



**Carnegie Foundation**  
for the Advancement of Teaching

**Quantway™**

# A Quantitative Reasoning Alternative for Developmental Mathematics

By

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# Remedial Mathematics

- 60% of community college students who take the placement exam place into remedial education classes.
- This could be as high as 90% for low-income and minority students at some community colleges.
- The number of students moving from remedial education classes to college-level courses can drop as low as 15%.

# The problem with remedial algebra

- Many students will never use it in their future coursework.
- Many students will never use it in their careers
- Many students will never use it in real life

# We need mathematics for the developmental student whose major is:

- Behavioral Sciences (child development, psychology)
- Biological Sciences
- Career Technical
- Communications/Journalism
- Criminal Justice Studies
- English and Foreign Languages
- Environmental Studies
- Fine and Performing Arts
- General Studies
- Geography/Geology
- Health Sciences (dental, medical, x-ray)
- Humanities
- Hospitality/Tourism/Culinary
- Humanities
- Kinesiology / Athletics
- Liberal Arts
- Nutritional Science
- Nursing
- Occupational Therapy
- Social Sciences (anthropology, history, poli sci, sociology)
- Social Work
- Undecided

***The Pathway opens doors for students...***

# Quantway I Course

- Designed to replace traditional Beginning Algebra developmental math course
- Has a strong focus on proportional reasoning and also covers algebraic topics such as linear and exponential functions
- Algebra is presented through a "quantitative literacy lens" with an emphasis on using and interpreting functions with less emphasis on algebraic manipulation of equations.
- Big emphasis on contexts: Citizenship, Personal Finance, and Medical Fluency
- Appropriate for students in programs that require a general education math course such as Math for Liberal Arts or program-specific math courses



# MAT04 I Quantway First Unit

	Name	Theme
1.1.1	Introduction to Quantitative Reasoning	Citizenship
1.1.2	Seven Billion and Counting	Citizenship
1.1.3	Percentages in Many Forms	General
1.1.4	The Flexible Quantitative Thinker	Personal Finance
1.1.5	The Credit Crunch	Personal Finance
1.2.1	Whose Footprint is Bigger	Citizenship
1.2.2	A Taxing Set of Problems	Personal Finance
1.2.3	Interpreting Statement about Percentages	Medical Fluency
1.2.4	Percents and Probabilities	Medical Fluency

# Design Elements of the Materials

- **Productive Struggle**

Engages students in thinking about important mathematics concepts. Productive struggle causes students to explore as they develop strategies and their own thinking about the use of mathematics to investigate a problem situation or question. The ultimate goal of productive struggle is to encourage students to make meaning of mathematical content for themselves

- **Explicit Connections**

Refers to the linkages or relationships among and between mathematical and/or statistical facts, procedures, and concepts. Explicit connections generally reference math ideas and concepts and may be about context as well. Connections may be drawn by students or faculty, but most often are presented and reinforced by faculty.

- **Deliberate Practice**

Deliberate practice consists of a set of tasks for students that are created to overcome gaps in understanding, apply what has been learned, and/or deepen fluency with key concepts. It represents a strategic progression of exercises that is purposefully designed to improve performance and strengthen cognitive understanding

# Origin of the Quantway Course

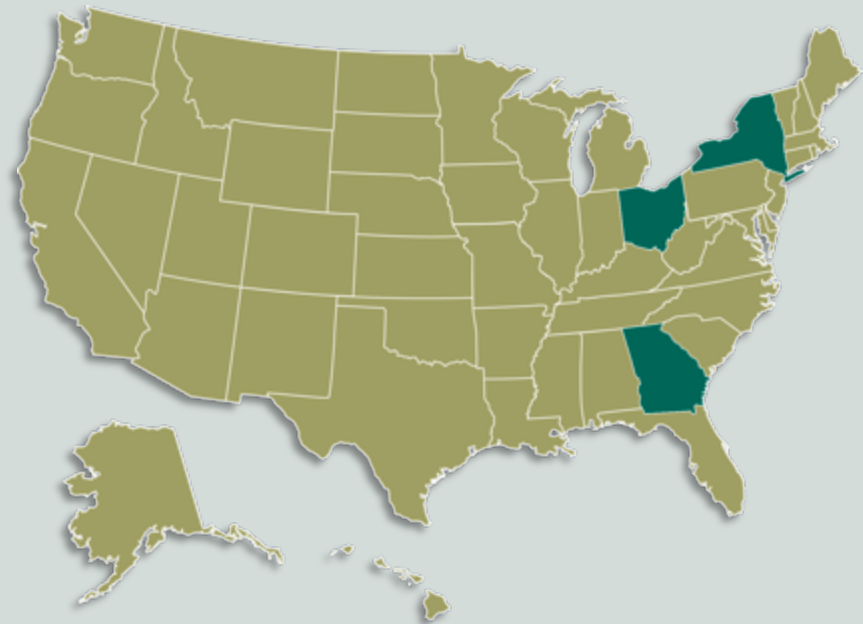
- The original version of the Quantway course materials were written by the Charles A. Dana Center at the University of Texas during 2010-2011 years
- Sponsored by the Carnegie Foundation for the Advancement of Teaching
- Representatives from eight community colleges from GA, NY, and OH involved in revision, development and piloting the original material
- Quantway launched in Spring 2012 semester



# Quantway™

8 Community Colleges

3 States (NY, OH, GA)



# A closer look at Productive Struggle ...

## Review Lesson 1.1.5 – “Credit Card Crunch”

- Where do you think students might “struggle” with this lesson?
- What do you think instructors might do to ensure this struggle is productive?



# Development of Communication Skills

Students will be able to...

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

# Language Use: Obstacle, Tool or Outcome?

- **Obstacle:** high reading level and specialized terminology and language structures can be an obstacle to learning
- **Tool:** Reading, writing and talking about mathematics can support learning and retention
- **Outcome:** Communicating about quantitative concepts is an essential component of quantitative literacy.

# Strategies in Quantway

- **Support** faculty with embedded notes and supplemental materials
- Intentionally **scaffold** reading and writing tasks
  - Direct instruction
  - Modeling followed by practice
  - Attention to confusing terminology
- **Distinguish** between different uses of text
  - Instructional
  - Authentic



# Example: Direct instruction and modeling

Second lesson in course:

**Writing Principle:** *Use specific and complete information. The reader should understand what you are trying to say even if they have not read the question or writing prompt. This includes*

- *information about context, and*
- *quantitative information.*

**(4)** Which of the following statements best describes the change in doubling times before 1800 AD?

- (a) The doubling times decreased.
- (b) *Before 1800 AD, estimated population doubling times decreased from 2,000 to 1,000.*
- (c) The doubling times decreased from 2,000 to 1,000.

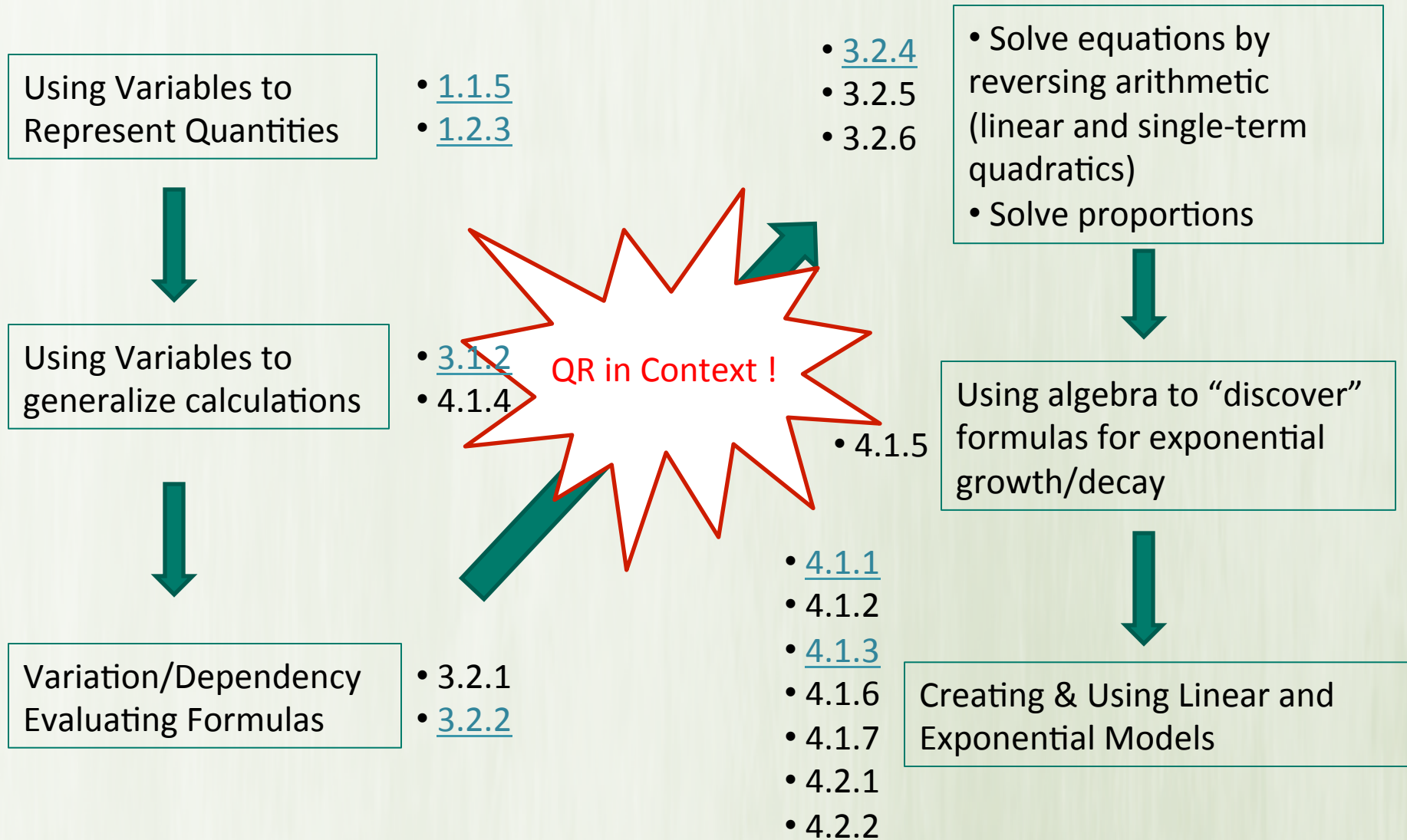
# Example: Terminology

People often confuse the words *million*, *billion*, and *trillion* when speaking. An estimate can help you decide if the speaker uses the correct word. Consider this situation: A speaker says, “The U.S. federal debt is \$14 billion dollars. That’s over \$45,000 for every person in the country.”

Select the correct statement from the choices below. **Note:** When you say the numbers are *consistent*, you mean that they make sense in relationship to each other.

- i. The two numbers in the statement are consistent with each other.
- ii. The two numbers in the statement are not consistent. If the debt is \$45,000 per person, the total debt must be \$14 million.
- iii. The two numbers in the statement are not consistent. If the debt is \$45,000 per person, the total debt must be \$14 trillion.

# Algebraic Development in Quantway



# Implementing Quantway

## The BMCC Quantway Course Timeline:

- Year 1 (2010-2011)
  - Initial co-development
- Year 2: (2011-2012)
  - Lesson studies Fall 2011
  - Piloted Spring 2012 (3 sections)
- Year 3: (2012-2013)
  - Faculty Training (summer 2012)
  - 7 sections Fall 2012
  - Continuous faculty collaboration

# Implementing Quantway Year I (2010 - 2011)

- **Curriculum Development**
  - Participation in the collaborative network
  - Lesson Studies
- **Student Recruitment and Selection for Quantway**
  - Series of Presentations to promote the Quantway
  - Visiting Other Department
  - Quantway Promotion Video
- **Course Approval**
  - Department
  - College Approval
  - CUNY Approval



# Implementing Quantway Year 2 (2011 - 2012)

- Continuous collaboration in the networked learning community
- Continuation of lesson studies and lesson revisions
- First Pilot of Quantway (MAT041) in Spring 2012 (3 sections) semester and Summer 2012 (1 section)
  - In-class and after-class tutor services
  - Shared the Quantway Faculty Office Hours
  - Exam Review Sessions
  - Tutor Training

# Implementing Quantway Year 2 (2011 - 2012)

- Spring 2012 and Summer I 2012 MAT04I student performance

		S (Passed)	R (Failed)	INC	W (Withdraw)	WU (Withdraw Unofficially)	WN (Never shows)
N	86	60	5	1	8	10	2
%		70%	6%	1%	9%	12%	2%

- Challenges

# Implementing Quantway Year 3 (2012 - 2013)

- Faculty Training
  - Reading in Mathematics Curriculum Workshop Seminars
  - BMCC Quantway Summer Institute
    - 10 faculty members (part-time and full-time)
    - Study the Curriculum
    - Discuss Pedagogical Strategies
    - Familiarize with Technology
    - Observation of Lessons
- 7 sections of MAT041 offered
- Weekly Quantway Faculty meetings

# Future of the Quantway Project

- Natural sequence into Quantitative Reasoning course, as well as other terminal mathematics courses
- Curriculum still a work-in-progress
- Faculty training is essential
- Challenges in managing group discussion
- Students needs to pass the CUNY final exam

# More information ...

- The Quantway Project:
  - <http://www.carnegiefoundation.org/quantway>
- Version 1.0 Lessons available at the Dana Center:
  - <http://www.utdanacenter.org/mathways/quantitative-pathway.php>
- Quantway at BMCC
  - <http://www.bmcc.cuny.edu/news/news.jsp?id=8320>
- Quantway Info Videos
  - “Take Quantway and get on your way”  
<https://www.youtube.com/watch?v=D0w2aGeiBVE>
  - “Student Voices from Statway and Quantway”  
<https://www.youtube.com/watch?v=PXPFLKCLKBU>