FAIRMONT STATE UNIVERSITY

MEMORANDUM

TO: Faculty Senate

FROM: Jack Kirby

DATE: October 26, 2016

SUBJECT: Curriculum Proposal #16-17-03

Math Support Simplification

I recommend approval of the attached Curriculum Proposal 16-17-03. This proposal seeks to create two new courses (MATH 1407 & 1430), deletion of MATH 1001, 1007, & 1012, and modifications to the name, course number, and pre-requisites for MATH 1011 (to be MATH 1400).

Dr. Christina Lavorata
Dr. Donald Trisel
Ms. Beth Thompson
Ms. Leslie Lovett
Ms. Laura Ransom
Dr. Shayne Gervais

FAIRMONT STATE UNIVERSITY

MEMORANDUM

TO: Curriculum Committee

FROM: Jack Kirby JRK

DATE: October 11, 2016

SUBJECT: Curriculum Proposal #16-17-03

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CURRICULUM PROPOSAL (Submit one hard copy and an electronic copy to the Associate Provost by the second Tuesday of the month.)

Proposal Number:	16-17-03
School/Department/Program:	SciTech/Math/Math Support
Preparer/Contact Person:	L. Beth Thompson
Telephone Extension:	4722
Date Originally Submitted:	October 7, 2016
Revision (Indicate date and label it Revision #1, #2, etc.):	
Implementation Date Requested:	Fall 2017

I. **PROPOSAL**. Write a brief abstract, not exceeding 100 words, which describes the overall content of the proposal.

The Math Support Program began as a pilot in Fall 2014. It currently includes four distinct courses (MATH 1001, 1007, 1011, & 1012), three of which utilize co-requisite support for gateway courses. Unfortunately, the current system is complicated and cannot provide a simple means for placement and self-registration. To resolve numerous registration inconsistencies and simplify placement, this proposal requests:

i. the creation of two new courses (MATH 1407 & 1430) with integrated support.

ii. the deletion of MATH 1001, 1007, & 1012

iii. modifications to the name, course number, and pre-requisites for MATH 1011. The new number will be MATH 1400.

II. **DESCRIPTION OF THE PROPOSAL**. Provide a response for each letter, A-H, and for each Roman Numeral II–V. If any section does not apply to your proposal, reply N/A.

A. Deletion of course(s) or credit(s) from program(s)

The following course numbers will be deleted and removed from the catalog:

MATH 1001: Applied Technical Math I Support

MATH 1007: Fundamental Concepts of Mathematics Support

MATH 1012: College Algebra Support

Total hours deleted. N/A

B. Addition of course(s) or credit(s) from program(s)

Total hours added. N/A

C. Provision for interchangeable use of course(s) with program(s)

Any student requiring *College Algebra* credit will receive this credit by completing either MATH 1430 or MATH 1530. The student's prerequisite level will determine which course is appropriate.

Any student requiring *Fundamental Concepts of Mathematics* credit will take MATH 1407 or MATH 1507. The student's prerequisite level will determine which course is appropriate.

In any case, NO student may receive credit for both MATH 1430 and MATH 1530.

Similarly, NO student may receive credit for both MATH 1407 and MATH 1507.

D. Revision of course content. Include, as an appendix, a revised course description, written in complete sentences, suitable for use in the university catalog.

MATH 1007 + 1107 will become MATH 1407
The content of the current courses, *MATH 1007: Fundamental Concepts of Mathematics Support* and *MATH 1107: Fundamental Concepts of Mathematics*, will be combined into a single course with integrated support, *MATH 1407: Fundamental Concepts of Mathematics with Support.*

MATH 1012 + 1112 will become MATH 1430
The content of the current courses, *MATH 1012: College Algebra Support* and *MATH 1112:College Algebra*, will be combined into a single course with integrated support, *MATH 1430: College Algebra with Support.*

E. Other changes to existing courses such as changes to title, course number, and elective or required status.

Current course: *MATH 1011: Pre-College Algebra*

Proposed change: *MATH 1400: Foundations of Algebra*.

Because of the course number changes being adopted in both introductory math and math support courses, it is requested that *MATH 1011* be changed to *MATH 1400*. Also, a name change is requested to provide a better indication of the content included in the course.

Note: Other proposed course number changes within the math department will be covered in a separate curriculum proposal. For cross-referencing purposes, the following table summarizes the proposed course number changes referenced in this proposal.

Current Course Number	Proposed Course Number
1001	Delete
1007	→combine with 1107 to make 1407
1011	1400-No Gen Ed Credit
1012	→combine with 1112 to make 1430
1101	1510
1102	1520
1107	1507
1112	1530

**Table provided courtesy of Joseph Riesen*

F. Creation of new course(s). For each new course

1. Designate the course number, title, units of credit, prerequisites (if any), ownership (FSU or shared) and specify its status as an elective or required course. If you are creating a shared course, attach a memo from the Deans of the affected Schools explaining the rationale for the course being shared.

MATH 1407 – *Fundamental Concepts of Math with Support* – 4.0 credit hours – PR: admission to FSU. No minimum test score requirement. FSU owned course. Required for students seeking credit for *Fundamental Concepts of Math* that do not meet the pre-requisite test score (math ACT score of 19 or equivalent) for direct entrance into MATH 1507. This course satisfies the same requirements as MATH 1507. Under no circumstances may a student receive credit for both MATH 1407 & 1507.

MATH 1430 –*College Algebra with Support* – 4.0 credit hours – PR: Math ACT 19-20 or equivalent* or a C or better in MATH 1400: Foundations of Algebra (or previously MATH 1011: Pre-College Algebra). FSU owned course. Required for students seeking credit for *College Algebra* credit that do not meet the pre-requisite test score for direct entrance into MATH 1530. This course satisfies the same requirements as MATH 1530. Under no circumstances may a student receive credit for both MATH 1430 & 1530.

* *See* ***Appendix B: Math Placement Chart*** *for complete list of equivalent test scores.*

Also, see* ***Appendix C: Proposed Math Support Pathways *for information about placement within desired curricular pathways.*

2. Include, as an appendix, a course description, written in complete sentences, suitable for use in the college catalog.
   - See ***Appendix D: Course Descriptions***

3. Include, as an appendix, a detailed course outline consisting of at least two levels.
   - See ***Appendix E: Course Outlines***

4. In order to meet the requirements as outlined in Goal One of the Strategic Plan, please include Outcome Competencies and Methods of Assessment as an appendix. Examples are available upon request from the Chair of the Curriculum Committee.
   - See ***Appendix F: Outcome Competencies and Assessment***

G. Attach an itemized summary of the present program(s) affected, if any, and of the proposed change(s).

Describe how this proposal affects the hours needed to complete this program. Specifically, what is the net gain or loss in hours? Use the format for Current and Proposed Programs in Appendix A.

Students who take integrated course 1407 or 1430 will complete their program of study with one additional hour than students who were able to register directly into 1507 or 1530 based upon math placement test scores in appendix B.

III. **RATIONALE FOR THE PROPOSAL**.

A. **Quantitative Assessment**: Indicate the types of assessment data, i.e., surveys, interviews, capstone courses, projects, licensure exams, nationally-normed tests, locally developed measurements, accreditation reports, etc., that were collected and analyzed to determine that curricular changes were warranted. Quantitative data is preferred.

The predominant change being requested in this proposal centers around streamlining and simplifying the current math support choices and allowing a method by which students (and their advisors) will be able to accurately place and register for math support courses. The current math support courses all begin with 10xx, while the other introductory math courses begin with 11xx. This alone is a cause of confusion, and it can be confusing distinguishing between the current courses MATH 1001, 1101, and 1011, for example.

In addition, the co-requisite support courses must be taken with the required gateway course. This means, for instance, that some students need to take MATH 1101 alone, while others must sign up for MATH 1001 + 1101, and the system cannot readily allow some students "in" and only let others in if they are also enrolled in a different course as well. The Registrar, the Math Support Coordinator, and the Dean of Science and Technology have exhausted efforts to make this happen. They all also agree fully upon the proposed solution.

The Math Support program provided courses to nearly 700 students in the 2015-16 academic year. Most of these students required assistance with course choice, placement, and enrollment, predominantly due to registration issues that cannot be fixed with the current course number scenario. Many of the hundreds of students that enrolled in a math support course had to obtain a course override and/or change their course schedule after enrolling in courses to meet the posted course requirements. This is not an efficient, sustainable long-term system, particularly when considering strategies to encourage and empower students and improve retention rates.

With the support courses rapidly filling to capacity, the numerous overrides that are required, and the often-misunderstood placement process, it is probable that there are still students who are not getting into the math courses they need. Providing new courses that integrate current content and math academic support and have their own pre-requisites, rather than having two separate required courses, should streamline the registration and placement process, allowing for self-registration.

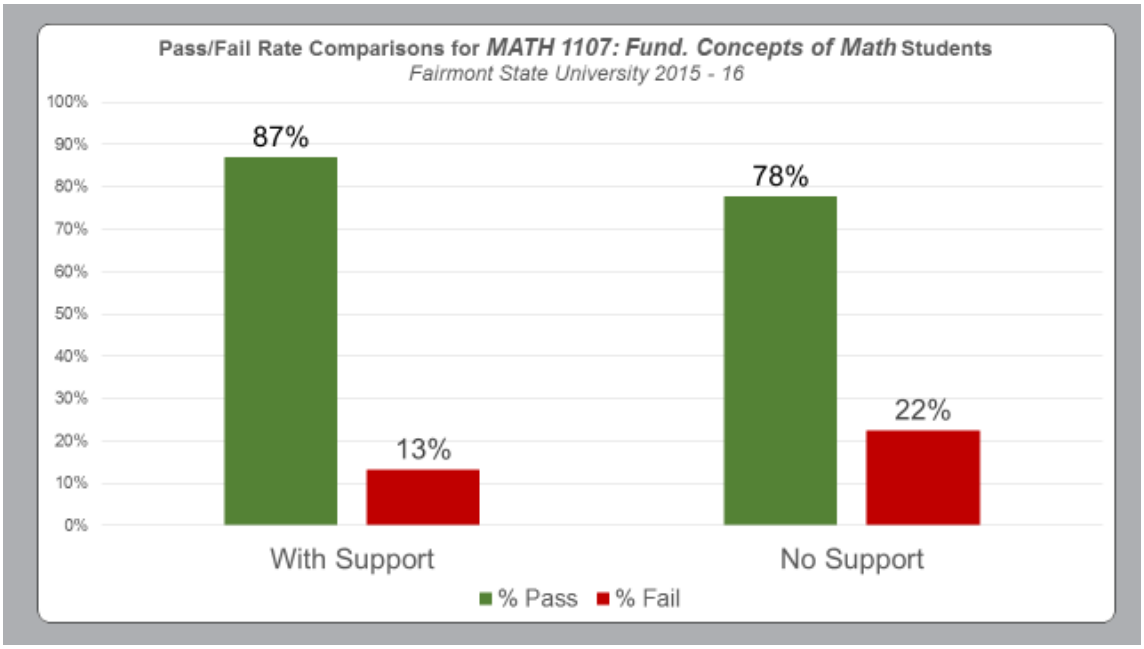
An overview of the math support courses provided in the 2015-2016 academic year is included below:

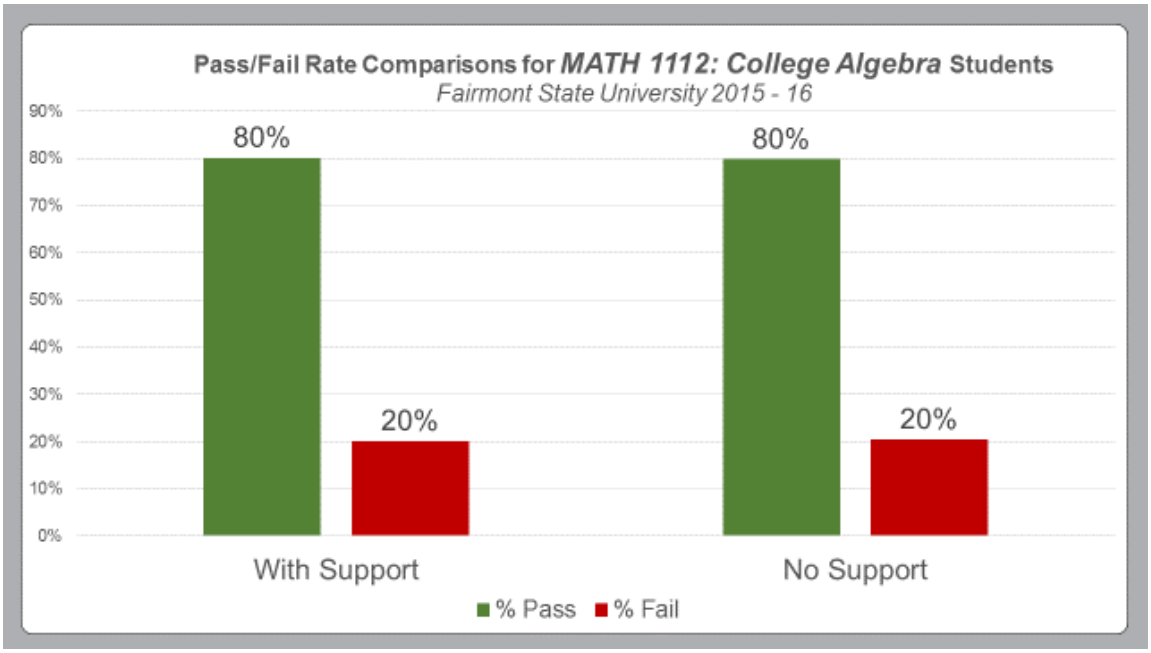
Math Support Program 2015-2016 Overview

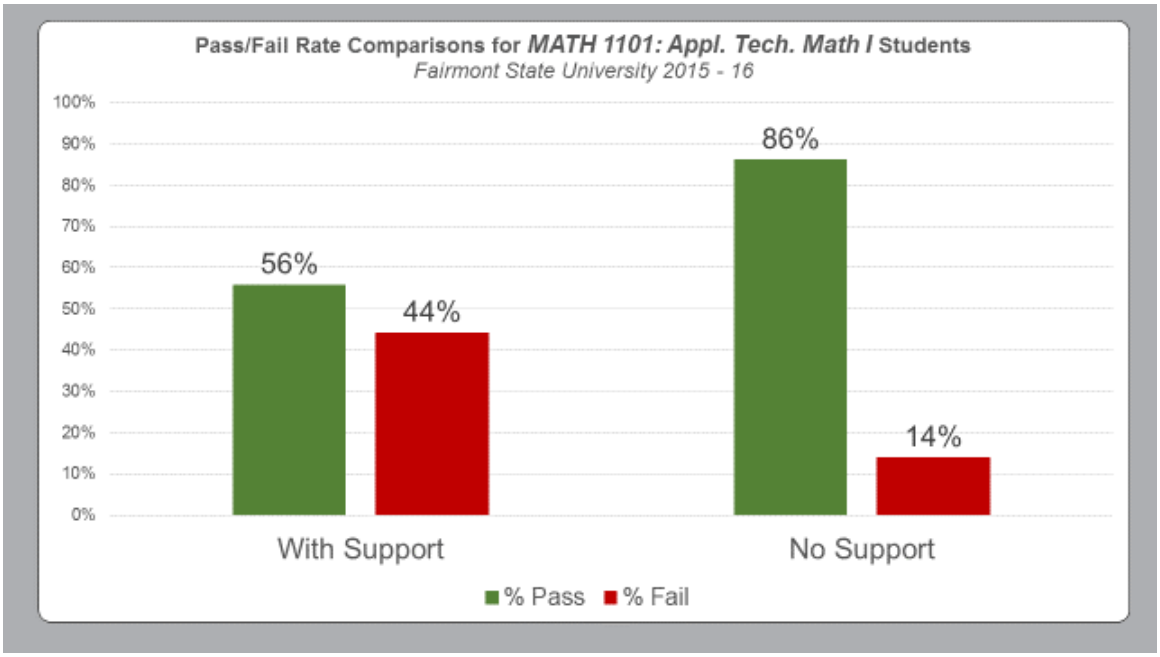
	Fall 2015	Spring 2016	Summer 2016
Number of support courses or designated support lectures	27	23	3
Number of split courses (half support students)	7	7	2
Number of support seats filled/offered	564/570	508/522	N/A
% Seats Filled	99%	97%	N/A
Full-time faculty*	2	2	2
Part-time faculty	2	3	-
Adjuncts	6	5	-
Peer mentors	2	N/A	-
Approximate number of students served	350	300	20
Notes of interest		Additional special topics course developed: Core Test Support (pre-education majors) – 27 seats	

*Includes the coordinator and assistant coordinator of the program.

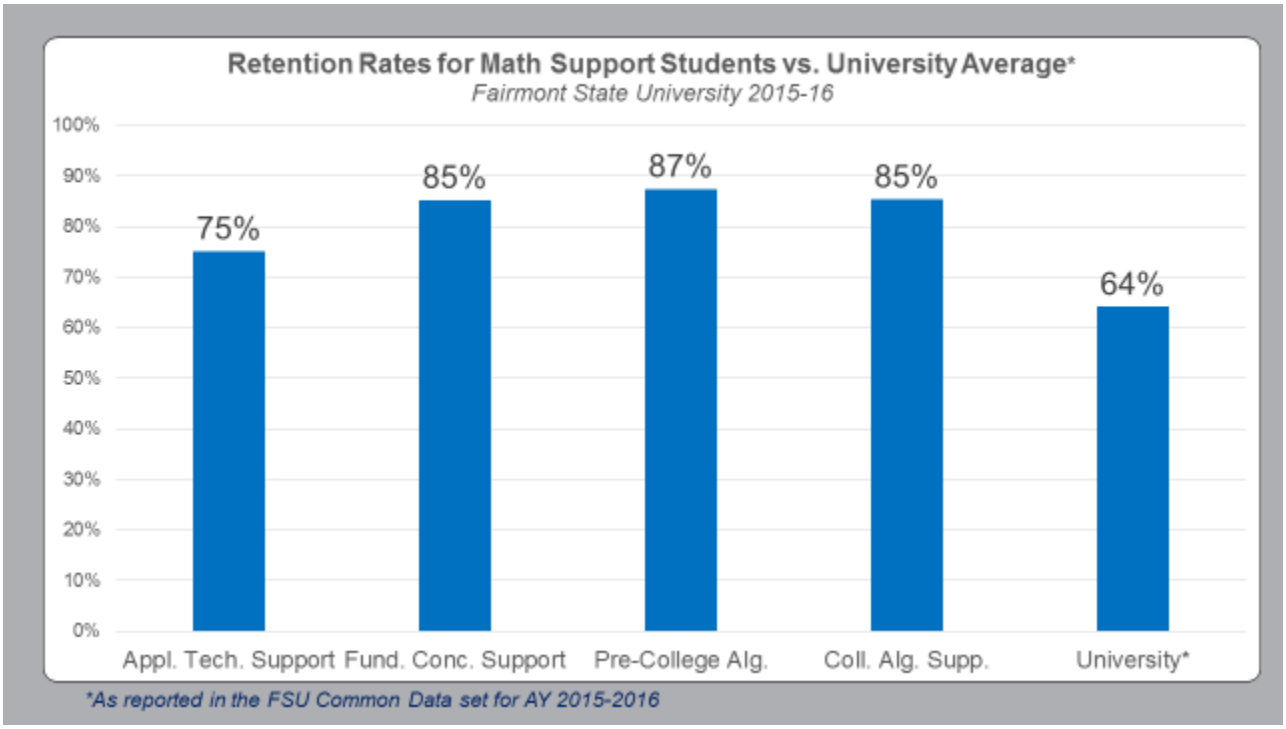
In addition to creating new courses and making course number changes, this proposal requests that *MATH 1001: Applied Technical Math I Support* be deleted. The quantitative rationale for this is based on pass rates for students in their required gateway courses. For *College Algebra* and *Fundamental Concepts of Mathematics* courses, students enrolled in concurrent support courses are passing the required gateway course at comparable or higher rates than their peers. This is not the case for the *Applied Technical Math I* students. In the 2015-16 academic year, 86% of students who were not in support passed MATH 1101; however, only 56% of the students enrolled in support passed the class. The faculty teaching the course have reported that these students could benefit from a better algebra foundation. Because these students are all on a STEM career path, it seems advisable for them to take *MATH 1400: Foundations of Algebra* rather than a concurrent support class. This provides a better STEM-based pathway for all Science and Technology students. The graphs below show the pass/fail rate comparisons for students enrolled in support in 2015-16 versus non-support students in Math 1107, 1112, & 1101.







Perhaps the strongest argument for implementing these changes is that providing math support to students at Fairmont State is working well. Support students are passing courses that, with the former developmental math model, could have taken them years to even get into. This program is providing a valuable service to the entire Fairmont State community in a respectful manner. Even with the difficulties in placement and registration, students enrolled in math support in the 2015-16 academic year returned to the university at rates ranging from 75% to 87%. The chart below outlines retention rates for math support students in specific courses during the 2015-16 academic year.



Making the course changes requested will provide a systematic means to keep doing what is working well for these students.

B. **Qualitative Assessment**: Based upon the assessment data above, indicate why a curricular change is justified. Indicate the expected results of the change. Be sure to include an estimate of the increased cost, or reduction in cost of implementation. FOR EXAMPLE: Will new faculty, facilities, equipment, or library materials be required?

The requested changes should not incur any additional expenses. Due primarily to excellent administrative support, creative problem solving, and tremendous faculty commitment to providing services to the math support students, there are currently classrooms, instructors, and a broad range of courses being offered, despite budget constraints and concerns.

Changing course numbers will simply allow the necessary pre-requisites, many of which are specified by state code, to be built into native Banner from the beginning. The number of overrides and time spent assisting students and faculty with placement are unacceptably high. Furthermore, currently, there is no way to insure that students remain in the "required" support class – once they are in both courses, many of them drop the support class. This requires additional time on the part of math support faculty to cross-reference lists, seek out students breaking written policy, and attempt to force them back into required courses. It is a drain on valuable resources. To insure effective implementation of requirements and policies, there must be back up in Banner. These proposed changes would allow for that.

Furthermore, by integrating support into a 4-credit lecture, students will have the same instructor for both their gateway lecture and support class, providing more seamless instruction than the separate co-requisite courses. The content for the gateway course will be identical – it is imperative to state that in no way will the content be "watered down." Coordinated course schedules will be utilized.

- See ***Appendix G: Sample Coordinated Schedule*** for a comparison of what MATH 1407 & 1507.

IV. Should this proposal affect any course or program in another school, a memo must be sent to the Dean of each school impacted and a copy of the memo(s) must be included with this proposal. In addition, the Deans of the affected schools must sign below to indicate their notification of this proposal.

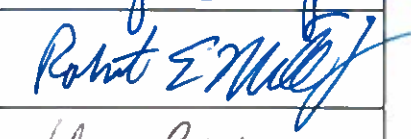
By signing here, you are indicating your college's/school's notification of this proposal.

College/School	Dean	Signature
See following page		

V. Should this proposal affect any course to be added or deleted from the general studies requirements, a memo from the chair of the General Studies Committee indicating approval of the change must be included with this proposal.

VI. ADDITIONAL COMMENTS.

The Math Support Program is operating at scale and working well. As often happens when implementing a new program, there have been some growing pains and learning experiences. The requested proposals should help eliminate some of the biggest obstacles that still remain. These solutions are the result of many meetings and collaborations and have been discussed and approved by both math support and math faculty, as well as the Dean of the College of Science and Technology and the registrar.

College/School	Dean	Signature
Science and Technology	Donald Trisel	
Liberal Arts	Deanna Shields	
Business	Richard Harvey	
Education, Health & Human Performance	Carolyn Crislip-Tacy	
Fine Arts	Robert Mild	
Nursing and Allied health Administration	Sharon Boni	

The above form indicates that the head of the academic unit has received a preliminary copy of each of the two curriculum proposals from the math department—

1. Math Support changes.
2. Math 1000-level course renumbering.

APPENDIX A

B.X. Degree in XXXXXXXX
Current Program

Required Major Courses	HRS
Not applicable	
TOTAL Required Major Courses	XX
Major Electives	XX
Minor Requirements/Electives (if minor is required)	XX
TOTAL HOURS FOR MAJOR (and minor if required)	**XX**

Required General Studies Courses (example text highlighted)	
Attribute IA – Critical Analysis	X
Major Course - PSYC 3310	
Attribute IB – Quantitative Literacy	3
MATH 1507, 1407 or higher in IB	
Attribute IC – Written Communication	3
ENGL 1104	
Attribute ID - Teamwork	X
Major Course - PSYC 3310	
Attribute IE – Information Literacy	3
ENGL 1108	
Attribute IF – Technology Literacy	3
ENGL 1109	
Attribute IG – Oral Communication	3
COMM 2200 or 2201 or 2202	
Attribute III - Citizenship	3
HIST 1107 or 1108 or POLI 1103	
Attribute IV - Ethics	3
Any course in IV	
Attribute V - Health	3
PHED 1101 or SCIE 1000	
Attribute VI - Interdisciplinary	3

	SOCY 2200 or any course in VI	
Attribute VIIA - Arts		3
	Any course in VIIA	
Attribute VIIB - Humanities		3
	Any course in VIIB	
Attribute VIIC – Social Sciences		X
	Major Course - PSYC 1101	
Attribute VIID - Natural Science		3
	Any course in VIID	
Attribute VIII – Cultural Awareness		3
	Any GEOG course in VIII	
Additional General Studies hours		X
	Major Course - PSYC 3390 writing intensive course	
TOTAL GENERAL STUDIES HOURS		**39**
TOTAL FREE ELECTIVES		**XX**
TOTAL HOURS		**120**

Appendix B: Math Support Placement Chart

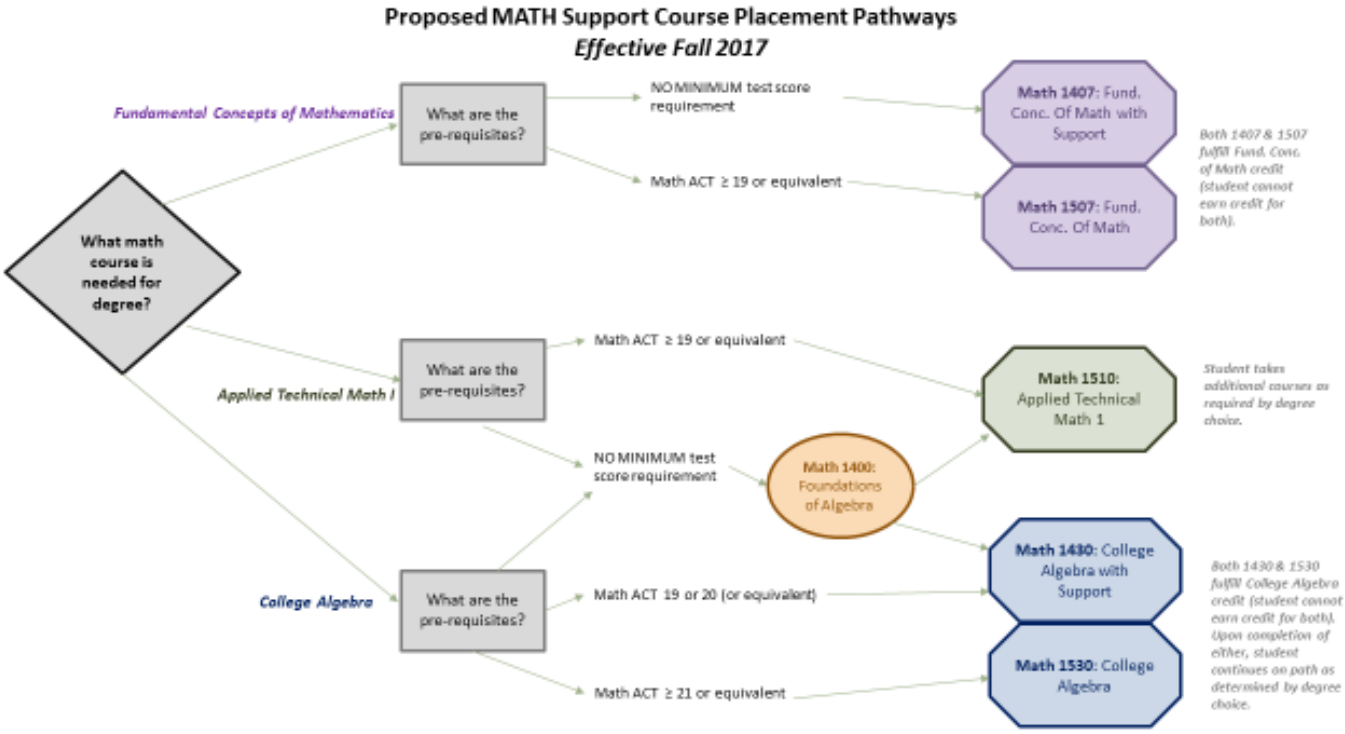
MATH SUPPORT PLACEMENT EQUIVALENCIES

**NOTE: ONLY MATH SUPPORT COURSES ARE SHOWN. OTHER MATH COURSES WILL BE COVERED IN A SEPARATE PROPOSAL.*

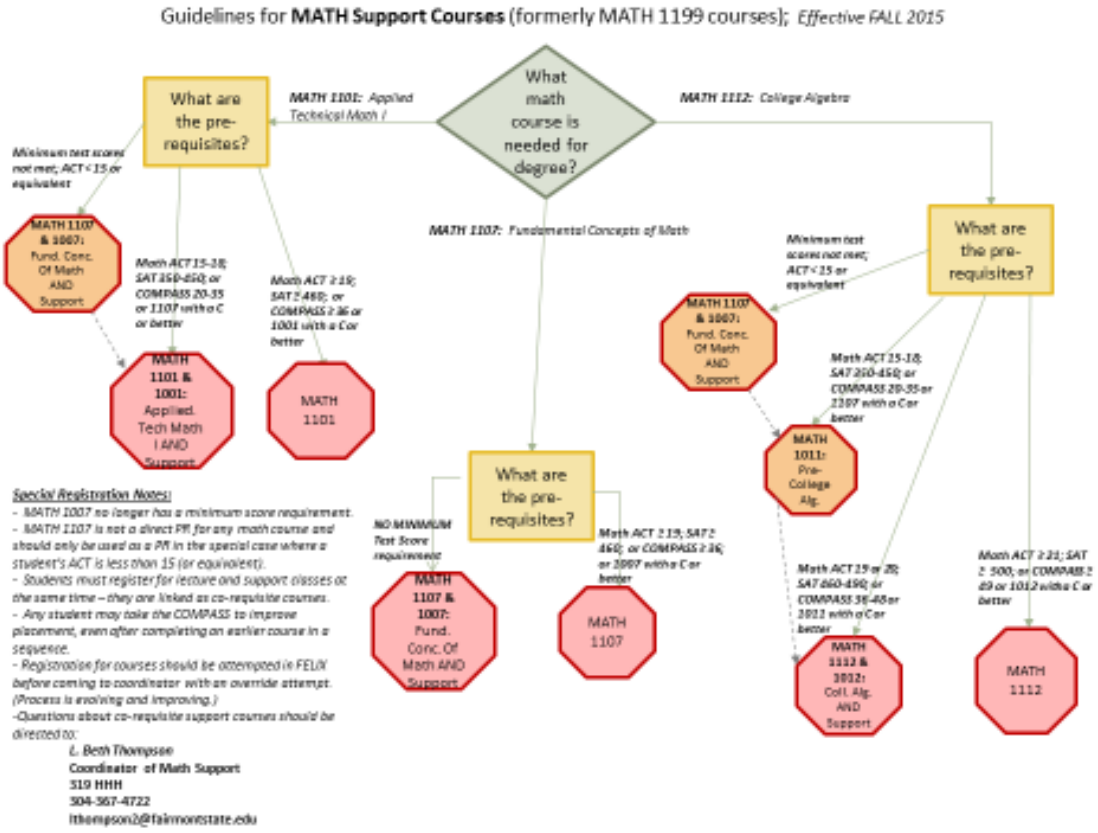
	Math Placement Tests								
				ACCUPLACER Tests					
	ACT Math	SAT Math	NEW SAT Math Effective 3/2016	Arithmetic	Preferred Test: Elementary Algebra	Preferred Test: College Level Math	COMPASS Algebra Portion	WV Summative Assessment	Recommended College Level Course Entrance
Test Scores	0 – 18	0 – 450	0 – 490	**	0 – 75	---	0 – 35	0 – 2	Math 1407: Fund. Conc. of Math with Support or MATH 1400: Foundations of Algebra
	19	460 – 470	500	85	76 – 77	40 – 44	36-41	3	MATH 1430: College Algebra with Support
	20	480 – 490	510 – 520	**	78 – 79	45 – 49	42-48	---	MATH 1430: College Algebra with Support
	21 – 22	500 – 530	530 – 560	**	80 – 84	50 – 54	49 – 62	---	
	23	540 – 550	570	**	85 – 120	55 – 64	63 – 66	---	
	24	560	580	**	---	65 – 74	67 – 72	---	
	25 – 27	570 – 620	590 – 640	**	---	75 – 89	73 – 88	---	
	28 –	630 –	650 –	**	---	90 – 120	89 –	---	
		only for Math 1507 *(1107)*		** Not Accepted		--- Not Applicable		As per WV state code	

** Table provided courtesy of Steven Roof*

Appendix C: Proposed Math Pathways



NOTE: The current model of placement is included below for comparison.



Appendix D: Course Descriptions

New Courses:

MATH 1407 Fundamental Concepts of Mathematics with Support.....4 hrs. This course fulfills the same requirements as MATH 1507: Fundamental Concepts of Mathematics and is intended for students who do not meet the pre-requisites for MATH 1507. The course will cover all content included in MATH 1507, as well as provide integrated academic support. This introductory survey course is specifically designed to fulfill General Studies requirements for quantitative literacy. It is designed to strengthen computational skills while focusing on real-world problems. Topics may include critical thinking skills, sequences, set theory, logic, probability, statistics, and consumer mathematics. The course will also review pre-requisite topics, such as order of operations, exponents, and linear equations, as deemed necessary. In addition to lecture and discussion, this course will utilize computer-assisted work, group activities, and math manipulatives to reinforce concepts and engage students. This course meets for five hours each week. PR: Admission into FSU. There are no minimum test score requirements for this course.

MATH 1430 College Algebra with Support.....4 hrs. This course fulfills the same requirements as MATH 1530: College Algebra and is intended for students who do not meet the pre-requisites for MATH 1530. The course will cover all content included in MATH 1530, as well as provide integrated academic support. This course includes the study of real numbers, complex numbers, algebraic expressions, equations and inequalities, functions and function operations, composition of functions, inverse functions, graphing and transformation of functions, exponents and radicals, quadratic, exponential, and logarithmic functions, and applications. It will also reinforce fundamental algebraic concepts and review pre-requisite topics, such as evaluating expressions, graphing and functions, linear equations, factoring, and geometric concepts, as deemed necessary. This course will utilize lectures, discussions, computer-assisted work, group activities, and math manipulatives to reinforce concepts and engage students. This course meets for five hours each week. PR: MATH ACT 19-20 (or equivalent) or MATH 1011 with a "C" or better or MATH 1400 with a "C" or better.

Modified/affected courses:

MATH 1400 Foundations of Algebra..... 4 hrs. This course is designed to provide a solid algebraic framework for students. This course covers Pre-Algebra, Elementary Algebra, & Intermediate Algebra. This course is designed for students who need MATH 1430: College Algebra with Support or MATH 1510:Applied Technical Math I, but do not have the minimum required MATH ACT score of 19 or equivalent. Students will complete Elementary Algebra concepts in the first portion of the term and then proceed into additional pre-requisite material for College Algebra in the remainder of the semester. Review of foundational concepts will occur to reinforce student learning as deemed appropriate by the instructor. Class work will include mini lectures, computer-assisted work, group activities, and use of math manipulatives to reinforce concepts and engage active student learning. This course meets for 5 hours each week. NOTE: This course does not provide general education credit; however, upon successful completion of this course, students are eligible for MATH 1430: College Algebra with Support or MATH 1510: Applied Technical Math I. PR: Admission to FSU. There are no minimum test score requirements for this course.

MATH 1510 Applied Technical Mathematics I..... 3 hrs. This course is an introduction to fundamental mechanics and techniques for performing operations with algebraic expressions, and subsequently solving linear equations, systems of linear equations and quadratic equations. The course also introduces trigonometric functions and is designed to develop methods of solving right angles and oblique triangles using trigonometry. PR: MATH ACT 19 or MATH SAT 460 or COMPASS 36 or MATH 1001, 1011, or 1400 with a "C" or better. MAJOR RESTRICTION – MAJORS in the College of Science and Technology.

Appendix E: Course Outlines

MATH 1507 Course Outline

**Source: MATH 1107 handbook by Dennine LaRue*

I. Apply a variety of problem solving methods to model, and solve application problems
- A. KenKen Puzzles
- B. Estimate solutions to problems
  - a. Review rounding according to place value rules
  - b. Given a situation, numerically estimate the answer
  - c. Given a graph, read information from the graph to estimate the answer
- C. Apply concepts of Number Theory
  - a. Prime numbers versus composite numbers
  - b. Rules for Divisibility 2,3,4,5,6,8,9,10,12
- D. Differentiate between inductive and deductive reasoning.
  1. Discuss the role of counterexamples.
  2. Explain why a proof by example" is not reliable
  3. Use number tricks to illustrate inductive reasoning and prove using algebra
  4. Identify different types of number patterns using inductive reasoning
     - a. Arithmetic, Geometric, Square, Cubic, Triangular, Fibonacci, Binary
     - b. Determine a pattern using finite differences.
- D. Use Polya's problem-solving process
  1. Understand the problem.
  2. Devise a plan.
  3. Carry out the plan and solve the problem.
  4. Look back and check the answer.
     - a. Determine reasonableness of solution by estimation.
     - b. If necessary, repeat the process. Identify patterns.
- E. Investigate examples of different problem solving strategies.
  1. Look for a pattern
  2. Examine a simpler, special, or related case
  3. Make a table
  4. Draw a diagram
  5. Algebraic reasoning or solving an equation
  6. Guess and check
  7. Working backward
  8. Direct and indirect reasoning
- F. Problem solving with sequences
  1. Calculate the 100^{th} or other term in arithmetic and geometric sequences
  2. Determine an expression for the nth term in arithmetic and geometric sequences
  3. Solve for the missing value in the arithmetic and geometric nth term formula when all remaining values are given
  4. Use Gauss technique to find sum of terms of an arithmetic sequence
  5. Compare and contrast linear (arithmetic) versus exponential (geometric) growth
     - a. Graph $y = x+2$ versus $y= 2x$ versus $y = 2^x$
  6. Discover a relationship between multiples of n and the formula for the nth term of an arithmetic sequence by using concrete examples

II. Problem solving with sets.
- A. Set theory terms. (Notation de-emphasized, concepts emphasized)
  1. Define terms including element, empty set, equal sets, equivalent sets and disjoint sets
  2. Define proper and improper subsets and state examples of each
     - a. Use inductive reasoning to discover pattern for the number of subsets
  3. Cardinality of a set, including finite and infinite sets
  4. Use subsets of real numbers to illustrate terminology and review pre-requisite concepts
- B. Calculations with sets.
  1. Find unions, intersections and complements of two sets

2. Show set relationships with Venn diagrams

C. Solving problems using sets.
1. Given descriptions of two and three sets, place elements into correct regions of a Venn diagram
2. Use Venn diagrams to solve survey problems with two and three sets
3. Relate Boolean searches on internet to Venn Diagrams
4. Use Venn diagram to show relationships – such as contents of the British Isles
5. Use of the connectives (and, or, not) in survey problems using Venn diagrams
6. Use Venn diagrams to determine Least Common Multiple and Greatest Common Factor.

III. Making informed decisions on questions about personal finances.

A. Percentages, sales, taxes, and tips
1. Compute percent increase and decrease
2. Analyze real life examples of percent increase and decrease
3. Calculate sales tax and income tax as one step and two step problems
4. Compute income tax using tax table in Form 1040 ES
5. Explain abuses in the use of percentages
6. Explain the difference between percent and percentile.

B. Saving and loans.
1. Compute simple interest on savings and loans
2. Compute compound interest and determine annual percentage yield
3. Calculate future and present value
4. Compare simple and compound interest with various data
5. Use Rule of 72 to determine when an investment amount will double

C. Mathematics of financing a car
1. Compute month payment and interest costs of a car given the payment formula.
2. Compare and contrast leasing versus buying a car.
3. Explain different types of car insurance.
3. Calculate monthly payments on new versus used cars and amount saved.
4. State sources of used car values.
5. Compute annual fuel expense.

D. Credit Cards
1. Calculate credit card payments
2. How early repayment affects the total cost of a purchase
3. How to use a credit card effectively

E. Purchasing a house.
1. Calculate the down payment and monthly payment
2. Calculate interest paid back over the term of the loan

F. Retirement
1. Estimate amount of money needed to retire

G. Other personal finance topics
1. Discuss topics of the “Financial Life” book
2. Discussion of credit reports and that annualcreditreport.com is the official website for obtaining your free annual credit reports (other websites require signing up for services)
3. Mention National Do Not Call registry to avoid unwanted solicitation
4. Discussion of “phishing” scams and email safety

IV. Using statistics for decision-making

A. Are the statistics of value?
1. Identifying sampling techniques.
2. Determining correct uses and misuses of statistical data.

B. Displaying statistical data
1. Constructing a frequency distribution
2. Construction of circle graphs on paper and/or in Excel
3. Constructing a stem and leaf display

C. Calculating statistics
1. Find and analyze measures of central tendency – mean, median, mode and midrange
2. Calculate measures of dispersion – range and standard deviation

D. Using standards deviations to understand data and solve problems
1. Calculate z-scores

2. Use z-scores to compare groups of similar data
3. The normal distribution and percentiles
    a. Determine if a distribution is normal
    b. Label all important information on the graph, including z-scores and percentages.
    c. Use the 68-95-99.7 Rule and the z-score/percentile table
    d. Use the normal distribution and percentiles to solve applied problems
4. Use and interpret margins of error

E. Interpreting scatter plots
1. Create a scatter plot
2. Explain the difference between correlation and causal connections
3. Match a scatter plot with a correlation coefficient r.
4. Given a scatter plot, draw appropriate conclusions from the graph.

V. Probability – Introductory Level

A. Understanding terms related to probability.
1. Apply the Fundamental Counting Principle
    a. Counting phone numbers needed
    b. Counting license plates needed – include WV plates starting with month of expiration
2. Distinguish between permutation and combinations.
    a. Show that the number of arrangements can be counted by using the "slot-filling" method (Fundamental Counting Principle) and verify this gives the same result as using the formulas
    b. Use factorials
    c. Use Pascal's Triangle for counting combinations
3. Define probability terms including experiment, sample space, event, probability of an event and odds in favor of, and against, an event
4. Consider examples of experiments and events
5. Calculate the sample space for an experiment in a variety of ways
    a. Construct a tree diagram
        i. Create tree diagrams for tossing two, three, and four coins to look for patterns about the number of arrangements with various amounts of head
        ii. Extend results by using Pascal's triangle to find combinations for the number of heads
    b. Construct a lattice diagram. (Rolling two die)
    c. Write sample space as a set and an event as a subset of the sample space

B. Calculating probability and odds at an introductory level.
1. Compute simple and compound probability
    a. Count elements in the event and in the sample space
    b. Independent versus dependent events
    c. Mutually exclusive events
    d. Using theorems to compute compound probabilities
    e. Use of connectives (and, or, not, if/then) in probability
2. Differentiate between theoretical probability and experimental results
3. Compute odds.

C. Solve problems using probability and determine mathematics expectation.
1. Car Insurance rates
2. Raffle tickets and fundraising
3. Monopoly – get out of jail free roll

D. Apply probability to real life examples
1. Drug testing
2. Medical testing
3. Discuss true positive, false positive, true negative, false negative

VI. Applications of Mathematics and Critical Thinking Skills to Voting and Apportionment
1. Use a preference table to tabulate votes and read information from a preference table
2. Critically read the criteria for voting and apportionment and apply the rules.
   (Note: Memorization of rules not required.)
3. Compare majority and plurality voting
4. Compute the outcome of a vote using plurality method, Borda count method, plurality-with-elimination method, pairwise comparison method, approval voting
5. Discover that the method used to tabulate votes affects the outcome of a vote
6. Explain why a two party system evolves even if more choices are available initially.

7. Explain Arrow's impossibility Theorem and why all of the fairness criteria cannot be met in a single voting system if there are three or more choices
8. Research voting methods used in the Heisman Trophy, Olympics Host City, general and primary elections, Academy Awards
9. Define apportionment and discuss methods to distribute items fairly whenever only a whole number can be awarded to each group.
10. Solve problems by applying Apply Hamilton's method of apportionment
11. Discuss apportionment methods used in the U.S. Congress and the Electoral College

MATH 1407 – Fundamental Concepts of Math with Support

**includes ALL MATH 1507 content PLUS the following pre-requisite topics*

I. Introduction
- A. Connection to MATH 1107: Fundamental Concepts of Math
- B. KenKen puzzles

II. Integers and Estimations
- A. Order of Operations
- B. Place value
- C. Rounding
- D. Estimation

III. Exponents
- A. Properties of exponents
- B. Hindu Arabic number system

IV. Solving Linear Equations
- A. Integer coefficients
- B. Rational coefficients

V. Math Applications
- A. Mathematical models
- B. Factor trees
- C. Number theory
- D. Fractions
- E. Decimals
- F. Percents
- G. Use of a calculator to aid in solving math applications

VI. Personal Finance Calculations
- A. Exponents
- B. Grouping symbols and order of operations
- C. Scientific notation

VII. Numbers and Operations
- A. Divisibility
- B. Irrational numbers
- ` C. Relationship to probability
- D. Simplifying square roots
- E. Positive and negative integers

VIII. Cartesian Plane
- A. Plotting points in the Cartesian plane
- B. Graphs of linear equations in the Cartesian plane

MATH 1400 – Foundations of Algebra

Course Outline

I. Introduction
- A. Math study skills
- B. Pathway to MATH 1430 or 1530

II. Algebraic Expressions
- A. Properties
- B. Fraction notation
- C. Positive/negative numbers
- D. Order of operations

III. Equations and inequalities
- A. Solving equations
- B. Formulas
- C. Solving inequalities
- D. Problem solving
- E. Set builder notation
- F. Interval notation

IV. Graphing
- A. Reading graphs, plotting points, and scaling
- B. Graphing linear equations
- C. Intercepts
- D. Slope
- E. Rates
- F. Slope-intercept and point-slope form

V. Polynomials
- A. Exponents
- B. Addition, subtraction, multiplication, and division of polynomials
- C. Negative exponents and scientific notation

VI. Factoring
- A. Factoring trinomials
- B. Quadratic equations
- C. Principle of zero products
- D. Applications
- E. Pythagorean theorem

VII. Rational Expressions and Equations
- A. Simplifying rational expressions
- B. Solving rational equations
- C. Combining unlike denominators
- D. Complex rational expressions
- E. Radicals

VIII. Systems of Equations
- A. Solving systems of equations
  1. Graphing
  2. Substitution
  3. Elimination
- B. Applications using systems

C. Linear inequalities

IX. Radicals
- A. Simplifying radicals
- B. Multiplying/dividing radicals
- C. Rationalizing denominators
- D. Adding/subtracting terms with radicals

X. Solving Quadratic Equations
- A. By factoring
- B. Principle of square roots
- C. Completing the square
- D. Quadratic formula

Math 1530: College Algebra

Course Outline

* *Source College Algebra Handbook by Dennine LaRue*

I. (***Review topics)*** Using appropriate symbolic manipulation skills, perform operations on elements of the real and complex number systems and write equations of lines.

A. Compare and contrast Algebra topics
1. Proper versus improper form for simplified fractions
2. Exact answers versus estimated answers for rational and irrational numbers
3. Solving equations versus simplifying expressions
4. Division by the constant zero versus division by an expression which could equal zero
5. Union versus Intersection
6. -x (opposite of x) versus a negative value for x
7. -3^2 versus $(-3)^2$
8. Compare roots and rational exponents

B. Subsets of the complex numbers
1. Define the Natural, Whole, Integers, Rational, Irrational, Real subsets and identify numbers which belong to each set
2. Review operations of real numbers involving radicals
3. Examine the set of complex numbers
   a. Define $\sqrt{-1} = i$
   b. Perform operations on square roots of negative numbers
   c. Define | = {a + bi | a and b 0Y}
   d. Perform addition, subtraction, multiplication, and division of complex number which are not real numbers and write the answer in standard form
4. Complex numbers are not graphed on the real number line, but in an Argand Plane

C. Review properties of operations on real numbers by proper title
1. Commutative of addition and multiplication
2. Associative of addition and multiplication
3. Distributive of multiplication over addition, rather than acronym FOIL.

D. Analytic Geometry
1. Write equations of lines, emphasizing slope intercept form due to function notation.
2. Discover the relationship between the Pythagorean Theorem and the distance formula.
3. Using two points in the Cartesian Plane, find the distance between the two points, the midpoint of the segment which the given endpoints, the slope of the line containing the two points, and the equation of the line containing the two points.

II. ***(Outcome 1)*** Demonstrate appropriate symbolic manipulation skills to solve both linear and non-linear equations/inequalities

A. Solve linear equations by using the addition and multiplication principles.
B. Solve rational equations by multiplying by the least common denominator.
C. Solve radical equations by using the inverse function.
D. Solve quadratic equations by factoring using the zero product principle, square root method, and quadratic formula.
E. Construct quadratic equations with two real roots, one double root, and two complex roots
F. Solve equations which are quadratic in form using u-substitution.
F. Use properties of logarithms
    1. Product
    2. Quotient
    3. Power rules
    4. Change of base
G. Solve equations involving exponential and logarithmic functions

III. ***(Outcome 2)*** Model and solve real world problems involving both linear and non-linear functions

A. Linear Models
B. Quadratic Models
C. Exponential Models
D. Logarithmic Models

IV. ***(Outcome 3)*** Use the language of math to define, evaluate, and analyze characteristics of functions

A. Convert between solution set, interval notation, and graphs on the real number line.
    1. Compare and contrast various enclosure symbols and their meanings, such as {2,4},(2,4), [2,4],{4,2},(4,2), [4,2]
    2. Combine intervals using union and intersection and express in simplest form
B. Function notation and terminology
    1. Determine whether ordered pairs, equations, and graphs are relations, functions, and/or one-to-one functions
    2. Determine the domain and range of a function
        a. Defined by a set of ordered pairs
        b. The explicit form of f(x)
        c. Graph
    3. Analyze characteristics of graphs of functions
        a. Use vertical and horizontal line tests to identify functions and one-to-one functions
        b. Determine the open intervals on which function increase, decrease, or are constant
        c. Identify where a function has a local (relative) minimum or maximum and the value of the maximum or minimum
        d. Determine graphically whether a function has x-axis symmetry (never), y-axis symmetry (even), origin symmetry (odd), or no symmetry
        e. Locate x and y intercepts both graphically and algebraically
        f. Identify intervals on a graph where the function is positive or negative
C. Identify and graph common algebra functions with continuous and discrete data.
    1. Linear
    2. Identity – special case of linear
    3. Constant – special case of linear
    4. Absolute Value – as a piecewise defined function
    5. Standard Quadratic
    6. Square Root
    7. Standard Cubic
    8. Cube Root
    9. Reciprocal or Rational
    10. Greatest Integer
    11. Piecewise defined functions using functions 1-9
D. Analyze domain and range; increasing, decreasing, and constant intervals; and even and odd characteristics of the common algebra functions
E. Use common algebra functions to graph piecewise defined functions
F. Perform operations on functions, including the domain of the new function

1. Add, subtract, multiply, and divide functions
2. Composition of functions

G. Inverses of a one-to-one function
1. Graph the inverse of a one-to-one function
2. Solve algebraically for the inverse of a one-to-one function
3. Verify that the functions are inverses algebraically

H. Draw graphs of functions which contain specific characteristics

V. ***(Outcome 4)*** Interpret mathematical knowledge to graph and analyze both linear and non-linear functions/ relations

A. Compare the algebraic solution to a linear equation/inequality to the graph of the associated linear function

B. Compare the algebraic solution to a quadratic equation/inequality to the graph of the associated quadratic function
1. Graph a parabola in the form $f(x) = ax^2 + bx + c$ and $f(x) = a(x-h)^2 + c$ and convert between the two forms by completing the square.
2. Locate the vertex, axis of symmetry, maximum or minimum
3. Solve a quadratic inequality by graphing the corresponding quadratic function and selecting intervals which satisfy the conditions

C. Apply transformations to graph common algebra functions in the library of functions
1. Vertical versus horizontal shift
2. Reflections in the x and the y axis
3. Shrinking and stretching by a multiplication factor

B. Apply graph analysis to solve equations and inequalities
1. Use the x intercepts to solve quadratic/ polynomial equations (Zero Method)
2. Use the x intercept of the intersection point of two functions which represent the left and right members of the equation. (Intersect Method)
3. Use the graph of the corresponding quadratic/polynomial function to solve a quadratic/polynomial inequality by selecting the interval which satisfies the given equality or inequality

C. Apply techniques of transformations to graph absolute value equality and inequalities
1. Solve absolute value equations and inequalities by graphing the function and selecting the solution from the appropriate intervals on the x axis which satisfy the given equality or inequality.
2. Relate the graph to the algebraic solution of the absolute value equations and inequalities

D. Apply the techniques of transformations to the graphing of circles and solve analytic geometry problems
1. Graphing a circle written in standard form
2. Given the center and the radius, write the equation of a circle in standard form
3. Convert an equation of a circle from general form to standard form by completing the square.

E. Identify and evaluate exponential and logarithmic functions

F. Derive the logarithm function from the inverse of the exponential function both graphically and algebraically

G. Graph the exponential and logarithmic functions through application of transformations

H. Identify characteristics of their graphs
1. Asymptotes
2. Intercepts
3. Increasing/decreasing intervals
4. One-to-One functions

I. Use the graph of the logarithmic function to verify the domain of the function.

MATH 1430 – College Algebra with Support

**Include ALL MATH 1530 course content PLUS the following pre-requisite topics*

I. Introduction
- A. Evaluating expressions
- B. Distributive property of multiplication over addition
- C. Determine if a candidate is a solution to an equation
- D. Reasonableness of solutions

II. Algebra Properties
- A. Integer exponents
- B. Rational exponents
- C. Negative exponents
- D. Zero exponents
- E. Roots
- F. Identities versus inverses for addition and multiplication of real numbers

III. Functions and Transformations
- A. Evaluating functions
- B. Modeling functions
- C. Graphing calculator activities
- D. Use of calculator to evaluate functions, including exponential and logarithmic

IV. Factoring
- A. Quadratic functions
- B. Factor by grouping

V. Geometry Concepts
- A. Pythagorean theorem
- B. Arithmetic average of two real numbers
- C. Analytic Geometry
- D. Slope between two points
- E. Definitions

VI. Linear Equations & Inequalities
- A. Solving linear equations
- B. Graphing linear equations
- C. Solving linear inequalities
- D. Graphing linear inequalities
- E. Translating applications using linear equations & inequalities
- F. Utilizing graphing utilities, such as fooplot, desmos, etc.

APPENDIX F – Course Outcome Competencies and Assessments

MATH 1400: Foundations of Algebra

Outcome	Assessment
Demonstrate proficiency in solving and graphing linear equations.	Exam score
Demonstrate proficiency in factoring polynomials and simplifying rational expressions.	Activity score
Utilize appropriate terminology to effectively translate word problems into mathematical language .	Group project score
Prepare a notebook that incorporates class notes and assignments and demonstrates progress throughout the term.	Notebook evaluation

MATH 1530: College Algebra

Course Outcomes

**Source: College Algebra Handbook by Dennine LaRue*

Course Outcomes	Direct assessment measures
Demonstrate appropriate symbolic manipulation skills to solve both linear and non-linear equations /inequalities.	Exam question and/or worksheet assessed using the attached Arizona Math Rubric.
Model and solve real world problems involving both linear and non-linear functions.	Exam question and/or activity assessed using the attached Arizona Math Rubric.
Use the language of math to define, evaluate, and analyze characteristics of functions.	Exam question and/or worksheet assessed using the attached Arizona Math Rubric.
Interpret mathematical knowledge to graph and analyze both linear and non-linear functions/relations.	Exam question and/or worksheet assessed using the attached Arizona Math Rubric.

MATH 1430: College Algebra with Support

- Will include ALL MATH 1530 goals & competencies PLUS the following

Outcome	Assessment
Demonstrate symbolic manipulation skills to solve linear equations and inequalities.	Activity score
Translate word problems into correct mathematical language to investigate, model, and solve real world problems.	Group collaborative project
Demonstrate knowledge of the language of math to evaluate and analyze problems.	Oral presentation score
Synthesize mathematical knowledge to graph, analyze, and evaluate linear functions and relations.	Activity score

MATH 1507: Fundamental Concepts of Mathematics

Course Outcomes

**Source MATH 1107 Handbook by Dennine LaRue*

The four general studies outcomes serve as the course outcomes for Math 1507.

1. Use problem solving methods to model and solve real-world problems at an appropriate mathematical level.

2. Demonstrate appropriate symbolic manipulation skills.

3. Use the language of mathematics to describe relationships and patterns using precise terminology.

4. Interpret mathematical knowledge for a reasoned, logical conclusion using correct terminology.

MATH 1407: Fundamental Concepts of Mathematics with Support

Will include ALL MATH 1507 course outcomes PLUS the following

1. Utilize technology to demonstrate problem solving and mathematical modeling skills. Assessment:

APPENDIX G – Sample Coordinated Course Calendar

**Only 3 weeks are provided as a sample*

Math 1507 Schedule and 1407 Parallel Course Content

	Math 1407/1507 Sections/Topics Coordinated & required order among all sections	Additional topics covered in MATH 1407	Resources (text section, , MyLabsPlus,instructor material, etc.)
Week 1	KenKen Puzzles www.kenkenpuzzle.com Sec 1.2 – place value and rounding, approximately equal to symbol isl ≈, estimate numerically and with graphs. Suggested problems: Pages 25-29 (subset of 1-52) and using group work **emphasize (53-77)** May need to create worksheets. Power point slides for 1.1, 1.2, 1.3, & 5.1 in blackboard until students have books.	**Order of Operations** **Place Value** **Rounding**	Sec 5.2 Integers, Order Operations Sec 1.2 Estimation, Graphs, Mathematical Models
Week 2	*5.1 Number Theory, Prime, Composite, Rules for Divisibility (2,3,4,5,6,8,9,10,12)* *Incorporate Pascal's Triangle into divisibility:http://www.shodor.org/interactivate/activities/ColoringMultiples/ and http://www.shodor.org/interactivate/activities/ColoringRemainder/ and http://www.watsonmath.com/?s=pascal%27s+triangle Good homework assignment.* *1.1 Inductive/Deductive Reasoning* - Patterns Include Fibonacci, Square, Cubes, Triangular, Binary, Arithmetic, Geometric. Incorporate looking for patterns into all content throughout the term. Explain finite difference method to find a pattern. http://mathworld.wolfram.com/FiniteDifference.html See Newton's Forward difference Formula on Line 14. This is being taught in Math I and II in high schools now. *See worksheets in Blackboard.* *1.3 Problem Solving* – Assign problems to illustrate various problem solving techniques throughout term.	**Introduction to Exponents** **Properties**	Sec 4.1 Hindu Arabic system Sec 5.5 Page 302
Week 3	1.1 & 5.7 *Arithmetic/Geometric Sequences* - Include Linear versus Exponential functions/growth and the appearance of graph in conjunction with arithmetic and geometric sequences. See materials supplied in Blackboard. – *Practice problem solving and algebraic solutions to problems as well as guess and check.* *5.5 Real Number Properties* Page 302 - Include discussion of properties into any appropriate discussion throughout the term. ***Quiz on 1.1 and 5.7***	**Solving 1 and 2 step linear equations with integer coefficients**	Sec 6.2 Linear Equations in one Variable

FROM: Mathematics Department

TO: General Studies Committee

RE: Course creation and number changes affecting General Studies choices

DATE: September 23, 2016

Dear General Studies Committee:

The math department has two curriculum proposals that will be introduced simultaneously to the Curriculum Committee at its September meeting that affect the General Studies Requirements in a minor fashion. These affect only courses in IB-Quantitative Literacy. There are only two types of changes that we are requesting and they are discussed below.

1. Most of the courses at the 1000-level will have number changes and no other change. The ones which affect General Studies will be:
    a. MATH 1101 will be changed to MATH 1510
    b. MATH 1107 will be changed to MATH 1507
    c. MATH 1112 will be changed to MATH 1530
    d. MATH 1115 will be changed to MATH 1550
    e. MATH 1185 will be changed to MATH 1585
    NOTE: MATH 1190 will be changed later in the academic year to a 2000-level course number and will be accomplished when all other number changes for math courses will be implemented.
2. The current co-requisite model that we use will be changed from a two-course model (MATH 1001/1101, for example) to a stand-alone course which will encompass both components in a single course. There will be two such courses—MATH 1407-Fundamental Concepts of Math "Extended" and MATH 1430-College Algebra "Extended". Each will be 4 credits. The change for General Studies will be that
    a. Upon completion of MATH 1407, the student will have completed the equivalent of MATH 1507—the current general studies course *Fundamental Concepts of Mathematics* (old number MATH 1107). We will make the additional restriction that no student may receive credit for both MATH 1407 and MATH 1507.
    b. Upon completion of MATH 1430, the student will have completed the equivalent of MATH 1530—the current general studies course *College Algebra* (old number MATH 1112). We will make the additional restriction that no student may receive credit for both MATH 1430 and MATH 1530.

Since we will deem the student to have completed College Algebra if either MATH 1430 or MATH 1530 is completed, we would like to add 1430 to the General Studies List for IB-Quantitative Literacy.

Similarly, since we will deem the student to have completed Fundamental Concepts of Mathematics if either MATH 1407 or MATH 1507 is completed, we would like to add 1407 to the General Studies List for IB-Quantitative Literacy.

The new General Studies List for IB-Quantitative Literacy would become:

CHEM 1105 Chemical Principles I, 5 hrs.
[1]MATH 1407 Fundamental Concepts of Math "Extended", 4 hrs.
[1,3]MATH 1507 Fundamental Concepts of Math, 3 hrs.
[3]MATH 1510 Applied Technical Mathematics I, 3 hrs.
[2]MATH 1430 College Algebra "Extended", 4 hrs.
[2,3]MATH 1530 College Algebra, 3 hrs.
[3]MATH 1540 Trigonometry & Elementary Functions, 3 hrs.
[3]MATH 1585 Applied Calculus I, 4 hrs.
MATH 1190 Calculus I 4 hrs.

[1] *The student would receive 3 credits of General Studies credit from either MATH 1407 or MATH 1507.*
[2] *The student would receive 3 credits of General Studies credit from either MATH 1430 or MATH 1530.*
[3] Change of course number only.

Thank you for your consideration of our request.

Sincerely,

Dr. Joseph Riesen

Ms. Beth Thompson

on behalf of the mathematics department.