mathematics. Those scores ranged from 410 to 700 in the SAT and from 12 to 31 on the ACT. We note that the ranges of the standardized test scores for the two groups were comparable.

Student Performance: Fall 2007 vs. Fall 2008

In Fall 2007, instruction in College Algebra was mainly the traditional face-to-face instruction with pencil and paper homework. Following the assessment of student performance in 2007, the department implemented a number of measures to enhance students' learning in the course as described above. Notably, beginning in Fall 2008, we decreased the number of lectures for topics on which the 2007 students showed high proficiency and allotted more time to those topics in which students had the greatest difficulty. In addition, we moved from the traditional face-to-face lecture with pencil and paper homework to face-to-face lectures with web-based homework. We now analyze the effect of the measures we implemented by comparing passing rates in 2008 with those of Fall 2007 in a variety of similar subgroups. Table VI shows the grade distributions for the entire groups that registered for College Algebra in Fall 2007 and Fall 2008, respectively.

We performed statistical tests of the difference in proportion to determine if the difference in success rates (grades of at least C) between the student groups in 2007 and 2008 was significant. The 95% confidence interval was (-0.122, -0.012), with p-value of 0.017. This shows that the difference in passing rates for 2007 and 2008 was indeed statistically significant. Moreover, it can be seen from Table VI that the passing rates for the entire groups increased from 67.7% in 2007 to 74.4% in 2008. While the percentage of students who completed the course but earned failing grades (below C) remained stagnant (16.5% and 15.9% in 2007 and 2008, respectively), it is noteworthy that the rate of withdrawal dropped sharply from 15.7% in 2007 to 10.1% in 2008.

We now turn to the groups with SAT scores of at least 520 or ACT scores of at least 22. Our guidelines for placement make this group important because they meet the requirement for placement into College Algebra without remediation. Table VII shows the grade distributions for this subgroup for the 2007 and 2008 semesters of interest. The respective passing rates were 73.7%

and 81.2% for 2007 and 2008. Aside from the fact that the failing rate (grades below C and early withdrawal) fell from 26.3% in 2007 to 18.8% in 2008, we observe that the percentage of students that withdrew also dropped from 10.7% in 2007 to 7.6% in 2008.

The data for students whose scores were below the cut-off points were also examined. As explained above, these represent mainly students who had remediation by means of Intermediate Algebra. As can be seen from the grade distribution for this subgroup (Table VIII), the passing rate was 60.7% for 2007 and 68.9% for 2008. As with the earlier groups, the data also show an appreciable drop in the percentage of early withdrawal, from 20.2% in 2007 to 10.2% in 2008. In contrast, the ratio of students who completed the course but earned failing grades increased slightly from 19.1% in 2007 to 20.9% in 2008.

For the group with no SAT or ACT scores, our data show that their performances in 2007 and 2008 were comparable. Table IX shows that they had passing rates of 57.9% and 57.1% in 2007 and 2008, respectively. Similarly, the rates of withdrawal were 31.6% in 2007 and 28.6 in 2008.

GPA, Standardized Tests Scores, and Success in College Algebra

As with many institutions in the United States, our students' scores on standardized tests such as the SAT and ACT are used for placement into freshman-level courses with an implicit understanding that scores beyond stipulated cutoff points indicate a readiness for those courses. However, there is evidence in the research literature to suggest that these tests may not be reliable predictors of performance in college studies. Gore (2006), and Stumpf & Stanley (2002), for example, have shown that high school grades are a better indicator of four-year college outcomes than the standardized tests. In order to investigate the relationship between performance in College Algebra and various other factors, we used the Statistical Analysis System (SAS), to perform deeper statistical analysis on the 2007 and 2008 group of students in College Algebra. Specifically, the objective was to investigate the relationships between students' grades in College Algebra (CAGRS) and four factors, namely, college cumulative GPA (CCGPA), high school GPA (HSGPA), SAT mathematics scores (SATMS), and ACT mathematics scores (ACTMS).

The students' grades in College Algebra (A, B, C, D, F/W) were converted into equivalent grade-point scores (4, 3, 2, 1, 0) in the manner identical to that used for computing cumulative GPA at UWF. In order to test the relationships among these factors, the Pearson Correlation Test was applied. See Table X for Pearson correlation coefficients. The results show that:

1. There was a correlation between students' performance in College Algebra and each factor considered.
2. College GPA and high school GPA had strong correlations with students' performance in College Algebra, with college GPA showing the strongest correlation. The standardized tests exhibited very weak correlations with students' performance in College Algebra.

In order to examine the nature of the relationships that existed, Analysis of Variance (ANOVA) was performed. The factors CCGPA, HSGPA, SATMS, and ACTMS were each divided into four levels as shown in Table XI. The classification of CCGPA and HSGPA were defined using the 25th, 50th, and 75th percentiles as internal boundaries. Cutoff points were used to define the various levels for the standardized test scores. We first used the Wilks-Shapiro Test to ascertain the normality of the 2007 and 2008 College Algebra scores. Since the data were not normal, we transformed them into normalized scores before testing for interactions. The test showed that there were no significant interactions among the factors. We then performed the ANOVA based on ranks, to compare the mean levels of College Algebra scores for the four effects of interest: CCGPA, HSGPA, SATMS, and ACTMS. Each of these four factors was found to be statistically significant relative to students' performance in College Algebra, at 0.05 significance level and p-values either 0.0001 or 0.0098. The implication here is that within each factor, the mean College Algebra scores differed for at least two levels. Further, we utilized the Tukey's Test, also at significance level of 0.05, to determine the differences of the level means for each factor. The following summarizes our findings in this regard:

1. For the college cumulative GPA, the mean College Algebra scores differed significantly from level to level in a monotonic manner. That is, each level differed from all other levels and the higher the CCGPA, the higher the mean College Algebra score.
2. With respect to the high school GPA, Level 1 and Level 2 had means that did not differ significantly from each other. In contrast, each of Level 3 and Level 4 differed significantly from the rest in mean College Algebra scores.
3. In the case of the SAT mathematics scores (SATMS), Level 4 differed significantly in its mean of College Algebra scores from each of the other levels. However, there was no significant difference in College Algebra means among Level 1, Level 2, and Level 3.
4. For the ACT mathematics scores, the top group (Level 4) had significantly higher College Algebra scores than the rest of the levels. While Level 2 and Level 1 also exhibited significant differences in mean College Algebra scores, the difference between mean scores for Level 2 and Level 3 was not significant.

Of the four factors studied, the correlation between college GPA and performance in College Algebra was the highest. This was followed by performance in high school as determined by the high school GPA. In the case of the standardized test scores, their respective top groups (i.e. SAT of at least 560 and ACT of at least 24) were the only reliable indicators of performance in College Algebra.

Conclusions

Summary of Findings

College Algebra is one of the important introductory courses to a college education for many majors in colleges and universities. In order to enhance students' performance in College Algebra at UWF, we performed assessments of students' performance and then adjusted the schedule of topics to focus on areas in which our students were weakest. In addition, we transited from the traditional mode of instruction to a blended format with web-based homework and re-assessed students' performance. A comparative study of our students' performance during this transition as well as students' GPAs in high school and in college reveals interesting traits. Among other things, our study shows that:

- Adjusting the College Algebra curriculum by devoting more time to problem areas and modifying the homework platform to a tech-mediated format yielded better success rates in each placement category: entire group, SAT<520 or ACT<22, minimum SAT of 520 or ACT of 22, and no SAT or ACT scores. Differences in success rates were statistically significant. We conclude that these two methods of curriculum development proved to be moderately useful in this case.
- In spite of the schedule shifts and introduction of tech-mediated homework, certain problem areas remained, notably, exponential, logarithmic, rational, and piece-wise functions. While the state-mandated curriculum presents less flexibility in College Algebra, these problem areas must be addressed in order to significantly enhance students' performance in the course.
- There was a correlation between performance in College Algebra and the factors that we considered: cumulative college GPA, high school GPA, SAT mathematics scores, and ACT mathematics scores. College GPA exhibited the strongest correlation with a correlation coefficient of 0.70739, followed by high school performance that had a correlation coefficient of 0.444270. Standardized test scores showed low correlations (the coefficients were 0.29590 for SAT and 0.29304 for ACT.)
- Aside from differing degree of correlations, a distinguishing feature in the nature of the correlations was in the fact that the higher the college or high school GPA, the better the performance in College Algebra, but a similar statement concerning the standardized tests could only be made for the subgroup with rather high SAT or ACT scores (at least 560 on the SAT or 24 on the ACT). In fact, differences in performance among various segments on the score spectrum for the standardized tests below these thresholds were neither significant nor did they exhibited any well-defined pattern.

We conclude from these analyses, that the scores on the SAT/ACT may not be good indicators of performance in College Algebra and that students' overall records (high school or college) are perhaps more reliable indicators. Our results are in agreement with reports of more robust studies that examine predictors of students' performance beyond the freshman year. See Geiser & Santelices (2007). It was clear, however, that students with scores of less than 520 on the SAT in mathematics or 22 on the ACT performed poorly, while students with at least 560 on the SAT or 24 on the ACT in mathematics performed well. This situation leaves a large group of students in the middle whose success may not be reasonably predicted by their scores on those tests. The above findings show that our current practice of utilizing SAT and ACT scores to place students in College Algebra and other GS/GR courses may not be valid. The current cutoff points of 520 on the SAT or 22 on the ACT for placement in College lie far below the 560 on the SAT or 24 on the ACT, where there is a close relationship between test scores and performance in the course. It should be noted that raising cutoff points for placement would have a tradeoff in terms of loss of students in College Algebra and needless delay in subsequent graduation for many students. Thus, lifting the floor for placement to 560 on the SAT and 24 on the ACT will result in a disproportionate loss of students in the course. Many of the students to be held back by such action have succeeded in College Algebra in spite of their standardized test scores.

Suggestions and Recommendations

- In order to improve success rates in College Algebra, departments may need to (a) devise viable methods of placing students into the course; (b) assess students' performance with the goal of identifying areas of greatest strength and, more importantly, of greatest weakness; (c) adjust the scheduled time to be spent on various topics by allotting more time to areas of greatest weakness which are gains from shortening the time spent on areas of greatest strength; (d) modify the mode of instruction such as the platform for homework and/or the mode of lecture (face-to-face is best) (e) re-assess success of curriculum shifts until an optimum is achieved.
- College records in all courses taken, where they exist, are perhaps the best indicators of performance in College Algebra. Where such college records are unavailable, colleges may rely on high school records for placement in College Algebra. Placement criteria may exclude scores on the ACT and SAT since these are not reliable predictors of success in college.
- We should devise alternative ways to deal with areas of concern that persist after curriculum shifts. For instance, we should introduce logarithmic and exponential functions in Intermediate Algebra even if only briefly, because most students who encounter these functions for the first time in College Algebra are overwhelmed by the rigor and apparent complexity of the material.
- A concerted effort should be made to keep tab on effects of tweaks and adjustments to the College Algebra curriculum for quality control and this should be a continuing process. Assessment of results should be made at the end of each semester. These, of course, may not be meaningful unless there are clearly defined and measurable course objectives, a unified course curriculum, a weekly schedule of topics and minimum assignments, similar hourly tests, and a uniform comprehensive final examination for all sections of the course.
- An early warning system by which students who are performing below expectation are flagged and counseled in a timely manner, so they may make mid-stream adjustment in study habits and concentration.

Table I
SLO and Question Numbers - Fall 2007

SLO	Question Number
1	3,4,5,6,7,8,9,10,11
2	1,2,12,13,14,16,17,18,19,20,21,22,23
3	24,25,26,27,28,29,30,31,32,33,34
4	15,38,39
5	35,36,37,40

Table II
Fall 2007 - Areas of Low Performance (> 40% incorrect responses)

Question Number	Content Area
6	Finding the domain and range of a function
17	Finding zeros with their multiplicities, of a polynomial function
19	Matching a graph to an equation of a rational function
24	Finding the composition of two functions
27	Converting a logarithmic expression to its exponential equivalent
29	Finding the domain of a logarithmic function
32	Finding the value of a logarithmic expression
33	Solving an exponential equation

Table III
Fall 2007 - Areas of High Performance (> 80% correct responses)

Question Number	Content Area	Correct Responses (%)
8	Finding the equation of a straight line	90
9	Evaluating a given function	92
10	Finding the x-intercepts, y-intercept, and vertex of a parabola	97
13	Finding the x- and y-intercepts, and vertex of a parabola, and graphing it	94
19	Finding vertical asymptote(s) of a rational function	88
20	Finding a horizontal asymptote of a rational function	85
27	Converting an exponential equation into its logarithmic form	90
40	Solving a system of linear equations	93

Table IV
SLO and Question Numbers - 2008

SLO	Question Number
1	1,2,4,5,7,8,9,10,11,16,17,25,29
2	6,14,22,23,28,30
3	12,13,18,19,20,21,24,26,27,32,33
4	3,15,38,39,40
5	31,35,36,37

Table V
Areas of Low Performance - 2008

Question Number	Content Area	Incorrect Responses (%)
6	Determining the domain and range of a given function	43%
11	Matching a given graph to a piece-wise function	39%
16	Determining whether a given function is a polynomial; if so, naming its degree	36%
17	Identifying zeros/multiplicities of a given polynomial function	46%
18	Finding the domain of a rational function	38%
23	Graphing a polynomial function using its zeros/multiplicities, and degree	23%
24	Finding the composition of two functions where one of them was rational	47%
32	Finding the value of a logarithmic expression using several properties of logarithm	71%
35	Solving a logarithmic equation	42%

Table VI
2007 & 2008 Grade Distribution for All Students

Grade	**2007**		**2008**	
	Frequency	%	Frequency	%
At least C	340	67.73	399	74.44
Below C	83	16.53	85	15.86
Withdrew	79	15.74	54	10.07
Totals	**502**	**100**	**536**	**100**

Table VII
2007 & 2008 Grade Distribution for SAT $\geq$ 520 or ACT $\geq$ 22

Grade	2007		2008	
	Frequency	%	Frequency	%
At least C	207	73.67	224	81.16
Below C	44	15.66	31	11.23
Withdrew	30	10.68	21	7.61
Total	**281**	**100**	**276**	**100**

Table VIII
2007 & 2008 Grade Distribution for SAT<520 or ACT<22

Grade	2007		2008	
	Frequency	%	Frequency	%
At least C	111	60.66	155	68.89
Below C	37	20.22	47	20.89
Withdrew	35	19.13	23	10.22
Totals	**183**	**100**	**225**	**100**

Table IX
2007 & 2008 Grade Distribution: Students with no SAT or ACT Scores

Grade	2007		2008	
	Frequency	%	Frequency	%
At least C	22	57.89	20	57.14
Below C	4	10.53	5	14.29
Withdrew	12	31.58	10	28.57
Totals	**38**	**100**	**35**	**100**

Table X
Pearson Correlation Coefficients

	CAGRS	CCGPA	HSGPA	SATMS	ACTMS
CAGRS	1.00000	0.70739	0.44270	0.29590	0.29304
CCGPA	0.70739	1.00000	0.40194	0.15246	0.18580
HSGPA	0.44270	0.40194	1.00000	0.15943	0.18580
SATMS	0.29590	0.15246	0.15943	1.00000	0.67835
ACTMS	0.29304	0.18580	0.18580	0.67835	1.00000

Table XI
Levels of Factors

Factor	Level 1	Level 2	Level 3	Level 4
CCGPA	< 2.39	[2.39, 2.90)	[2.90, 3.33)	[3.33, 4.00]
HSGPA	< 2.90	2.90, 3.30	[3.30, 3.70)	[3.70, 4.00]
SATMS	< 520	[520, 539]	[540, 559]	≥ 560
ACTMS	< 22	22	23	≥ 24

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