

What is this Integrated Math Curriculum?

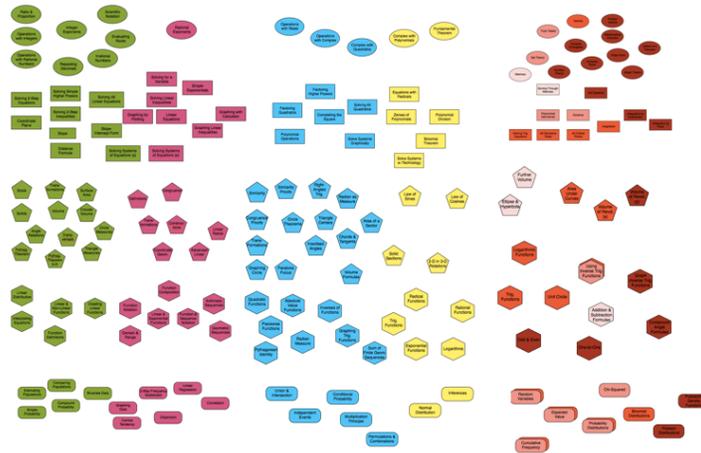
This is a system of reviews we wrote for our high school students in 2014. At the time we were looking at possibly have to go to Common Core testing. We also felt we did not have enough review of old concepts in our current program. Most importantly, we were looking at ways to have more freedom in the classroom to do more integrated projects and a curriculum driven by the students. We really wanted to make sure that we could do any project at any time and make sure our students still covered at least the minimum skills they would need, at least according to the Common Core Integrated Math curriculum. So we developed this series of reviews which cover those concepts after months of discussions and years of observation.

Each Review Set has 7 reviews of 12 questions each, an exam, and a retake exam. Answer keys are also provided. Each Review Set introduces 2 or 3 new skill concepts which comprise approximately half the questions in the Review Set, whereas the remaining half of the questions are review questions from previously learned skills, with more emphasis on the more recently learned skills. There are 96 questions per Review Set (including the exam) for a total of 1,536 questions per year. There is also a retake exam with 12 additional questions, if needed. There are five years worth of questions from Montessori Integrated Math 1 (MIM1) through MIM5.

If the students do these reviews, does that cover Common Core?

Yes and no. What I did was I looked at all the Common Core standards for Integrated Math 1, 2, and 3, as well as grades 7 and 8, and found what I considered to be skill standards. These would be things students can do that would be easily quantifiable such as solving one-step linear equations, being able to use mean, median, and mode, using interior angles of triangles, and so on. It does not include more of the loftier standards such as “prove...” or “will recognize...” or “will use...”. These types of standards are best done through project work and activities. These should be done in parallel with the skills here.

I originally created a Common Core map, similar to other graphic organizers I have used in the Montessori math classroom. The green is grade 7/8 because when I wrote this originally I did not have grades 7 or 8, so I did this as kind of a pre-year. This has since been expanded into two full years (IM1 and IM2) with guidance from the DMHS and Compass teams as to what their students need. So some of these skills are from elementary as well. The map has grade 7/8 in green (now MIM1 and MIM2), Grade 9 Integrated Math (MIM3) in red, Grade 10 Integrated Math (MIM4) in blue, and Grade 11 Integrated Math (MIM5) in yellow. The work beyond that is a combination of Grade 12 Integrated Math and IB Curriculum and is not included in the daily reviews. The shapes correspond to the strand; so going from top to bottom we have Numeration, Algebra, Geometry, Functions, and Probability and Statistics.



Could this be the entire curriculum for a year?

Skill-wise, yes, but was is not meant to be the entire curriculum. Instead it is a series of follow-up work that should supplement a class full of work and activity. But if students only do the review questions, they will be missing out on much math that is critical to their development, specifically experimentation and concept building. The way the lessons are to be given should be done with a Montessori approach, appropriate to the adolescent. Work with slope for example, should be done through graphing data in science, examining rates of change, etc., before the formal lesson on slope is given.

The skills presented here are not meant to be a driver of the curriculum, but more of an insurance policy freeing the child and adult to do mathematics that makes sense within the context of the larger environment. If students work through the reviews in a year they should have covered a minimum of skills. So if project work and other activities do not correspond to the skill concepts in the reviews, that is ok.

Is this Montessori?

There is nothing particularly Montessori about the list of questions. However, it can be a great supplement to a Montessori classroom where students want to have the freedom to work at their own pace, to problem solve, to work with their peers, to receive lessons, etc. The skills in the reviews have been aligned to lessons from *Montessori Algebra for the Adolescent* or other sources such as the elementary geometry album. The math teams at Compass and DMHS have written a spreadsheet which they have generously shared which shows how each skill in the reviews matches with a lesson in the algebra album or other resources.

If a student is in 8th grade for example, then they should do IM2, right?

Students will be in many different places and that may not be the best fit. They may need to start earlier or be further ahead. It really depends on their background and their level of mastery. But that would be a good place to start.

Do students have to start at the beginning?

Many students who work on this will not be starting at the beginning of MIM1. When students first start work in any other place, there will be review questions consisting of all the concepts that have come previously. Because of this, the first few review sets students try may contain more skills than just the new 3 skills that are unfamiliar to students. This may require then for more lessons to be given, and this work may be slower. It might be advisable for teachers to not teach too any new skills in this first review set to avoid overwhelming the student. If a student cannot do the majority of the skills, then placing them in an earlier set would be advisable. In general the first two or three review sets more lessons will have to be given but this tapers off and then students can work at a regular pace with the normal amount of lessons.

The reviews topics don't seem to match the skills on the map. Why?

When aligning with the Common Core, I made a large map of skills similar to the road maps I had been using previously. It is from these maps the skills were developed, though many skills have different names and are broken into sub-skills when in the daily reviews. For example:

- Operations with Integers has been spread out to be 1A, 3A, 5B, 12A, and 13B
- Operations with rational Numbers is 2A, 4A, 6A, 9A, 10A, etc.
- Solving 2-step Equations is 25C
- Ratio & Proportion is 15B
- Integer Exponents is 11A and 21B

For the most part, those skills on the map are present in some form in the Daily Reviews.

There are some skills that are missing and some skills I would like to teach. How can I do that with these reviews?

If there are skills in the reviews that you do not feel students should have right now, just have students skip those questions. If there are skills you want them to have, just do that in parallel to the review work. The questions are just a resource and may or may not fit your specific curricular needs. So use them as makes sense with your program.

I notice some skills are repeated in IM2 and IM3. Why is that?

This is because MIM1 and MIM2 were built after MIM3 and some skills were better suited for introduction earlier (like exponents) and it was too much to rewrite

everything to take these skills out later. So when students come to these skills, if they had MIM1 and MIM2, they can treat these as review instead of a new lesson.

How was the 7th and 8th grade (IM1 and IM2) developed?

Originally I had MIM1 and MIM2 (which corresponds to grade 7 and 8) as one grade level, MIM0 for my high schoolers as a pre-course. In working with the math teams at DMHS and Compass, we have split this out into two years with a slower, more detailed pace, while also reviewing lots of basic math skills from elementary such as fractions and decimal work.

What is the rationale for how the skills for a year are organized?

One problem with a traditional classroom model where all students move on to the next concept at the same time is that all students may not be ready, and so they get confused, lost, and ultimately cannot keep up. By spacing consecutive skills out further, this gives students more time to continue working on a skill before the next skill is needed. For example, when students first start to learn integers, the concept of zero pairs is in Set 1, but they don't apply it to addition until Set 3, and then they do opposite sign addition in Set 5. Similarly for areas, rectangles and squares are in Set 5, while parallelograms aren't until Set 8, and then Triangles are in Set 10. Now these lessons can be taught all together, but they can be spread out over time if the teacher wishes.

For each set there are usually 3 skills. I tried to vary these concepts from algebra, geometry and statistics. I also tried to vary the length of lessons given for each of these concepts. For example, one concept might be brand new and might need some time to teach. Another concept though might be an extension of a previously learned skill and therefore might not need nearly as long, and the third skill might not even need to be taught as it might be a follow-up from previous lessons.

How are the questions for each skill organized?

When a new concept is introduced, the questions asked are very simple and straightforward. I really tried to isolate the difficulty and focus in on the mechanics of the skill with simple examples. The last review in each Set asks these new skills exclusively, and is a good way for students and teachers to informally assess where students are at with these new skills. In the next set, when this new skill now becomes review, I then ask questions related to the skill with some new twists; perhaps asking the question backwards, having it in a problem-solving context, or combining it with other

skills. This gives students a chance to apply and analyze with the concept more than they did in the initial set, which was more at the knowledge and comprehension level.

How are the exams to be used? What score do students need on the exam to move on?

The exams test on only the new skills, and are essentially the same as the last review in each Set. The exams however are organized so that all the questions that test on the same skill are together, so it is easy to see what skills are mastered or need additional work. I think the exams can be used as post or pre tests. If students want to move on faster, they can just take the test and then move on. If not, students can do the review work and take the exam.

Since the next set of reviews still have a heavy amount of questions from the previous Set, students do not have to get a perfect score before they move on. They may just need more time and the reviews can give them additional practice and time for reteaching lessons or for students to do parallel work if necessary. If students do well on the new review questions involving a skill not previously mastered in the test, there may not be a need to retest. But retests are provided if teachers want to formally assess skills again.

Conferencing with students about their exams is an effective tool. It is a good way to help students understand their learning and study habits. Sometimes students do poorly on a skill on the exam because of repeating one small error, which could easily be fixed. For these students I generally let them move on without retesting or additional work. If there is a major misunderstanding, we would discuss how they did on the rest of these skill questions throughout the previous review, would reteach, and perhaps retest later.

I do not think a certain score on the exam should indicate passing or failing, as a student may get 9/12 and have fully mastered two skills and not understood one at all. Where as another student may get a 9/12 and only may have gotten 3/4 correct on each skill, showing they have a good understanding of all the skills. In general, 3/4 on a skill is generally good enough to feel comfortable letting a student move on with no discussion, where as getting 1/4 or 0/4 would indicate further work in some way needs to be done.

This seems like a lot of grading! Is there a way to make it easier?

It is recommended to have student check their own daily reviews by providing the answer key in the classroom. If students can correct themselves, that is great. If not, this would signal lessons and help the teacher should provide. This would leave the teacher to give and grade only the exams.

Additionally, DMHS has developed a software package where students record their own work. They may make this available for purchase.

What is the pacing for the students?

If students complete a review set every 2 weeks, they would finish the year's worth of curriculum in 32 weeks. That would mean students are completing 4 daily reviews per week (including an exam), or about 1 review per day. That may or may not be realistic for certain students. But that is why there are the number of reviews and questions there are.

Do students have to do every question?

Certainly not! If teachers want to increase the pace, students can skip certain Daily Reviews (perhaps do the first 2 and the last 3 of a set of 7), or the teacher can select certain questions from a review to do. Perhaps to have students do the 5 questions with the new skill and then the students can choose and 3 to do.

What should students be scoring on each review?

Some questions are certainly more challenging than others, so all are not weighted equally in time or skill. I think it would depend on which questions students are getting wrong or struggling with. But if all questions in a review are assigned, I would think students should definitely be getting more than half correct, and should probably be closer to getting 8/12 or 9/12 to be truly successful.

What are the "Group 1, Group 2" etc. for?

I modeled this after summer homework I made for students, which gave three questions per day. I then kept that model for what I called a Weekly Review; 4 sets of 3 questions per day, Monday-Thursday. When I gave that to students on Monday, however, most just did all the questions for the week right then on the first day! That is when I thought, "Well, if they can do 12 questions in a day, then why not make it a Daily Review?" So I just kept the format and renamed them "Groups." I think this can also be helpful in chunking the work up for students. For example, perhaps Group 1 is a daily warmup, students do Group 2 in class, do Group 3 for homework, and do Group 4 for extra practice if they want. Doing "Just 3" questions seems more doable than 12!

When I give a lesson for a new skill, do students need follow-up work or can they do the review right away?

I think that depends on the student. I usually provide some sort of focused follow-up work right away, whether that is done in class or an outside activity. Some students like being able to focus on just one type of question, so in that case I may have students do more concentrated follow-up work and less review work.

Do students need the lessons before they come to the review with that skill listed?

I don't think it's necessary depending on the type of skill. If it is a skill that is new for all students, and not a follow-up skill to some previous work, I usually do a group lesson sometime before they arrive at that Set. Other times if there are skills that students may already know or if they can figure out how to do it based upon previous lessons and work, I may not teach it, but I would be prepared to give a more formal lesson when students arrive at a question involving this new skill and need help with it. Rather than just helping them, I would teach the lesson as needed.

What's the deal with the Stop Signs?

STOP signs are provided at the end of each review set, and are there for students who are moving through the work more independently. This lets the student know that a consolidation of skills needs to happen in the form of the check-up exam, and sets the stage for the new skills. The STOP signs tell students to ask for lessons if needed on the upcoming new skills, but the teacher can feel free to ignore this if group lessons will be given on a schedule rather than individualized or as needed. The teacher may give the lessons up front before the review set begins, or can let the students work through the questions and be prepared to give lessons to those students who need them only as they come to unfamiliar work.

In MIM4 and MIM5 some sets only have 2 new skills. Why?

These skills tend to be larger in scope and it makes sense with the pacing to have fewer new skills introduced.

It looks like IM5 isn't finished yet. What is the deal with that?

I need to finish that off. Retake Exams and Answer Keys still need to be completed. I'll get those out as soon as I can.