

## Curriculum Overview

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### Using Electronic Files

Version 1.5 is supplied to the original collaboratory in both PDF and Word files and will be posted for the general public in PDF files. The following are some issues to be aware of:

- PDF files need to be viewed with Adobe Acrobat for full functionality. If viewed through Preview, which is the default on some computers, URLs may not be correct.
- Some equations and graphics may not appear correctly in different versions of Word, but they are correct in PDF form.
- The files are named and organized into folders so that they are listed in the order listed in the Table of Contents. It is recommended that users print the Table of Contents and employ it as a guide for the electronic files.
- The file names indicate the lesson number and whether the document is the instructor or student version or the out-of-class experience (OCE).

### Structure of the Instructor's Notes for the Lessons

The following main features of the Instructor's Notes for the lessons are described in this document:

- Opening Grid
- Prerequisite Assumptions
- Specific Objectives
- Explicit Connections
- Notes to Self
- Suggested Timeline
- Special Notes
- Student Handout with Embedded Instructor Notes
- Further Applications
- Key to OCE

#### Opening Grid

The following grid appears at the beginning of each lesson:

Main Math Topic	Main Quantitative Reasoning Context	Productive Persistence Focus	Level of Productive Struggle
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This serves as a quick summary of key features of the lesson. The math topic and quantitative reasoning context are self-explanatory. The last two require explanation.

- **Productive Persistence Focus:** Some lessons, especially early in the course, have direct connections to productive persistence. Later in the course, some lessons contain a note about supporting struggle to indicate that the lesson has increased expectations for students. Some lessons also contain references about the self-regulated learning (SRL) information in the previous OCE. This alerts the instructor to aspects of SRL that he or she might want to reinforce in class. **Note on Version 1.5:** The integration of productive persistence strategies is still an early stage in this version. It is anticipated that this will be considerably enhanced in future versions.
- **Level of Productive Struggle:** The levels of productive struggle are a way to help authors and instructors think about scaffolding productive struggle through the course. The levels (defined below) should be viewed broadly as a continuum rather than as distinct, well-defined categories. In general, the level increases through the course, but this does not mean that every Module 3 and 4 lesson will be a Level 3. The level is based both on the development of students and the demands of the content. Some content requires greater structure and more direct instruction. The levels of productive struggle are as follows:

- **Level 1:** The problem is broken into subquestions that help develop strategies. Students reflect on and discuss briefly (3–5 minutes) and then are brought back together to discuss with the full class. This process moves back and forth between individual or small-group discussion and class discussion in short intervals.

**Goal of the instructor:** Develop the culture of discussion, establish norms of listening, and model the language used to discuss quantitative concepts.

- **Level 2:** The problem is broken into subquestions that give students some direction but do not explicitly define or limit strategies and approaches. Students work in groups on multiple steps for longer periods (10–15 minutes) with the instructor facilitating individual groups as needed. The instructor brings the class together at strategic points at which important connections need to be made explicit or when breakdowns of understanding are likely to occur.

**Goal of the instructor:** Support students in working more independently and evaluating their own work so they feel confident about moving through multiple questions without constant reinforcement from the instructor.

- **Level 3:** The problem is not broken into steps or is broken into very few steps. Students are expected to identify strategies for themselves. Groups work independently on the problem with facilitation by the instructor as necessary (15–30 minutes). Groups report on results, and class discussion focuses on reflecting on the problem as a whole.

**Goal of the instructor:** Support students in persisting with challenging problems, including trying multiple strategies before asking for help.

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### Prerequisite Assumptions

This section lists the skills that students need to be prepared for the lesson. The same list is given to the students in the previous OCE. The OCE contains at least one question using each skill. Students are asked to rate their confidence on each skill. If they struggle with transference of these skills into the new context of the lessons, the instructor can refer back to the previous OCE to help students recognize that they have done similar problems.

### Specific Objectives

These objectives are based on the course outcomes, but are narrower so that they apply to the specific focus of the lesson. The student handout also contains the specific objectives to help students evaluate their learning. The mapping of course outcomes by lesson is in a separate document, Mapping of Outcomes.

### Explicit Connections

This section is tied to sections in the student handout and OCE. The full description of how these sections are related is given on the following page.

### Notes to Self

These prompts are provided to support instructors in defining a few goals on which to focus while teaching the lesson. An instructor would not necessarily identify a goal in each area for every lesson.

### Suggested Timeline

The timeline provides suggestions from the author on the timing, flow, and pedagogical structure of the lesson. This also ties back to the level of productive struggle as it sets forth suggestions for when instructors should provide large-group facilitation versus facilitating small-group or individual work.

### Special Notes

Some lessons contain general notes before the beginning of the lesson. These indicate special considerations such as

- support materials needed for the lesson,
- notes on information from the previous OCE that is used in the lesson, and
- notes about the overall purpose or structure of the lesson.

### Student Handout with Embedded Instructor Notes

The student handout sections are indicated by the subheading [*Student Handout*], and the sections are indented. Instructor notes and answers are flush left, and the answers are in italics.

The student handout begins with the second section of Specific Objectives. These are the same objectives listed on the first page of the instructor notes.

The next section is the Problem Situation. This frames the lesson for students. In some lessons, there are multiple problem situations.

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The questions that form the lesson are followed by the Making Connections section. This relates to the other “connections” pieces of the curriculum and is discussed separately in this document.

### Further Applications

The last section in the student handout is Further Applications. This section contains one or two optional questions that the instructor may assign as a part of the OCE so students can do some more in-depth written work. Alternatively, the instructor may cover the questions in class if there is time. These questions can also be used for review later in the course. It is important to be clear with students when and if they are expected to do these questions.

### Key to OCE

The solutions to the OCE are on the last page of the Instructor's Notes.

## **Pathways Learning Opportunity: Making Explicit Connections About Important Mathematical Ideas**

The Quantway curriculum is designed promote a mindset of looking for connections in the mathematics. This is different from connections between contexts, which are also an important aspect of quantitative reasoning.

The curriculum identifies some broad, high-level connections between the concepts in different lessons. These are not the only connections that exist. The connections identified in the curriculum are a starting point. It is expected that instructors and students will make other connections in the course of the work.

The following structures support the development of the “connections mindset.” They are closely articulated. It is important to understand how they build upon each other.

### Instructor's Notes: Explicit Connections

This section gives one or two bulleted statements about the connections of the mathematical ideas to other lessons. These are listed at the beginning of the lesson so the instructor can be aware of the connections as he or she reads the lesson.

### Instructor's Notes and Student Handout: Making Connections

This is the last section in the lesson (followed by Further Applications). Its purpose is to provide structure for making explicit connections in the lesson wrap-up. The student handout simply gives a prompt for students to take notes on the important mathematical ideas. The instructor version repeats the statements from the previous Explicit Connections and provides facilitation prompts to support discussion of the connections. Instructors should be aware of the following:

- The instructor's notes do not summarize all ideas of the lesson. It is assumed that the instructor will incorporate the usual lesson wrap-up into this discussion. These notes are intended to facilitate the inclusion of broader ideas.
- The goal is to have students actively engaged in making the connections rather than the instructor informing them of the connections. This is a challenging skill that will be developed through the course. Early discussions are likely to be slow-starting and require a great deal of prompting. Instructors can build on what students say and model how to express these abstract

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concepts. The facilitation prompts provide instructors with ideas of how to promote student discussion. As the explicit connections emerge, the instructor should record the ideas on the board and, especially early in the course, make sure students record the ideas in their notes.

### OCE: Making Connections to the Lesson

The first section of the OCE contains two questions designed to encourage students to refer back to notes and think about connections.

**Question 1:** This is a multiple-choice question that relates directly back to the Making Connections portion of the lesson. It asks students to identify an important mathematical idea from the lesson. The answer will be one of the Explicit Connections from the instructor materials. This question is designed to assess three common problems:

1. Students focus so much on calculations and procedures that they do not recognize common and important mathematical concepts. The multiple-choice question contains a distractor that requires students to distinguish between procedural skills and a main idea.
2. When mathematics is taught in context, the context can obscure the mathematical ideas. So students learn, for example, how to calculate a population density, but do not recognize that ratios can be used in the same way in other contexts. The multiple-choice question contains a distractor about the context of the lesson that requires students to differentiate between context and a mathematical idea.
3. The multiple-choice question also contains a distractor with a common misconception about the mathematical content.

**Question 2:** This requires students to make a connection between the current lesson and previous lessons. This is a high-level skill, so the questions are scaffolded over the course:

- **Module 1:** Multiple-choice questions that model what is meant by “connections” and how to state connections.
- **Module 2:** Narrowly defined, free-response items with specific references to lessons to use. Students are given sentence stems or some other structure to support them writing about the ideas.
- **Modules 3 and 4:** Students write to similar prompts as in Module 2 with specific references of lessons to use, but without the sentence stems.

## The Role of the Out-of-Class Experience

One of the most important aspects of the Quantway curriculum is the role and design of the OCE. The Quantway OCEs differ from traditional homework in several ways:

- Each question has a specific purpose. While some questions are specifically skill based, repetition of a skill in a single form is never used. If repetition is deemed valuable, it is done with different contexts or formats that require students to think about each question rather than assume they can repeat the steps of the previous question.
- The OCEs review previous material, practice and develop skills from the current lesson, and prepare students for the next lesson. The latter is done explicitly. Students are given a list of

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prerequisite set of skills for the next lesson and asked to rate themselves. Each of these prerequisite skills is used in the assignment.

- The OCEs occasionally contain information or questions that are directly used in the next lesson.
- The OCEs are designed based on the same principle of productive struggle as the rest of the Quantway curriculum. Ideally, each assignment should offer entry-level questions that all students should be able to complete successfully and also more challenging questions. One goal of the entire curriculum is that students will increasingly engage in productive struggle. The expectation is not that every student should be able to answer every question correctly, but that every student should make a valid attempt on each question. Therefore, there are questions in the OCEs, especially in the later modules, that many students may not answer correctly. This raises issues about grading practices, which are discussed below.
- In some cases, the OCE includes actual instructional materials. It is expected that students will read this material because it is usually something that is not presented directly in class. This distinguishes the material from traditional textbooks in which the text is often assigned by instructors, but often only used by students as a reference.
- The purpose and structure of the OCE is explained directly to students. Instructors are encouraged to reinforce this by discussing it with students.
- The OCEs purposefully refer students back to previous lessons. This is done to support students in making connections across the course, encourage students to review previous material, and support good organizational habits.

### Format of the OCE

In general, the OCE questions are written in the form of multiple choice or short answer with clearly defined answers. This was done to facilitate the use of an online platform. There are occasional exceptions when a free-response answer is used. It is assumed that these types of questions are given credit for completion in an online system and that instructors occasionally read and grade these responses.

In addition to the OCE assignments, the Further Applications questions at the end of each lesson give instructors an option to assign more open-ended questions so they can see student work, ask students to write explanations, or ask more conceptual questions.

The OCE have four sections:

- **Making Connections to the Lesson**—This section is tied to the Explicit Connections in the lesson and is described earlier in this document.
- **Developing Skills and Understanding**—This section gives students the opportunity to practice and use the skills and concepts from the current lesson. Usually, this section includes questions using the context from the lesson to give students a familiar context as they begin using the new skills.
- **Making Connections Across the Course**—This section contains questions that use material from previous lessons. Ideally, this is tied to the material from the current lesson, but sometimes it is not. In a few cases, this section also presents instructional material on concepts that will be used in future lessons.

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- **Preparing for the Next Lesson**—This section includes information and skills that will be used in the upcoming lesson. Occasionally, students do work that will be the starting point for the lesson. Students rate themselves on each of the skills that they need for the next lesson.

### Strategies for Supporting the OCE

The central role and unique design of the OCE in the curriculum requires instructors to develop strategies and procedures for supporting students to use the OCE appropriately. The following are some areas instructors should consider and some suggestions for strategies.

**Motivating Students to Complete the OCE**—The design of the OCE supports motivation as students come to realize that much of the material in the OCE is actually useful to them in class. Instructors can support this by doing the following:

- Discuss the role of the OCE with students.
- Set and maintain an expectation that students should be able to use the prerequisite skills for a lesson. Students may take this lightly at first, so it is important that instructors do not take class time to review these skills but make it clear that students are responsible for being prepared. Keep in mind the following:
  - Students may have prepared, but may not recognize that what they are being asked to do in class is the same skill they used in the OCE. Be prepared to refer back to specific questions in the OCE to help them make this connection.
  - If a student is truly unprepared, do not reprimand him or her in front of the class. Privately explain the expectation for preparation to the student and invite him or her to meet with you outside of class to review the material. If you do meet the student outside of class, take the opportunity to talk about the importance of preparation and inquire about how the student does the self-assessment. Help the student develop strategies for using this tool more effectively.
- In OCEs that require work that will be used in class, have some way for students who do the work to receive credit. The model of group work allows all students to participate in the lesson even if they did not do the OCE work. This is important, but students who come prepared should feel that their work is valued. You can give students a quick completion grade by walking around the room and seeing who has their work complete while students are reading the problem statement or by having students turn the work in before class.
- Early in the course, take the time to grade some assignments individually and give students written comments.
- Notify students at the end of the first, second, and third weeks if they have failed to complete any of their work. This can be done by email or by handing out notes in class. It is important for students to know that the instructor is aware of their individual work. Always include an offer of help and expressions of support in these notices. For example, “If there is something preventing you from completing your work, please come to see me. I want to help you be successful in this course.” Keep in mind that there are many reasons that students fail to complete out-of-class work.

**Grading OCEs**—Since the OCEs are designed to challenge students and promote productive struggle, grading only on correct answers may not be appropriate and may discourage students. On the other

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hand, grading on completion has drawbacks as well. Since multiple-choice questions are used so extensively, a student can complete (i.e., give answers to) a large portion of the OCE without doing much work. Effective grading strategies have to be individualized depending on the grading time instructors have, the length of classes, and the student population. Some ideas follow.

- Use a scoring method that gives points for both completion and correctness.
- On a regular basis, require that students turn in a written explanation for one of the challenging questions. Weight the grade toward the quality of their attempts versus the correct answer.
- Grade on correctness, but allow students to turn in written explanations for problems they missed and earn back points. This can be managed by limiting the opportunity to one or two problems each week or to certain assignments.
- Occasionally require students to turn in an assignment with written explanations.

**Organization of Materials**—The physical organization of the class materials is important for the entire course. It affects OCEs because of the design that requires students to use previous material. If an online platform is used for the OCE, instructors should consider if students will be required to print out their assignments. If students are not generally printing out their work, they need to do so for the assignments that require work be used in the next lesson.

Many students struggle with organization. Instructors should provide some sort of structure to support students. Strategies include the following:

- Explain to students why it is important to organize their materials. Give specific examples of the ways in which they will use the materials in this course.
- Require that students keep materials in a three-ring binder.
  - **High structure:** Give students guidelines on how to order and label materials.
  - **Moderate structure:** Give students guidelines, but also give them the option to create their own method of organization.
- Any structure that is required should be graded in some way (or students will not do it). Checks should be done in the first few weeks of the course to establish a routine.
  - Check in class on a regular basis: tell students to find a specific document within a specified amount of time (e.g., 2 minutes). Students get a grade for showing the instructor the document.
  - Start with a quick check for having the system (binder, folder, etc.) set up. Then occasionally have students turn their materials in and do a spot-check for certain documents.
  - Give timed quizzes in which students are referred to certain documents and respond to some quick question about the materials.

## Language and Literacy Skills in Quantway

Quantitative literacy has unique language demands that are different from other subjects, even other math courses. Even skilled readers and writers often struggle with using and interpreting quantitative information in conjunction with language. One of the greatest challenges of Quantway is that it seeks to teach quantitative literacy to a population that has a high proportion of students who are not college-level readers or writers for a variety of reasons.

The learning outcomes of the course include the following:



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- Reading and interpreting quantitative information from a variety of real-world sources.
- Communicating quantitative results both in writing and orally using appropriate language, symbolism, data, and graphs.

The designers of the course have further defined the expectations and purpose of reading and writing in Quantway. Students will read and use *authentic texts*, which are defined as text that comes from a real-life source or, in rare occasions, has been written by a lesson author to replicate a real-life source. The purpose of using authentic texts is to support engagement and the development of skills in reading quantitative information in real-life situations.

The purpose of writing in Quantway is to

- make sense of quantitative information and processes, especially in relationship to a context.
- build skills in communicating about quantitative information.
- provide one form of assessment by which students may demonstrate their understanding of the course material. (**Note:** Other assessment methods will be used including verbal responses [in class], short answer, fill in the blank, multiple choice, true–false, presentations.)

As much as possible, writing assignments are framed with a specific context, purpose, and audience (e.g., write a letter to your congressman supporting your views on ...).

By the end of the first term of Quantway, students will be able to write two to three paragraphs that make appropriate and accurate use of quantitative information.

Quantway seeks to address this by building reading and writing skills along with the mathematics skills through the course. Two supplemental materials are provided to support this work: Writing About Quantitative Information and Visual Displays of Information. Both have student and instructor versions. In addition, points of direct instruction and practice are built into Modules 1 and 2 as indicated in the table below. Modules 1 and 2 provide these opportunities for instruction and highly structured skill-building to prepare students for Modules 3 and 4 when students are expected to use their reading and writing skills more independently. Instructors should pay special attention to these points in the lessons and give ample time to discuss them in class. The Module 2 Culminating Activity provides an opportunity for instructors to assess the reading and writing skills and give students feedback and ongoing support as needed.

In addition to the built-in tasks, it is expected that instructors will read and give feedback on at least three written items before students do the Module 2 culminating activity. The exact placement of these assignments is left to the instructor due to the need to schedule grading time. These can be very basic, one- or two-sentence responses to a question. The Further Applications questions are a good source for prompts. There are also opportunities within lessons. Due to time constraints in class, it may not be reasonable to have students write complete statements in response to every prompt, but instructors can select prompts that are more summary in nature to use for this purpose. See the instructor version of the Writing About Quantitative Information document for ideas about modeling and giving feedback on writing.

Lesson	Task/Goal
1.1	Students are introduced to the complexity of communicating quantitative concepts.

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Lesson	Task/Goal
	This sets the stage for the use of language in the course.
1.2	Students are given a basic Writing Principle to use in the course. Students see examples of well-written and poorly written statements. Students write a statement with quantitative information. <i>Instructors should use/assign the Writing Routine document.</i>
1.3	Students write estimation strategies. Instruction about words used with estimation is provided (OCE). Students write a statement with quantitative information (OCE).
1.5	Introduction to reading strategies Students read complex information with instructor support and discuss strategies about picking out important information. Multiple-choice question on selecting the best statement (OCE).
1.6	Multiple-choice question on selecting the best statement (OCE) based on authentic text.
1.7	Students use IRS form with instructor support.
1.8 and 1.9	Students interpret nuanced quantitative statements related to percentages.
2.1	Multiple-choice question on selecting the best statement (OCE).
2.2	Multiple-choice question on selecting the best statement (OCE). Students write a statement based on a model (OCE).
2.4	Students read a map showing U.S. House of Representative apportionment with instructor support. Students read and interpret bar, pie and line graphs (OCE). <i>Instructors should assign Visual Displays of Information.</i>
2.5	Students interpret nuanced quantitative statements related to percentages.
2.6	Students read complex information with instructor support and discuss making meaning of quantitative information.
2.7	Students read and use information presented in the form of advertising. Students write statements about information from a line graph. Students read and use information from press releases and from a website (OCE).
2.8	Students justify a statement with quantitative information. Students read and use line and bar graphs (OCE).
2.9	Students use a table from a website with support of instructor and discuss making sense of the numbers.
Module 2 Culminating Activity	Students find, read, and interpret information from a website or other source. Students select the best type of visual display for a given purpose and make graphs. Students write a one-paragraph response to a question and make a poster presentation

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Lesson	Task/Goal
	including a graph.

Reading quantitative information continues to be embedded in Modules 3 and 4, although there is less emphasis on instruction. Instructors should continue to grade and give feedback on occasional writing assignments. Several lessons contain writing prompts or have topics that lend themselves to instructor-created prompts that can be used for this purpose. The frequency of these depends upon the skill level of students. In the Module 4 Culminating Activity, students are expected to write a brief report or article on a topic. The in-class work supports them in preparing the information and the general outline of their report.

## Content Outline of Curriculum

The following outline gives an overview of the curriculum. Because of the spiraling nature of the curriculum, it can be difficult for an instructor to know what level of mastery to expect at different points. The outline shows where topics are introduced and what should be mastered by the end of the unit.

Some lessons are designated as “formative assessment lessons.” The lessons do not introduce new concepts, but review the important concepts and skills from the previous lessons in the unit in a new context. This is an opportunity for instructors assess whether students have learned the skills well enough to apply them in a new context. Instructors may also choose to cut portions of these lessons to focus on areas in which students are struggling. The lessons provide suggestions for how instructors might individualize for their situation. Since the formative assessment lessons do not introduce new material, they are not listed separately in the outline.

Lesson	Main Topics	Expectations for Mastery at End of Unit
<u>1.1–1.5</u> “The Toolbox” 1.5 is a formative assessment lesson.	<u>1.1 and 1.2</u> Number Basics <ul style="list-style-type: none"> <li>• Rounding</li> <li>• Large numbers: Place value, naming, standard notation, powers of 10</li> <li>• Relative magnitude of large numbers</li> </ul>	<b>Mastered:</b> All skills listed
	<u>1.3</u> Percentage: Interpretation, estimation, calculation	Focus should be on conceptual understanding (10% is 10 out of 100) and estimation strategies. Calculation of percentages is introduced, but will be reinforced later if students have not mastered the skills.  <b>Mastered:</b> Interpreting percentages; estimating simple percentages based on benchmarks, including explaining estimation strategies
	<u>1.4</u>	The course assumes that other than for estimation, students will usually use

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Lesson	Main Topics	Expectations for Mastery at End of Unit
	<b>Calculation Fluency:</b> Relationship of multiplication and division, fractions and decimals; commutative property, order of operations, distributive property	technology for calculations. The emphasis here is on the types of skills that will be helpful in using technology, using formulas and solving equations. Students should master the basics such as: <ul style="list-style-type: none"> <li>Order of operations for expressions such as <math>3(5) + 3</math></li> <li><math>a \times 1/2</math> is the same as <math>a \div 2</math></li> <li>Addition and multiplication can be reordered to make calculations easier.</li> </ul>
<u>1.6–1.9</u> Ratios	<u>1.6</u> Scientific notation	<b>Mastered:</b> Writing large numbers in scientific notation
	<u>1.6</u> Creating ratios Interpreting ratios with units Creating ratios with large numbers	Students should be gaining confidence with working with large numbers. <b>Mastered:</b> Basic concept of ratio, creating and interpreting ratios with units; using technology for calculations with large numbers
	<u>1.7</u> Performing multistep calculations based on instructions	Students should be gaining confidence with reading and interpreting instructions for calculations. <b>Mastered:</b> Able to perform a three-step calculation based on simple instructions (not as complex as the lesson)
<u>1.6–1.9</u> Ratios	<u>1.8 and 1.9</u> Complex uses of percentages—Identifying reference value, interpreting language, selecting correct data from a table	Students should recognize the complexities of situations with percentages. While they may not have mastery of these situations, they should know to take care in thinking about the reference value. <b>Mastered:</b> Calculating a percentage of a number and what percent one number is of another; using information in a two-way table
<b>Note:</b> Instructors should plan for the review before the Module 1 test. A student handout is provided, and there are suggestions in the Lesson 1.2.4 Instructor's Notes.		
<u>2.1–2.5</u> Proportional Reasoning and Graphs	<u>2.1 and 2.2</u> Ratios, including equivalent forms Using proportional reasoning to calculate a new value based on a ratio	More practice with ratios and introduce using proportional reasoning to calculate a new value based on a ratio. This concept will be used again in Lesson 2.8 so mastery is not expected here.
	<u>2.3 and 2.5</u> Calculating and interpreting absolute and	As in Module 1, students may not fully master the complexity of the situations with

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Lesson	Main Topics	Expectations for Mastery at End of Unit
	relative change, including complexities with interpreting language	percentages, but they should be developing skills to identify issues with reference values <b>Mastered:</b> Calculating absolute and relative change; recognizing problems in comparing absolute and relative change and percentages with different reference values (in pie graphs and data)
	<u>2.4</u> Reading and interpreting graphs Using information to calculate relative change Recognizing misleading graphs	Students may not fully master the ability to identify subtle misleading graphs, but should know that care must be taken in reading labels and scales. <b>Mastered:</b> Reading information from graphs, use information to calculate relative change
<b>Note:</b> Instructors should think about when they will do the Module 2 culminating activity lessons. While they are listed at the end of Module 2, it is suggested that instructors might want to intersperse them with the last Module 2 lessons. See the Module 2 Culminating Activity Part 1 for details.		

2.6–2.9 Measures of Central Tendency and Index Numbers 2.9 is a formative assessment lesson.	<u>2.6 and 2.7</u> Calculating measures of central tendency Interpreting meaning of measures of central tendency	The lessons introduce concepts about the differences in the measures of central tendency and deciding which is most appropriate but mastery is not expected. <b>Mastered:</b> All skills listed
	<u>2.8</u> Using and interpreting index numbers Using proportional reasoning to calculate a new value based on a ratio	Students should understand the general concept of index numbers: They provide a way to compare values over time or in different places. <b>Mastered:</b> Using proportional reasoning to calculate a new value based on a ratio
<b>Note:</b> There is no OCE for Lesson 2.9. It leads into the culminating activity and the module test. There is an OCE that students need to do before starting Module 3 to prepare for Lesson 3.1. See the Lesson 2.9 Instructor's Notes in for details.  Instructors should plan for the review for the Module 2 test. There is a student handout and notes in the Lesson 2.9 Instructor's Notes.		

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Lesson	Main Topics	Expectations for Mastery at End of Unit
Culminating Activity Parts 1, 2, and 3	<p>Conducting a simple Internet search</p> <p>Evaluating if a source is relevant and reliable</p> <p>Using quantitative information to make an argument</p> <p>Communicating with quantitative information</p>	<p>Evaluating sources is a complex skill. This lesson provides an introduction, but a high level of skill is not expected.</p> <p>This is the students' first formal writing assignment of more than one or two sentences. This should be seen as part of the development in their skills.</p> <p><b>Mastered:</b> Conducting a very simple Internet search on a well-defined topic</p>
<u>3.1 and 3.2</u> Dimensional Analysis	<p>Multiplication of fractions</p> <p>Using units to set up dimensional analysis problems and check for errors in calculations</p> <p>Using dimensional analysis to make calculations using multiple conversion factors</p>	<p>While multiplication of fractions is assumed in the dimensional analysis, it is not separately assessed.</p> <p><b>Mastered:</b> Using dimensional analysis to make calculations using multiple conversion factors</p>
<u>3.3–3.8</u> 3.5 is a formative assessment lesson.	<p><u>3.3 and 3.4</u></p> <p>Understanding the use of variables, including importance of units</p> <p>Evaluating formulas</p> <p>Geometric concepts of linear measure, area, and volume</p>	<b>Mastered:</b> All skills listed
	<p><u>3.6–3.8</u></p> <p>Solving equations, including</p> <ul style="list-style-type: none"> <li>• basic two-step equations</li> <li>• equations written as proportions</li> <li>• literal equations</li> <li>• equations with multiple variable terms that need to be simplified</li> <li>• simple quadratics (estimation of solution is accepted)</li> </ul>	<p>The three lessons reinforce the fundamentals of solving equations.</p> <p><b>Mastered:</b> All skills listed</p>
Instructors should plan for the review for the Module 3 test. There is a student handout and notes in the Lesson 3.8 Instructor's Notes.		
Lesson	Main Topics	Expectations for Mastery at End of Unit
<u>4.1–4.9</u> Models 4.7 is a formative assessment lesson.	<p><u>4.1–4.3</u></p> <p>Using, creating, and interpreting four representations of a linear model</p> <p>Understanding that a linear model has a constant rate of change</p> <p>Identifying and interpreting slope, vertical and horizontal intercept in context</p>	<p>Students are expected to master all the skills listed for linear models, but they may not accomplish this by the end of Lessons 4.3. Lessons 4.4–4.6 explore other topics, but Lessons 4.7 and 4.8 give students more practice with linear models. The lessons give students a lot of information up front, and then they have time to work with the skills</p>

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Lesson	Main Topics	Expectations for Mastery at End of Unit
	Creating a linear model from data	over time. <b>Mastered:</b> All skills listed
	<u>4.4</u> Writing an expression for a relative increase or decrease Calculating the results of multiple relative increases/decreases (shifting reference value)	This lesson reviews percentages and prepares students for the exponential lessons. <b>Mastered:</b> All skills listed
	<u>4.5 and 4.6</u> Basic understanding of how an exponential function differs from a linear function Understanding compound interest and using formula to find values Writing an exponential equation given a starting value and rate Using an exponential equation to find values Creating exponential graphs	Students should have a general understanding about how the rate of change of an exponential function varies. Students receive more practice with exponential functions in Lessons 4.7 and 4.9. As with linear, full mastery may not occur with these initial lessons. <b>Mastered:</b> Compound interest; writing and using exponential equations
	<u>4.8 and 4.9</u> While these two lessons are not categorized as formative assessment, they basically serve that purpose for reviewing the concepts of linear and exponential models. These lessons also provide a challenging problem-solving situation at the end of the course.	<b>Mastered:</b> Linear and exponential concepts from above.
<b>Note:</b> There is one OCE for these two lessons. The OCE is to prepare for the Module 4 culminating activity. Instructors should also plan for the review for the Module 4 test and the course final. There is a student handout and notes in the Lesson 4.8 Instructor's Notes.		
Module 4 Culminating Activity	Reading and interpreting information Selecting relevant information to answer a question Making and justifying assumptions in a complex situation Creating and using models based on data Making and justifying an argument	This activity gives students an opportunity to bring together many skills from the course. It serves as the assessment for the Communication outcome.

## Suggestions for Shortening the Curriculum

The curriculum contains forty 50-minute lessons, four module tests, and a final. The amount of actual class time varies by institution, and some instructors may not be able to cover all the materials. Due to the spiraling, interconnected nature of the curriculum, it is difficult for someone who is not very familiar

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with the materials to know where it is possible to make cuts. The authors make the following suggestions.

First, some things to consider in making cuts.

- Even if a lesson is cut, do not cut the entire OCE. The Prepare for the Next Lesson section is still important and the Making Connections Across the Course section provides opportunities to use previous skills in new contexts.
- Consider not only mathematical content but also language and literacy scaffolding. You can refer to the list of embedded language and literacy materials in this document. If you cut mathematical content that contains these embedded elements, be sure to incorporate the same elements into other lessons.
- Lessons and OCEs often refer back to previous materials. Be aware of this as you make cuts.
- It is tempting to cut the culminating activities since they do not cover new content. The authors strongly urge you not to do this. The culminating activities are important learning and assessment opportunities and embody the philosophy of quantitative literacy.
- The formative assessment lessons (1.5, 2.9, 3.5, 4.7) are designed to allow for some individualization based on needs. These are one place to look to shortening materials. Notes on the specific lessons are given below.

Lesson	Notes	Ramifications
1.2	<p>Lesson 1.2 should not be cut, but it can be shortened by putting less emphasis on the doubling time.</p> <p><b>Option 1:</b> Students should do at least two of doubling time estimates, but you can focus on the simpler ones (Questions 2a and 2b) and give students the remaining entries in the table. Then students should still be able to do Questions 3–5.</p> <p><b>Option 2:</b> Cut the doubling time discussion. This requires that the instructor modify questions 3–5 to fit the material in Problem Situation 1 or in the material that replaces this lesson.</p>	<p>Problem Situation 1 is important for relative magnitude and should not be cut.</p> <p>The introduction to writing about quantitative patterns (Questions 3-5) sets up future writing. There are a few doubling time questions throughout the curriculum, but these can be deleted without impacting other content.</p>
1.5	<p>This lesson contains instruction on reading complex material that is essential. The topic of credit cards is also an important personal finance topic. However, specific questions in the lesson are review of previous material and can be cut.</p>	<p>Students will need a basic understanding of how credit cards work in later work.</p> <p>This lesson provides some in-class discussion of spreadsheets that you may or may not need depending on your students.</p> <p>Students need the instructional material that follows Question 5 regarding the instructions “explain in terms of the context.”</p> <p>Question 3 uses a percentage less than one. Students should see a problem like this in class.</p>
2.6 and 2.7	<p>Lessons 2.6 and 2.7 cover measures of center. These two lessons could be shortened into one</p>	<p>For the later course materials, it is most important that students understand the following:</p>



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Lesson	Notes	Ramifications
	depending on the level of understanding expected. This content is very important in quantitative literacy, but is often covered in college-level courses. Consider the expectations for your students in their next level of courses.	<ul style="list-style-type: none"> <li>General concept of an average (not just measures of center)</li> <li>How to calculate mean and median</li> <li>What a median represents</li> </ul> <p>Module 2 test questions would need to be modified based on changes in the lessons.</p>
2.9	This formative assessment lesson is probably the least important since it reviews a small amount of material.	None
Module 2 Culminating Activity	<p>The Module 2 Culminating Activity is designed for three days. The second day serves two purposes. First, it is a check-in to support students in finding references for the activity. Second, it gives students practice with selecting an appropriate type of graph and making graphs. This day could be cut, and these goals can be incorporated in other ways.</p> <p><b>Options for check-in:</b> Have students meet with you to review their references, have students turn in their references early, and meet with students that are struggling. Incorporate this into another lesson.</p> <p><b>Option for graphs:</b> Delete Problem Situation 2 in Lesson 2.4 and replace it with discussion about making graphs. Assign one or more of the graphs from the Culminating Activity Part 2 in the 2.4 OCE.</p>	<p>The written paragraph in the Module 2 Culminating Activity is an important formative assessment point. Students are expected to write more in Modules 3 and 4.</p> <p>The OCEs in Modules 3 and 4 assume that students can do a simple Internet search. These skills are covered in Part 1 of the culminating activity.</p> <p>Problem Situation 2 in Lesson 2.4 is based on gross domestic product (GDP). Later OCE problems refer to GDP. These questions can be answered without fully understanding GDP, but students may be confused by the reference.</p>
3.1 and 3.2	Lessons 3.1 and 3.2 both cover dimensional analysis. As with Lessons 2.6 and 2.7, these could be shortened depending on the level of mastery expected.	Later materials assume that students can make conversions with multiple conversion factors.
3.5	Lesson 3.5 is a formative assessment lesson that reviews dimensional analysis, geometric concepts and the use of formulas. It also introduces a type of visual distortion in pictographs. The material on pictographs is valuable but is not carried over into other materials.	None
4.7, 4.8, and 4.9	Lesson 4.7 is a formative assessment lesson covering linear and exponential models. Lessons 4.8 and 4.9 are also designed to give more practice with linear and exponential models and to provide a strong problem-solving experience at the end of the course. You may determine that	A discussion about organizing a written argument as described in Lesson 4.9 is important before the Module 4 Culminating Activity.

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Lesson	Notes	Ramifications
	<p>students do not need this much review.</p> <p>The written summary in Lesson 4.9 prepares students for the written work in the culminating activity.</p>	

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