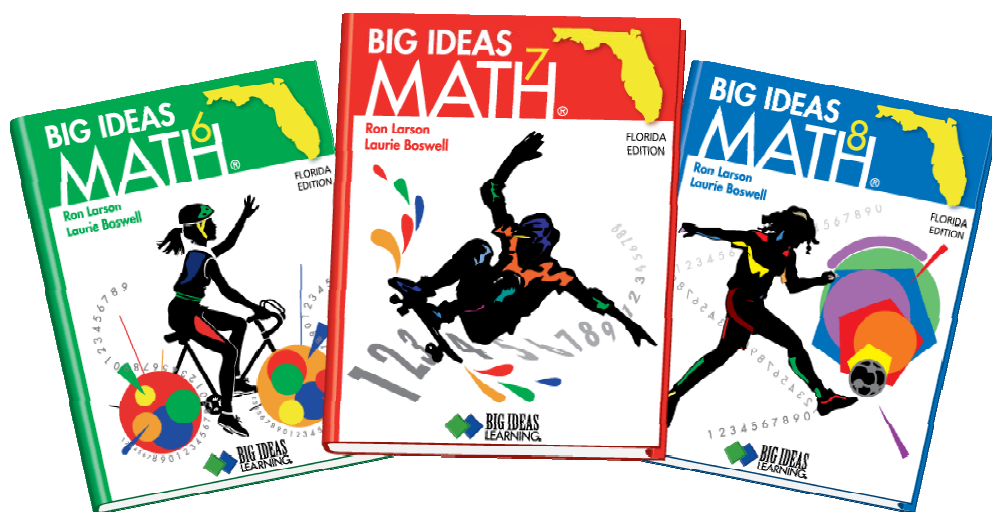


# BIG IDEAS MATH<sup>®</sup>



**Differentiated Instruction**



Your partner in educational solutions

## What is Differentiated Instruction?

“Differentiated Instruction is an instructional concept that maximizes learning for ALL students—regardless of skill level or background. It's based on the fact that in a typical classroom, students vary in their academic abilities, learning styles, personalities, interests, background knowledge and experiences, and levels of motivation for learning. When a teacher differentiates instruction, he or she uses the best teaching practices and strategies to create different pathways that respond to the needs of diverse learners” (Staff Development for Educators).

Staff Development for Educators (2006) writes that Differentiated Instruction is critical for the following reasons.

- Enable teachers to open up learning opportunities for all students by offering varied learning experiences.
- Allows teachers to put research-based best practices into a meaningful context for learning.
- Helps teachers to understand and use assessment as a critical tool to drive instruction.
- Adds new instructional strategies to teachers' "toolboxes" — introducing or reinforcing techniques to help teachers focus on essentials of curriculum.
- Gives administrators, teachers, and students an instructional management system to more efficiently meet the demands of high stakes testing.
- Meets curriculum requirements in a meaningful way for achieving students' success.

## Four Steps to Planning for Differentiated Instruction

The online teacher resource website [teAchnology.com](http://teAchnology.com) describes how to plan for Differentiated Instruction using the four steps below.

### 1 Know Your Students

*Determine the ability level of your students.*

This can be done by surveying past records of student performance to determine capabilities, prior learning, past experiences with learning, etc.

***Survey student interests.***

It is also important to get to know your students informally. This can be done by an interest inventory, an interview/conference, or asking students to respond to an open-ended questionnaire with key questions about their learning preferences (depending on the age group).

***Is behavior management a problem?***

This is key when planning for activities that require less structure. However, it is still important to determine learning styles and preferences for students who may have a hard time controlling their behaviors. Sometimes knowing preferences can help to motivate students to attend to any tasks that are presented.



**Have a Repertoire of Teaching Strategies**

Because "one size does not fit all," it is imperative that a variety of teaching strategies be used in a differentiated classroom. Among many teaching strategies that can be considered, there are four worth mentioning: direct instruction, inquiry-based learning, cooperative learning, and information processing models.

***Direct Instruction***

This is the most widely used and most traditional teaching strategy. It is teacher centered and can be used to cover a great amount of material in the amount of time teachers have to cover what students need to learn. It is structured and is based on mastery learning.

***Inquiry-based Learning***

Inquiry-based learning has become very popular in teaching today. It is based on the scientific method and works very well in developing critical thinking and problem solving skills. It is student centered and requires students to conduct investigations independent of the teacher, unless otherwise directed or guided through the process of discovery.

***Cooperative Learning***

Probably one of the most misunderstood strategies for teaching is "cooperative learning." Yet, if employed properly, cooperative learning can produce extraordinary results in learning outcomes. It is based on grouping small teams of students heterogeneously according to ability, interest, background, etc. However, one of the most important features of cooperative learning is to pick the best strategy that will be used to assign the task for students to accomplish.

### *Information Processing Strategies*

Teaching students "how to" process information is a key factor in teaching students how to strategically organize, store, retrieve, and apply information presented. Such strategies include, but are not limited to, memorization, KWL, reciprocal teaching, graphic organizing, scaffolding, or webbing.

## **3 Identify a Variety of Instructional Activities**

Engaging students in the learning process using activities that motivate and challenge students to remain on task is probably one of the most frustrating events in the teaching learning process. But if you know your students' profiles, you have a better chance at keeping them on task to completion of any given assignment or activity. In a differentiated classroom, activities are suited to the needs of students according to the mixed ability levels, interests, backgrounds, etc. For example, if you have English language learners in your class, you need to provide activities that are bilingual in nature or that provide the necessary resources for students to complete the activity with success. Good activities require students to develop and apply knowledge in ways that make sense to them and that they find meaningful and relevant.

## **4 Identify Ways to Assess Student Progress**

Once again, we cannot assume that "one size fits all." As a result, varying means of student assessment is necessary if students are to be given every opportunity to demonstrate authentic learning. Authentic assessment has been around for a long time and is now taking the limelight as we attempt to measure students' progress in a fair and equitable way. A variety of assessment techniques can include portfolios, rubrics, performance-based assessment, and knowledge mapping.

### **References**

"Differentiated Instruction." Staff Development for Educators (2006). Web. 12 Aug. 2009. <<http://differentiatedinstruction.com/>>

"How to Differentiate Instruction." teAchnology (2009). Web. 13 Aug. 2009. <<http://www.teach-nology.com/tutorials/teaching/differentiate/planning/>>

## Opening Doors to Learning

Two primary concerns while developing the *Big Ideas Math* program were the diversity of the student population and their different learning profiles. Our goal was to develop a curriculum that helps teachers create classrooms that concentrate on learner needs. Because each classroom is heterogeneous, teaching styles need to be flexible and responsive to student learning. There is no one teaching style that is most effective. By using Differentiated Instruction, teachers open doors to learning that students are unable to open themselves.

### Explicit Differentiated Instruction Tools in *Big Ideas Math*

Some tools and features are obviously intended for use in Differentiated Instruction.

- In the teaching edition, various ideas for *Differentiated Instruction* are provided to address the visual, kinesthetic, and auditory learners, as well as the below-level and advanced learners.

#### Differentiated Instruction

##### Visual

Students should understand that the Cross Products Property is an application of the Multiplication Property of Equality. Show the following steps on the board or overhead.

$$\frac{a}{b} = \frac{c}{d}$$

Proportion

$$\frac{a}{b} \cdot b \cdot d = \frac{c}{d} \cdot b \cdot d$$

Multiply each side by  $b \cdot d$ .

$$a \cdot d = c \cdot b$$

Simplify.

$$ad = bc$$

Commutative Property of Multiplication

- In the teaching edition, The *English Language Learners* (ELL) feature provides a brief description of how a teacher can assist an ELL. This feature will focus on defining vocabulary or explaining a concept in more detail, with simplified terminology.

#### English Language Learners

Have students add a glossary to their math notebook. Key vocabulary words should be added as they are introduced. Illustrations next to the vocabulary words will help in understanding and reinforcing the concept.

## Differentiated Instruction and Big Ideas Math

- *Reteaching and Enrichment Strategies* provide a list of resources in the teaching edition that the teacher can use if a student needs more help or if a student thoroughly understands the topic.

<b>Reteaching and Enrichment Strategies</b>	
If students need help . . .	If students got it . . .
Resources by Chapter <ul style="list-style-type: none"> <li>• Practice A and Practice B</li> <li>• Puzzle Time</li> </ul> Record and Practice Journal Practice Differentiating the Lesson Lesson Tutorials Skills Review Handbook	Resources by Chapter <ul style="list-style-type: none"> <li>• Enrichment and Extension</li> <li>• School-to-Work</li> </ul> Start the next section

- The *Resources by Chapter* book contains blackline masters of support material. The following resources can be used to differentiate instruction.
  - Family and Community Involvement
  - Enrichment and Extension
  - Puzzle Time
  - School-to-Work
  - Graphic Organizers / Study Help
  - Financial Literacy
  - Technology Connection
  - Life Connections
  - Stories in History
  - Unit Project with Rubric
- *Differentiating the Lesson* is an online ancillary available at [BigIdeasMath.com](http://BigIdeasMath.com). This ancillary provides complete teaching notes and worksheets to address the diverse learners in the classroom. The lessons engage students in activities that often incorporate visual learning and kinesthetic learning. Some lessons present an alternative approach to teaching the content while other lessons extend the concepts of the text in a challenging way for advanced students. Each chapter of the *Differentiating the Lesson* ancillary begins with an overview outlining the differentiated lessons in the chapter, and describing the students who would most benefit from the approach used in each lesson.
- *Alternative Quiz Ideas* and *Alternative Assessment Options* are provided in the teaching edition for teachers who want to try something other than the traditional quizzes given in the pupil edition.

<b>Alternative Quiz Ideas</b>	
100% Quiz	Math Log
<b>Error Notebook</b>	Notebook Quiz
Group Quiz	Partner Quiz
Homework Quiz	Pass the Paper

<b>Alternative Assessment Options</b>	
Math Chat	Student Reflective Focus Question
<b>Structured Interview</b>	Writing Prompt

## Differentiated Instruction and Big Ideas Math

- The *Assessment Book* contains an alternative assessment for each chapter. Each *Alternative Assessment* includes at least one multi-step problem that combines a variety of concepts from the chapter. Students are asked to explain their solutions, write about the mathematics, or compare and analyze different situations. The *Alternative Assessment Rubric* is a grading rubric that gives the teacher guidance in assessing students' work. The rubric is based on a 4-point scale. It identifies the key elements that students' answers should have in order to earn 1, 2, 3, or 4 points.

Name \_\_\_\_\_ Date \_\_\_\_\_

**Chapter 1 Alternative Assessment**

1. Your teacher has asked you to help Alec, a transfer student, who missed the teaching of operations with integers. You agree to help him and you plan to work together at the library after school. You will not have any counters, so you decide to use number lines to introduce Alec to the concepts of the four operations with integers. After that, you will explain the rules for each operation.

Write a description of how you will help Alec. Include some sample problems you will do with Alec, the number lines, and how you will present the rules for each operation.

2. Of the 26 letters in the alphabet, 15 are drawn with only line segments. For this activity, you will plot 4 points, and determine which of the 15 letters can be drawn using those 4 points and 2 or more line segments.

a. Solve the equations.

$$a = -2 \times 2 \quad -15 \div (-3) = b \quad c = 10 \div (-6) \quad -8 - (-3) = d$$

b. Use your answers from part (a) to write the coordinates of the ordered pairs for the following points.

B(c, b)    C(a, b)    G(d, d)    Q(c, d)

c. Plot and label the ordered pairs in a coordinate plane.

d. Explore what alphabet letters that have no curved lines can be made if you use the points you graphed as endpoints of line segments.

- Each of the four points must be the endpoint of at least one line segment.
- Two or more line segments may be used.
- Any line segment that is used must have two of the points as its endpoints.
- Do not draw a line segment that has an endpoint point other than the four points you graphed.

e. Name the letters that can be formed.

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Name \_\_\_\_\_ Date \_\_\_\_\_

**Chapter 1 Alternative Assessment Rubric**

Score	Conceptual Understanding	Mathematical Skills	Work Habits
4	Shows complete understanding of: <ul style="list-style-type: none"> <li>using a number line as a conceptual model for representing integers</li> <li>operations with integers</li> <li>plotting ordered pairs in a coordinate plane</li> </ul>	Explains all integer operation concepts and rules correctly. Operational models represent given operations exactly. Plotting of all ordered pairs is correctly done.	Answers all parts of each problem. Number lines and coordinate plane are drawn carefully and accurately. Work is neat and well organized.
3	Shows nearly complete understanding of: <ul style="list-style-type: none"> <li>using a number line as a conceptual model for representing integers</li> <li>operations with integers</li> <li>plotting ordered pairs in a coordinate plane</li> </ul>	Explains most integer operation concepts and rules correctly. Operational models represent given operations adequately. Plotting of three ordered pairs is correctly done.	Answers all parts of each problem. Number lines and coordinate plane are drawn with some care. Work is neat and easy to follow.
2	Shows some understanding of: <ul style="list-style-type: none"> <li>using a number line as a conceptual model for representing integers</li> <li>operations with integers</li> <li>plotting ordered pairs in a coordinate plane</li> </ul>	Explains some integer operation concepts and rules correctly. Operational models do not represent given operations adequately. Plotting of two ordered pairs is correctly done.	Answers all parts of each problem. Number lines and coordinate plane are not carefully drawn. Work is sloppy and hard to follow.
1	Shows little understanding of: <ul style="list-style-type: none"> <li>using a number line as a conceptual model for representing integers</li> <li>operations with integers</li> <li>plotting ordered pairs in a coordinate plane</li> </ul>	Does not explain integer operation concepts and rules correctly. Operational models do not represent given operations. No ordered pairs are plotted.	Does not answer all parts of each problem. Number lines and coordinate plane are drawn poorly. Work is sloppy and hard to follow.

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- A **Review Game** from the *Big Ideas Game Closet* is listed at the end of every chapter in the teaching edition. Detailed directions and rules of the review game are provided.



- The appendices at the end of each book offer a wealth of material for the class to do after the state test. Appendix A offers rich, comprehensive interdisciplinary projects in Literature, History, Art and Science. Appendix B extends the topics of this grade level through an added chapter in the text, complete with all of the features from chapters 1-9.

## Implicit Differentiated Instruction Tools in *Big Ideas Math*

Some tools and features incorporated into the curriculum for Differentiated Instruction are *not* so obvious.

- *Big Ideas Math* uses a balanced approach between direct instruction and inquiry based learning teaching strategies. Each section begins with a 2-page activity that is introduced by an Essential Question. After the concept has been introduced with a full-class period activity (inquiry based learning), it is extended the following day through the lesson (direct instruction). Cooperative learning and information processing strategies are integrated in the activities, lessons, and exercises throughout the program.
- A wide range of real-life examples and application topics that are age appropriate but diverse in gender, culture, and interests are used.
- *Laurie's Notes*, written by master teacher Laurie Boswell, are opposite the lesson plans in the teaching edition. This feature provides insight into her professional training and years of experience to share best practices in teaching and modeling to help teachers guide students to better understanding. *Laurie's Notes* provides a daily mentor to any educator, especially novice teachers.
- Students gain a deeper understanding of topics through **Inductive Reasoning** and exploration. This feature is used in various activities.

**Inductive Reasoning**

4. Copy and complete the table.

Velocity (feet per second)	-14	20	-2	0	25	-15
Speed (feet per second)						

5. Find two different velocities for which the speed is 16 feet per second.

6. Which number is greater:  $-4$  or  $3$ ? Use a number line to explain your reasoning.

7. One object has a velocity of  $-4$  feet per second. Another object has a velocity of  $3$  feet per second. Which object has the greater speed? Explain your answer.

- The language of mathematics is essential for success. **The Meaning of a Word** feature helps students understand mathematical language and to make connections to known common words.


**The Meaning of a Word** ● Rational

The word **rational** comes from the word *ratio*.

If you sleep for 8 hours in a day, then the *ratio* of your sleeping time to the total hours in a day can be written as  $\frac{8 \text{ h}}{24 \text{ h}}$ .



- The **Vocabulary and Concept Check** asks meaningful questions that verify a student knows the vocabulary and concepts, rather than simply filling in the blank.



### Vocabulary and Concept Check

1. **VOCABULARY** How can you tell that a number is rational?
2. **WRITING** You have to write 0.63 as a fraction. How do you choose the denominator?


- Students often confuse the terminology of mathematics. In **DIFFERENT WORDS, SAME QUESTION** students are asked to find the three questions that ask the same thing and to answer the question, and then to answer the question that is different.

3. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find "both" answers.

Add $-4.8$ and $3.9$ .	What is $3.9$ less than $-4.8$ ?
What is $-4.8$ increased by $3.9$ ?	Find the sum of $-4.8$ and $3.9$ .

- ERROR ANALYSIS** is included to provide students with the opportunity to be a critical thinker. They are analyzing rather than rationalizing in order to solve the problem.

22. **ERROR ANALYSIS** Describe and correct the error in finding the difference.



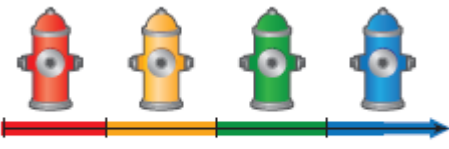
$$\frac{3}{4} - \frac{9}{2} = \frac{3-9}{4-2} = \frac{-6}{2} = -3$$

- The second page exercises include rich, open-ended problem solving. These are the kind of critical thinking problems that help students develop a deeper understanding of the concepts. This is when students become producers of their own knowledge rather than just consumers of knowledge.
- Throughout the program students are asked to use **RESEARCH** methods to help solve real world problems. Generally, there is a wide variety of appropriate answers. The most challenging exercises are indicated by a starburst inline heading. These problems are designed to extend the concept to the next level.

33. **Open-Ended** Fire hydrants are painted four different colors to indicate the rate at which water comes from the hydrant.

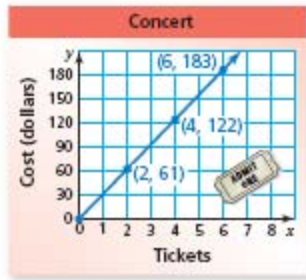
a. **RESEARCH** Use the Internet to find the ranges of the rates for each color.

b. Research why a firefighter needs to know the rate at which water comes out of the hydrant.

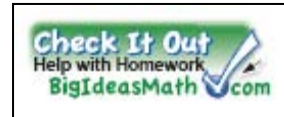
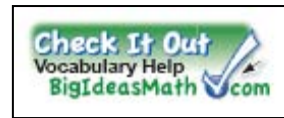


## Differentiated Instruction and Big Ideas Math

- The exercise sets are designed to be visually appealing. Most visual elements contain information needed to solve the problem.



- Students can review vocabulary online using the interactive, multi-language glossary at *BigIdeasMath.com*, available in English, Spanish and Haitian-Creole.
- Students have access to lesson tutorials at *BigIdeasMath.com*.
- If students need more help with their homework, it is available at *BigIdeasMath.com*.
- Students can access a self-grading quiz online at *BigIdeasMath.com* to further assess their progress.
- Additional assessment practice is available at *BigIdeasMath.com*.



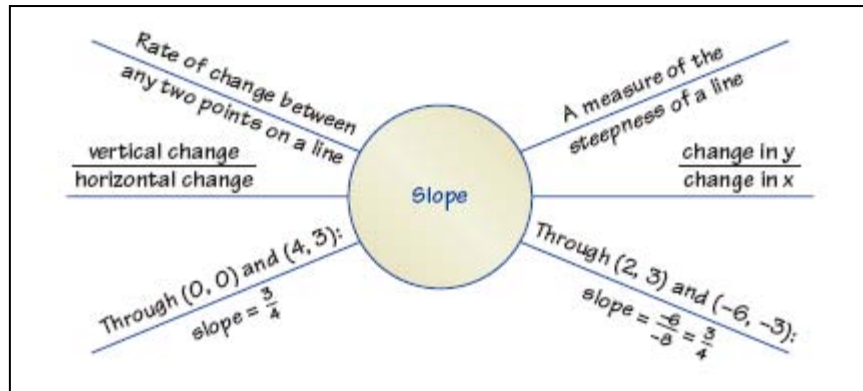
- Students have access to interactive e-Books online with English and Spanish audio.
- Many of the activities and exercises are “writing intensive”. This allows the students to be more creative in communicating their thoughts and answers.

**2** **ACTIVITY: Writing a Story**

Work with a partner. Write a story that uses addition, subtraction, multiplication, or division of rational numbers.

## Differentiated Instruction and Big Ideas Math

- There are 10 different Graphic Organizers in each book of the program. They are designed to reflect Robert Marzano's research in "Classroom Instruction that Works". Here students see an example of how to use the graphic organizer. They can make their own or download editable graphic organizers off the web, or CD, to fill out on their own.



- Most activities are done in groups. This allows students to interact and learn from each other.
- The **Common Errors** feature is included at least once per exercise set in the teaching edition. This feature identifies exercises where students may be more likely to make a mistake or perform a common error. Proven strategies of what to look for and how to address and/or fix them are provided.
- At the end of every chapter there is a Standardized Test Practice. The teaching edition provides an **Item Analysis** that is used to examine student's responses to individual questions. Each wrong answer is analyzed and assigned a common error that is most likely.

*Big Ideas Math* doesn't just provide tools for Differentiated Instruction, we actually developed a curriculum that promotes and uses them!



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