Elements of Mathematics Foundations

EMF Frequently Asked Questions

Here are questions often asked by current and prospective EMF parents and students.

Getting In

How does a student qualify for BCPS-EMF?

All rising 6th graders and students who have completed 5th grade mathematics in BCPS brick-and-mortar schools are invited to participate in the qualification process. To be accepted into the BCPS-EMF program, students must complete the first two EMF modules, *EMF01: Operational Systems* and *EMF02: The Integers*, with an EMF Course Grade of at least 90%, and the third EMF module, *EMF03: Sets, Subsets and Set Operations*, with at least 85% **prior to the start of the new school year**.

Note that EMF is designed to be a self-study program in which students learn by closely reading the online text and carefully completing the online exercises. Prospective students should be reading above grade level and be ready to learn new concepts through reading. Completing the *Operational Systems* module is an excellent way to gauge whether a student is ready for EMF's self-study approach.

What are the first three EMF courses about?

EMF01: Operational Systems introduces students to modular arithmetic; operational systems and their properties (commutativity, associativity, neutral elements, invertibility); several non-numeric operations; least common multiple and greatest common divisor; and the geometric concepts of midpoint and reflection.

EMF02: The Integers introduces students to integers; arithmetic operations on integers using the number line and number plane; additive inverses; inequalities; integer-based operational systems and their properties, including the distributive property of multiplication over addition; and two-fold operational systems.

EMF03: Sets, Subsets and Set Operations introduces students to sets and membership in a set; roster names; the empty set; singleton sets; Venn diagrams; subsets and power sets; set operations including intersection, union, set difference and complement; counting the k-element subsets of an n-element set; and the Pascal Formula.

When should students start the first EMF course?

Data shows that, on average, students who study EMF early in the summer obtain higher grades than those who start later.

All EMF modules require students to read carefully and methodically. In many instances, students will need to re-read sections before attempting to answer exercises. Since EMF focuses on deep structures and concepts in mathematics, and not on technique or execution speed, students need

sufficient time to allow concepts to cement.

Are students allowed to get help on the first course while trying to qualify for BCPS-EMF?

Students attempting to qualify for the BCPS-EMF program are limited to three Help Forum posts during the first module; there are no restrictions on subsequent modules.

EMF is a self-contained, self-study online course. Experience indicates that it tends to be a poor fit for those who need help in the first module. Students who successfully complete the first module and decide to continue have full access to the Help Forum beginning with the second module. Note that in all modules including *Operational Systems*, students will be able to review prior Help Forum exchanges by clicking on the green question mark icon [?] when it appears with an exercise.

How long will it take to complete the first three EMF modules?

The average times for completions of the first three modules are: EMF01: 18 hours; EMF02: 15 hours; EMF03: 24 hours. However, individual times vary considerably. For example, students who have completed the first EMF module with an average of at least 90% have taken as little as 8 hours. There is no correlation between the time taken and the final grade, nor between the time taken and success in EMF. However, the EMF Course Grades for the first three courses are a good indicator of future success in the program. Therefore, students are encouraged to take as much time as they feel they need in order to completely master the covered material.

After I complete the first three modules — what then?

If you score 90% or better on the EMF01 and EMF02 and 85% or better on EMF03, you will receive an email explaining how you may elect BCPS-EMF as your full-time mathematics class. If you choose BCPS-EMF as your mathematics class then you will immediately be enrolled into the fourth EMF module.

I elected to take BCPS-EMF as my full-time math program — can I change my mind?

Yes. You may rejoin your GEM class at any time. EMF students adjust well to the GEM curriculum, and find that the foundational mathematics learned in EMF provides an invaluable tool in future mathematics classes. To rejoin your GEM class, simply inform the BCPS-EMF Coordinator.

Getting Help

There's no teacher! What should my child do if he or she needs help understanding the material?

Parents and students should also note that the EMF program does not provide tutors. If you feel that your child needs a tutor to complete the EMF coursework, then EMF may not be the right program for him or her.

All the information students need to understand and answer exercises is contained in the pages of the relevant section. Usually, re-reading the section several times will overcome any misunderstandings.

When students are logged into the EMF site they may access the Help Forum, in which students are encouraged to post well-thought-out questions to be discussed and answered by highly-advanced students. Questions that are not answered satisfactorily are filtered through to experienced instructors and mathematicians who respond through the Help Forum.

Note that the Help Forum is *not* designed or intended to substitute as a teacher. The Help Forum is provided to answer students' specific and focused questions; however, the main responsibility for learning the material through close reading belongs to each EMF student.

For each exercise, students may read previously posted Help Forum questions and answers about that exercise by clicking on the green question mark icon [?] that appears with that exercise.

To use the Help Forum, students must obey strict rules, including rules prohibiting the request or provision of answers and the use of inappropriate language. Students who do not obey these rules are prohibited from accessing the Help Forum and are not permitted to continue in the EMF program.

(It is worth pointing out that, historically, 85% of help requests from students taking the first EMF course generate responses that encourage the student to solve the issue themselves by either re-reading the section or by using the index button, and almost invariably the student overcomes the issue by following this advice.)

Why do you say that it's not good for parents to help their child with the EMF curriculum? What if they know mathematics and want to help?

A rare selection of parents possess the characteristics that it takes to effectively help their EMF student, namely university-level training in abstract mathematics and the ability to guide young people while still allowing them to experience productive struggle. Even for such individuals, refraining from helping allows their child to develop strong independent study habits that he or she will certainly benefit from in high school and at university.

Parents' most important role is to provide a supportive environment in which students can study without interruption or distraction, and where necessary to help with organization and time-management.

Why doesn't EMF have more practice problems?

EMF was designed for talented students who are motivated to explore mathematics deeply and who typically master calculation with little repetition. Given that computers long ago outpaced the computational abilities of humans, EMF focuses instead on teaching the analytical reasoning and creative thinking skills needed to solve more complex problems.

That being said, earlier EMF courses include practice problems for students who want them. Practice exercises are always optional, and some graded computational exercises become optional for students whose grades are high enough.

Are students allowed to use calculators and graphing tools such as those available online?

EMF provides integrated scientific calculators, graphing tools and the GeoGebra app that students may use in completing their EMF coursework. Additionally, EMF teaches students to use sophisticated AI math engines such as WolframAlpha.com. However, EMF students are limited in how they may use these external tools.

Students may use the integrated and external-site tools as investigative and research tools, and to check answers arrived at through their own thinking, but are prohibited from using these tools to generate answers directly. Use of external tools for any purpose on EMF tests is strictly prohibited.

The use of external tools to calculate answers in earlier EMF courses is self-defeating. Later courses focus on proofs for which there are no online tools. Success in the proof-based courses is

possible only if a student has developed strong mathematical intuition by solving problems using their own brainpower. There simply is no substitute for the experience gained by figuring things out for yourself.

What should my child do if he or she is having technical difficulties with an EMF course?

Students should report the issue by clicking the “Technical Support” button in the Help Forum.

Grades

How are EMF grades calculated?

Each course contains several units, each of which is either an assignment (containing exercises and review problems), or a test. Raw point scores are then adjusted depending on the unit's level of difficulty. A grade is then calculated as a weighted average of the assignments (60% weight) and tests (40% weight). This is the *EMF course grade.* Students must maintain EMF course grades of 85% or better. (Since EMF courses typically contain between eight and ten assignments, but only one or two tests, it is vital that students prepare well for tests in order to obtain a high EMF course grade.)

Are the EMF grades used as the basis for the students' school grades?

Yes. Students enrolled in the first year will receive grades for their coursework as long as they are on schedule. A student's official quarterly grade is calculated using the EMF assignment and test grades for coursework scheduled for completion during the quarter. These grades are curved upwards to reflect the fact that EMF courses are more challenging and demanding than the regular GEM course.

Students enrolled in years two and three of EMF will receive grades for Algebra 2 Honors and Precalculus Honors based on the EMF coursework, midterm exam, Discussion Based Assessments with a teacher of record, and a final exam. Midterms and finals cannot be waived for these courses. These students will also receive credits, but not grades, for Algebra 1 and Geometry by passing EOC exams.

Parents should *not* consider EMF for their child's official BCPS middle school math program unless their child plans to take advanced math courses during high school.

How will parents know how their child is doing in the program?

A progress report is emailed to EMF parents each Monday morning showing the EMF course grade for the student's current course. A real-time report card is available at any time by using their child's login and choosing "My grades" from the menu. Report cards also detail how far the student is ahead (or behind) schedule, the next five upcoming weekly benchmarks, and a summary of the student's recent Help Forum activity. Students are advised to try to stay at least two weeks ahead of schedule in order to allow for unforeseen interruptions in progress.

Does a student need to meet certain standards to remain in the program?

Yes. To remain in the program, students must maintain a EMF Course Grades of 85% or better and be no more than 14 days behind schedule. If either criterion is breached, the student receives a warning that they have to redo assignments to raise their EMF Course Grade to 85% or better and/or catch up to the schedule. If they are not able to remedy the situation in 14 days, they must rejoin the GEM program. Exceptions for unique situations will be considered on a case-by-case basis.

Some students insist on getting everything correct. Are there do-overs in EMF?

Yes and No. Certain exercises in EMF allow a student one, and only one, do-over if the student's initial answers would receive a score below 50%. The student is given a warning and encouraged to carefully rethink his or her answers.

With regard to EMF course tests, all students must obtain a raw score of at least 60% on a test in order to pass that test. If a student does not pass a test, he or she is required to retake that test, and the maximum curved grade on that test is capped at 75%.

A student learns as much, if not more, from submitting an imperfect answer and then carefully reading the answer key as he or she does by submitting the correct answer.

Schedule and Pacing

When are the 18 EMF courses scheduled for completion?

EMF01, EMF02 and EMF03 (Year 1), EMF10 and EMF11 (Year 2), and EMF15 and EMF16 (Year 3) are scheduled over summer vacations. Students may start upon completion of the preceding module, and may complete the summer requirements before summer vacation begins:

Course	*Date*	*Notes*
EMF01-03	Summer prior to 6th grade	
EMF04-09	6th grade	
EMF10-11	Summer prior to 7th grade	
EMF12-14	7th grade	*Algebra I EOC & Algebra II Final exams*
EMF15-16	Summer prior to 8th grade	
EMF17-18	8th grade	*Geometry EOC & Precalculus Final exams*

Do students have to work on EMF at specific dates and times?

Students will work on EMF during the time that they are assigned to mathematics class during the school day. However, as long as a student is enrolled in an EMF course, he or she will be able to work on that course whenever he or she has internet access on a laptop or desktop computer.

What is the appropriate pace for working through an EMF course?

BCPS-EMF students are provided with a minimum benchmark schedule. However, within this framework each student must find the pace that best suits him or her.

The appropriate pace varies considerably from student to student. It is best not to go too many days without completing some EMF coursework. A student needs to keep the material fresh in his or her mind since EMF courses move along steadily with little to no repetition.

In addition to his or her daily mathematics lesson, a BCPS-EMF student *will need to work on EMF after school, at weekends and during holidays*. Many EMF students work well ahead of schedule, but this should not be confused with working faster. Proceeding too quickly through EMF can be detrimental to a student's long term success in the program. Students should bear in mind that there is no prize for finishing first, but significant rewards for those whose meticulousness and dedication leads to a deep and lasting understanding.

Students who take the time to read and re-read EMF material and to work through the problems slowly and carefully do much better. Students who are used to succeeding in regular school math despite jumping from exercise to exercise and ignoring or speed-reading the intervening text will quickly discover that the same approach will not work in EMF. Students are also expected to take a long time puzzling through the more difficult problems, often by putting pencil to paper, and

without giving up too quickly. In other words, EMF rewards patience and persistence.

Does a student have to take the courses in order, or can some courses be skipped or taken out of order?

The EMF courses must be completed in order and without skipping. Furthermore, all exercises within a course must be completed in order and without skipping. The program is designed to build an intuitive foundation for mathematics through carefully planned steps.

During winter, spring, and summer breaks, will my child's EMF pacing schedule "freeze", or should my child continue to work on EMF over the break?

EMF does *not* pause the pacing schedule over school vacations, including winter, spring, and summer breaks.

If your child is well ahead of schedule, then he or she probably doesn't need to worry about falling behind if you need them to pause during a vacation. If your child is just about on schedule, then he or she should consider putting in extra time after school or on weekends before the break so that there is no need to rush later on. Regardless of where your child is in the schedule, it would be wise for him or her to put in some regular work on EMF during vacations to keep the material fresh in the mind.

Why does my child's number of days ahead or behind schedule sometimes change more than expected?

Note that EMF calculates the days-ahead/behind data using Universal Coordinated Time (UTC). Because the date boundaries of UTC may differ from yours by many hours, the days-ahead/behind count may appear to jump forwards (or backwards). In addition, the algorithm which paces work does not always allot the same number of exercises for each day.

Should you work on EMF if you have 15 minutes to spare?

It depends on the student and the circumstances, but probably not. Success with the EMF curriculum requires longer stretches of deep focus and concentration. It would be better to use those 15 minutes to help free up a longer block of time later.

Miscellaneous

How many students will be in the BCPS-EMF program at my school?

This number is currently undetermined since it will depend on how many students successfully complete the required summer work and elect BCPS-EMF as their full-time mathematics class.

How will the BCPS-EMF students be able to concentrate if the classroom teacher and the rest of the class are discussing different curriculum in the same room? Won't that be distracting?

Most EMF students develop an ability to focus and sustain work on exercises because they are immersed in their lessons and are interested in what they are learning. BCPS will work with individual cases to make the best possible provision for every student, bearing in mind constraints that individual schools may have. Parents are encouraged to provide their child with headphones to listen to EMF videos while in class, and we recommend headphones with a microphone for Discussion-Based Assessment (DBA) sessions on Microsoft Teams.

Does the BCPS-EMF program replace my child's middle school math program?

Yes. Your child will study the EMF program during the time allotted for his or her mathematics education.

Parents should *not* consider EMF for their child's official BCPS middle school math program

unless their child plans to take advanced math courses during high school.

Is EMF algebra the same as the algebra taught in schools and in other online courses?

No. EMF teaches what mathematicians call "abstract algebra." The algebra taught in high school and in other online courses is a special case of abstract algebra usually referred to by mathematicians as "elementary algebra". Students who complete EMF will earn high school credit in Algebra 1 and Algebra 2. But they will also be ready to take junior-level college algebra courses.

Will IMACS provide any kind of documentation to show that my child has completed a course?

When students complete an EMF course, parents receive an email containing links to a Student Transcript and Completion Certificate.

What if a student successfully completes the BCPS-EMF program?

He or she will have high school credits in Algebra 1, Algebra 2, Geometry and Precalculus, and will be ready to take Calculus in 9th grade through an Advanced Placement class in high school or through the University of Florida as a dual-enrolled student. He or she will also be ready to take junior-level college courses in subjects including Discrete Mathematics and Linear and Abstract Algebra.

What technology do students need?

EMF requires an active internet connection and is supported on the free Chrome and Firefox browsers. In addition to laptops and desktops, EMF is compatible with iPads, Android tablets, and touchscreen computers. However, some features are easier to use with a mouse or other pointing device. EMF is not compatible with smartphones. *Headphones are highly recommended.*