

Developmental Math—An Open Program

Instructor Guide

Unit 1 – Table of Contents and Learning Objectives

Unit 1: Whole Numbers

Unit Table of Contents

Lesson 1: Introduction to Whole Numbers

Topic 1: Place Value and Names for Whole Numbers

Learning Objectives

- Find the place value of a digit in a whole number.
- Write a whole number in words and in standard form.
- Write a whole number in expanded form.

Topic 2: Rounding Whole Numbers

Learning Objectives

- Learn the rules for rounding.
- Round whole numbers to specific place values, including tens, hundreds, and thousands.

Topic 3: Comparing Whole Numbers

Learning Objectives

- Use $>$ or $<$ to compare whole numbers.

Lesson 2: Adding and Subtracting Whole Numbers

Topic 1: Adding Whole Numbers and Applications

Learning Objectives

- Add whole numbers without regrouping.
- Add whole numbers with regrouping.
- Find the perimeter of a polygon.
- Solve application problems using addition.

Topic 2: Subtracting Whole Numbers and Applications

Learning Objectives

- Subtract whole numbers without regrouping.
- Subtract whole numbers with regrouping.
- Solve application problems using subtraction.

Topic 3: Estimation

Learning Objectives

- Use rounding to estimate sums and differences.
- Use rounding to estimate the solutions for application problems.



Developmental Math—An Open Program

Instructor Guide

Lesson 3: Multiplying and Dividing Whole Numbers

Topic 1: Multiplying Whole Numbers and Applications

Learning Objectives

- Use three different ways to represent multiplication.
- Multiply whole numbers.
- Multiply whole numbers by a power of 10.
- Use rounding to estimate products.
- Find the area of a rectangle.
- Solve application problems using multiplication.

Topic 2: Dividing Whole Numbers and Applications

Learning Objectives

- Use three different ways to represent division.
- Divide whole numbers.
- Perform long division.
- Divide whole numbers by a power of 10.
- Recognize that division by 0 is not defined.
- Solve application problems using division.

Lesson 4: Properties of Whole Numbers

Topic 1: Properties and Laws of Whole Numbers

Learning Objectives

- Simplify by using the addition property of 0.
- Simplify by using the multiplication property of 1.
- Identify and use the commutative law of addition.
- Identify and use the commutative law of multiplication.
- Identify and use the associative law of addition.
- Identify and use the associative law of multiplication.

Topic 2: The Distributive Property

Learning Objectives

- Simplify using the distributive property of multiplication over addition.
- Simplify using the distributive property of multiplication over subtraction.

Developmental Math—An Open Program

Instructor Guide

Lesson 5: Exponents, Square Roots, and the Order of Operations

Topic 1: Understanding Exponents and Square Roots

Learning Objectives

- Evaluate expressions containing exponents.
- Write repeated factors using exponential notation.
- Find a square root of a perfect square.

Topic 2: Order of Operations

Learning Objectives

- Use the order of operations to simplify expressions, including those with parentheses.
- Use the order of operations to simplify expressions containing exponents and square roots.

Developmental Math—An Open Program

Instructor Guide

Unit 1 – Instructor Notes

Unit 1: Whole Numbers

Instructor Notes

The Mathematics of Whole Numbers

Unit 1 introduces whole numbers and the rules and procedures for manipulating them. These ideas are the basic building blocks of mathematics, and students must understand them to succeed not only in this course but in almost any mathematical endeavor.

After completing this unit, students will understand place value and rounding and know how to carry out basic operations (addition, subtraction, multiplication, and division). They'll have learned how to use the properties of whole numbers (associative, commutative, distributive, and identity) and the order of operations to simplify expressions. They will also have seen how these techniques can help them in their everyday lives outside of Developmental Math.

Teaching Tips: Challenges and Approaches

Most, but not all, students will already know this material. It's challenging to discuss these fundamental ideas in ways that neither insult nor intimidate students. Our approach is to describe basic math skills using conversational language, visual representations, and examples that are relevant to the students.

For example, in the problem below students are shown how rounding and estimation can be applied to a situation they likely know all too well—deciding if they can afford to buy something they want:

Developmental Math—An Open Program Instructor Guide

Example	
Problem	<p>When buying a new computer, you find that the computer tower and keyboard cost \$1,295, the monitor costs \$679, the printer costs \$486, the 2-year warranty costs \$196, and a software package costs \$374. Estimate the total cost by first rounding each number to the nearest hundred.</p>
<p>1,295.....1,300</p> <p>679..... 700</p> <p>486.....500</p> <p>196.....200</p> <p>374.....400</p>	<p>First, round each number to the nearest hundred.</p>
$ \begin{array}{r} 2 \\ 1300 \\ 700 \\ 500 \\ 200 \\ + 400 \\ \hline 3,100 \end{array} $	<p>Add.</p> <p>After adding all of the rounded values, the estimated answer is \$3,100.</p>
Answer	The total cost is approximately \$3,100.

[From Lesson 2, Topic 3, Topic Text]

Multiplication is represented in three ways in this unit:

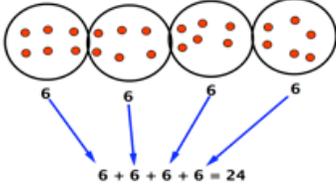
Developmental Math—An Open Program

Instructor Guide

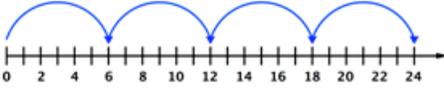
Example

Problem What is the product of $4 \cdot 6$? Use the set model, number line model and area model to represent the multiplication problem.

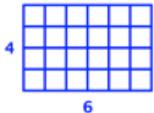
Set Model:



Number line model:



Area Model:



Answer $4 \cdot 6 = 24$

[From Lesson 3, Topic 1, Topic Text]

Models like these can help an inexperienced math learner understand a fundamental concept, and at the same time give more assured students new ways of thinking about a familiar idea.

Calculation Errors

Since this unit is mainly a review of basic mathematics, most students will have little difficulty carrying out individual calculations. There are some common mistakes to watch for, however.

Rounding is an important skill for estimating and for deciding if an answer to a problem actually makes sense. Sometimes students will “double” round—for example, if they are told to round 746 to the nearest hundred they will round 746 to 750 first (which is correct if they were rounding to the nearest ten) and then round 750 to 800. This error can be prevented by correctly placing 746 between 700 and 800 and showing that 746 is actually closer to 700 and thus should be rounded to 700.

Exponents often trip up students. It's common for some to think that 2^3 is 6 rather than 8. Be sure they understand that the base is multiplied by itself and not by the exponent. Practice is the key to avoiding these mistakes.

Developmental Math—An Open Program

Instructor Guide

The properties of whole numbers generally make intuitive sense to students. Provide lots of practice applying and defining them, and these ideas will stick with the students through this course and beyond into algebra.

Many students instinctively evaluate expressions in sequential order from left to right in the same way they read sentences in English. It will take practice to help them overcome this tendency. Group work is also a good way to drive this idea home. Pose a “simple” problem like $2 + 5 \cdot 3$ and ask what the answer is. Some will say 21 and some will say 17. You can then explain why 17 is the correct answer. This can also lead to a discussion about entering such an expression into a calculator and the importance of parentheses.

Teaching the acronym PEMDAS will help students remember the order of operations, especially when combined with a memory trick like learning the phrase “Please Excuse My Dear Aunt Sally.” It may be even more helpful to have students come up with their own phrase.

Language Issues

Some students will have trouble with the symbolism of mathematics. The meaning of the words “greater than” and “less than” are easily understood, but the symbols can be confusing. There are a number of different ways to help distinguish between “>” and “<”. Describe how the “pointy” part of the sign points to the smaller number, while the larger end of the sign is next to the larger number. Illustrate the difference with a sketch of a hungry alligator that gobbles up the larger, tastier number (images are from titus2homemaker.com):



Or mention that $<$ looks a bit like a slightly squished “L”, and “l” is the first letter of “less than.”

Although math is largely symbolic, students will also need to develop their mathematical vocabulary. It's important to explain that learning how to use math words is as necessary as knowing how to perform operations on the numbers. Be consistent with the language you use, and make sure students know the meaning of all new terms.

For example, it's crucial that students know the difference between “rounding” and “estimating.” We have students carry out both procedures until they're comfortable with the distinctions:

Developmental Math—An Open Program Instructor Guide

Estimate the solution to $582,205 + 610,859$ by first rounding these two numbers to the nearest thousand.

$$\begin{array}{r} 582, \textcircled{2}05 \xrightarrow{\downarrow} 582,000 \\ 610, \textcircled{8}59 \xrightarrow{\uparrow} 611,000 \\ \hline 1,193,000 \end{array}$$

Presented by the
Khan Academy

0:17

[From Lesson 2, Topic 3, Worked Example 2]

When addition, subtraction, multiplication, and division are reviewed, be sure to stress language cues and skills that will be needed to solve those dreaded word problems. Students need to know the names of the individual parts of arithmetic problems (such as dividend, divisor, and quotient for division). They also need to recognize that certain words are surefire hints of what to do with a problem. For example, “increased by” means add, and “subtracted from” specifies not only subtraction but also order (6 subtracted from 10 is $10 - 6$ not $6 - 10$). Developmental math students commonly stumble over language, so go over these key words and give students lots of practice picking them out for themselves.

Shortcuts

This unit is a good time to introduce some algorithmic shortcuts. Multiplying and dividing by powers of 10 makes it easier to do long calculations. Understanding this will also help during the metric system section of this course.

The example below illustrates that numbers can be added together more easily if the order and grouping is changed:

Developmental Math—An Open Program

Instructor Guide

Example	
Problem	Write the expression $13 + 28 + 7$ a different way to make it easier to simplify. Then simplify.
$13 + 28 + 7$	
$13 + 7 + 28$	Using the commutative property, reorder the numbers 7 and 28 since $13 + 7$ is easier to add than $13 + 28$.
$20 + 28$	Using the associative property, group the 13 and 7 together and add them first.
48	Add 20 and 28.
Answer	$13 + 28 + 7 = 13 + 7 + 28 = 48$

[From Lesson 4, Topic 1, Topic Text]

Teaching students that there are different and creative ways to solve problems, like the use of shortcuts, can help them appreciate that mathematics is more than just a rote exercise in drudgery.

Calculators

Once students can easily do arithmetic with pencil and paper, we recommend letting them use calculators. However, calculators can lead students astray because they assume that the machine makes no mistakes, so its numbers are always right. Be very sure students understand that if they enter the wrong information or hit the wrong key, the answer will still be wrong even if the calculator functions perfectly.

One of the beautiful things about mathematics is the fact that answers can be checked. Because addition and subtraction are inverse operations to each other, one can be used to check the other. This is also true for multiplication and division. Rounding and estimation ahead of time can help identify mistakes later. This unit is the perfect time to get students into the habit of always checking their work for accuracy.

Keep In Mind

Some students, especially if they first learned math a while ago, will talk about “carrying” in addition and “borrowing” in subtraction. But these terms have mostly been abandoned in favor of “regrouping”—this may throw people off at first.

Section 4, Topic 1 is entitled “Properties and Laws of Whole Numbers”. In this course, the words are used interchangeably—the “commutative *property* of addition” and the “commutative *law* of addition” are both acceptable.

Developmental Math—An Open Program

Instructor Guide

Additional Resources

In all mathematics, the best way to really learn new skills and ideas is repetition. Problem solving is woven into every aspect of this course—each topic includes warm-up, practice, and review problems for students to solve on their own. The presentations, worked examples, and topic texts demonstrate how to tackle even more problems. But practice makes perfect, and some students will benefit from additional work.

A good site for drilling basic facts is <http://www.thatquiz.org/tq-1/math/arithmetic/> . Students can choose the operation and the complexity of the problem.

Practice in rounding can be found at <http://www.brainiaccamp.com/resources/math/rounding/interactive.php>.

A game at <http://www.math-play.com/Order-of-Operations-Millionaire/order-of-operations-millionaire.html> will give some practice with order of operation problems. This can be used individually or as a group.

Summary

Unit 1 gives students a solid grounding in whole numbers and their properties. They'll be reminded of how to carry out mathematical operations and apply mathematical laws. They'll understand the order of operations, and appreciate the importance of vocabulary in problem-solving. Many of the concepts learned here will be applied to future units on fractions, decimals and percents.

Developmental Math—An Open Program

Instructor Guide

Unit 1 – Tutor Simulation

Unit 1: Whole Numbers

Instructor Overview

Tutor Simulation: Shopping For Office Supplies

Purpose

This simulation is designed to challenge a student’s knowledge of basic mathematics. In order to solve a real-world problem, students must demonstrate an understanding of the following areas:

- Multiplication
- Addition
- Subtraction
- Rounding
- Estimating

Problem

Students are presented with the following problem:

Your challenge will be to shop for office supplies for your boss. To accomplish this task, you'll need to know addition, subtraction, multiplication, and cost estimating. Time to go shopping.

Recommendations

Tutor simulations are designed to give students a chance to assess their understanding of unit material in a personal, risk-free situation. Before directing students to the simulation,

- make sure they have completed all other unit material
- explain the mechanics of tutor simulations
 - Students will be given a problem and then guided through its solution by a video tutor;
 - After each answer is chosen, students should wait for tutor feedback before continuing;
 - After the simulation is completed, students will be given an assessment of their efforts. If areas of concern are found, the students should review unit materials or seek help from their instructor.
- emphasize that this is an exploration, not an exam

Developmental Math—An Open Program

Instructor Guide

Unit 1 – Puzzle

Unit 1: Whole Numbers

Instructor Overview

Puzzle: Which Comes First?

Objectives

Which Comes First? is a puzzle that challenges a student's grasp of the order of operations. To solve the puzzles, players must identify the correct sequence of actions that will simplify an expression.



Figure 1. Players pick the card showing the operation that should be performed next.

Description

This game has three levels of difficulty, each with 10 puzzles. In each puzzle, students are shown a mathematical expression and asked to simplify it following the order of operations. When they pick correctly, they gain points and are asked to pick the next step. When they make an error, they lose points and are prompted to try again. There is also a challenge round, where players are given a time limit in which to solve each puzzle.

Developmental Math—An Open Program

Instructor Guide

Which Comes First? is suitable for both individual play and group learning in a classroom setting.

The ten puzzles at each level are scripted, but they are sufficiently challenging that students who are having difficulty may benefit from replay.

Developmental Math—An Open Program

Instructor Guide

Unit 1 – Project

Unit 1: Whole Numbers

Instructor Overview **Project: Open For Business**

Student Instructions

Introduction

Do you have a marketable skill? Are you mechanically inclined? Do your friends come to you for help with their projects? Have you ever thought about trying to make some extra money by putting your skills to use? During the course of this project, your group will work together to develop a business plan and the necessary forms to run a successful business.

Task

Your first task is to discuss the various hidden talents within your group and choose one to focus on. Next, your group will begin exploring the services that you plan to offer and the price for each. Your next step will be to decide what needs to be purchased just to get the business started. Finally, your group will explore the possible profits of a well-planned business.

Instructions

Complete each problem in order. Be sure to keep careful notes and save your work as you proceed. You will work together to create a business proposal at the conclusion of the project.

1. Within your group, discuss your various skills and the possibility of people paying money for your particular skill set. Use the table below to organize your thoughts. Be sure to save the information, as you will include it with your final product.

Name	Skill	Charge for service

Developmental Math—An Open Program

Instructor Guide

- Everyone has a special skill or talent. Sometimes we can't take advantage of the ability to make some extra money due to time constraints. (There are only so many hours in the day.) Imagine you had all the time in the world. What could you create? What could you help others create? What are your passions?
2. Now discuss the various skills within your group and work together to collect information. In order to make a good decision about which business would be most successful, you will need to use math. Use the following table to help organize your work. Round to the nearest dollar. Again, be sure to save the work to include in your final product.

Explanation of Table for Problem 2

- Number of items sold or services performed per month: How many items or services would you be able to sell per month? Think about how many paintings you could make in one month? How many haircuts could you give? Etc.
- Selling cost per item or service: Set an average selling cost. Some items will be more complex and some will be simpler, but try to come up with an average price for which you would sell your product or service.
- Potential Revenue: In order to find the potential revenue, your group will need to perform the following math calculation for each skill.

$$\begin{array}{|c|} \hline \text{Number of} \\ \text{items or} \\ \text{services per} \\ \text{month} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Selling Cost} \\ \text{of each item} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Potential} \\ \text{Revenue} \\ \text{(one month)} \\ \hline \end{array}$$

- Start up costs: What will need to be purchased to make the business run? Include any one-time costs such as hair clippers, paper cutters, easel, etc. Also, include supplies necessary to make the product, such as, paper, lumber, etc. Include enough supplies to make your product for one month. Use the following model to find your total start up costs.

$$\begin{array}{|c|} \hline \text{One-time} \\ \text{Costs} \\ \hline \end{array} + \begin{array}{|c|} \hline \text{Supplies for} \\ \text{one month} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Total Start-} \\ \text{up Costs} \\ \text{(one month)} \\ \hline \end{array}$$

- Potential Profit: In order to find the potential profit, your group will need to perform the following math calculation for each skill.

Developmental Math—An Open Program Instructor Guide

$$\boxed{\begin{array}{c} \text{Potential} \\ \text{Revenue} \\ \text{(one month)} \end{array}} - \boxed{\begin{array}{c} \text{Total start-} \\ \text{up Costs} \\ \text{(one month)} \end{array}} = \boxed{\begin{array}{c} \text{Potential} \\ \text{Profit} \\ \text{(one month)} \end{array}}$$

Table for Problem 2

	Skill 1	Skill 2	Skill 3	Skill 4
Number of items sold or services performed per month				
Selling cost per item or service				
Potential Revenue for one month: Show your math within the table. (See below for how to set up the math)				
Total start-up costs for one month: Show your math within the table. (See below for how to set up the math)				
Potential Profit after one month: Show your math within the table. (See below for how to set up the math)				

Developmental Math—An Open Program

Instructor Guide

3. Based on the information gathered in the table above, discuss which business your group will decide to focus on and why. Answer the following questions and include the answers in your final product.
 - Which skill has the biggest start-up cost? Why?
 - Which skill will be able to charge the most per item?
 - Which skill will be able to sell the most items in a month?
 - Which skill did your group choose to use for this project? Why?

4. Develop a price list for the various services provided. A price list will have a detailed description of each product or service for sale. Include at least five items on your price list. Make the prices each whole dollar amounts.
 - You will need to create a professional-looking product. Create a business logo or slogan for the top of the price list and then create a table with the description of each item and the price. You can either create your price list using a word-processing program or neatly hand-write it.

5. Now that you have your price list developed, create an invoice for five customers. An invoice is an itemized bill given to the customer. The customer will make payment based on the invoice. You will need to calculate the total cost for each invoice and show your work mathematically. Save all five invoices, as they will be included in your final product.
 - A sample invoice appears below. A Google search of “Invoice Template” will also allow your group to see additional samples.

Sally's Card Emporium			
Product:	Price per product:	Quantity:	Subtotal:
Small greeting card	\$2	4	\$8
Large greeting card	\$3	2	\$6
Postcard	\$1	1	\$1
Envelopes, small	\$1	4	\$4
Envelopes, large	\$2	2	\$4
TOTAL			\$23

Developmental Math—An Open Program

Instructor Guide

- Notice that the price per product is multiplied by the quantity, or number of products, to get the subtotal. Then the subtotal column is added to get the total of the invoice. This is the amount that the customer would pay. Be sure to check your work carefully on each invoice.
6. Use the totals from the five invoices to determine an average total for all customers. To find the average, you will need to add the totals from each of the five invoices and then divide by five. Use the following model to help:

$$\text{Average} = \frac{\text{Total1} + \text{Total2} + \text{Total3} + \text{Total4} + \text{Total5}}{5}$$

Collaboration

Get together with another group and work together before beginning your final product. This is the time to find potential errors before finalizing your project.

First: Compare the tables from Problem 2 with another group. Work specifically to check for errors in the math calculations. If an error is noted, discuss the error and work together to find the correct answer.

Second: Compare your price list with the other group. Make sure that the other group agrees that your prices are fair. You do not want to set your prices too low, but cannot set them too high, either.

Third: Look over the other group's five invoices carefully. If an error is noted, discuss the error and work together to make a correction. (Be careful. If an error is found on an invoice, the group will need to re-work problem six to get a correct average price.)

Fourth: Discuss whether you believe that your business has the ability to generate additional money. What have you learned in the course of this project?

Conclusion

You have two options for your final product. You will need to include the answers to each of the six problems no matter which product you choose. You will also need to include all of your mathematical calculations. The math can either be neatly hand-written or typed. Work together to create a product that represents your group's individual interests and strengths. You may choose between a written report and an oral presentation with handouts.

Written Report: Work together with your group to create professional looking, finalized versions for each of the six problems. Consider including a business logo on each written document to unify your presentation.

Oral Presentation: Who will discuss problem one? Two? Etc. What handouts will you need to prepare in order to help the audience follow along? You will want to create professional looking, finalized handouts. Again, consider creating a business logo to unify your presentation.

Developmental Math—An Open Program

Instructor Guide

Instructor Notes

Teacher's Guide

This is a very simplified version of a business plan. There will be other obvious factors that will need to be taken in to consideration. For instance, the original one-time expenses would be spread over more than just one month. For the sake of a basic approach, the time frame of one month was used. There are also taxes to consider. Often profits look good on paper, but once everything is said and done, the profit is no longer worth the time investment. These are all good topics of discussion as the students are working on the project.

The overall goal of the project is for the students to see how mathematics impacts daily decision making, especially in the business world.

Assignment Procedures

Problem 1

This is a great opportunity to capitalize on your students' strengths and help develop a positive relationship that will help your students want to do well in the course. Wander from group to group engaging in the conversations and inquiring about the talents.

Problem 2

There is quite a bit of mathematical calculation required to complete the above table successfully. Consider collecting the table and performing a mini-check to ensure that good progress is being made. This will allow you to ensure that all groups are on track before continuing.

Problem 3

Ensure that groups are taking into consideration the one-time outlay for start-up expenses, the expense per product or service, and the price per product or service. The most expensive product or service may not yield the most profit.

Problem 4

Ensure that the price lists include only whole dollar amounts. The next step requires addition and multiplication that should be performed only on whole dollar amounts.

Problem 5

Encourage the groups to work together by asking that one group member make a rough draft of the invoice, the next group member can check the math, and another group member can create the final draft.

Problem 6

It may be beneficial to model taking an average of two or three numbers in order to build the student's confidence with problem six.

Developmental Math—An Open Program

Instructor Guide

Extension

If students would like to explore a little deeper, consider allowing them to work on this additional problem.

7. Running your own business can be rewarding and can help you earn some extra money putting your talents to use for others. There are some additional legal and financial requirements in order to successfully run your own business. Research the following website and compile a list of additional expenses that would need to be considered before opening up your own business.

<http://www.sba.gov/smallbusinessplanner/index.html>

- How has the research impacted the potential profits of your business?
- Does the business still have the ability to generate additional income?
- What would the next step be in order to open the business?
- Is this something that you might consider in the future?

Recommendations

- Have students work in teams to encourage brainstorming and cooperative learning.
- Assign a specific timeline for completion of the project that includes milestone dates.
- Provide students feedback as they complete each milestone.
- Ensure that each member of student groups has a specific job.

Technology Integration

This project provides abundant opportunities for technology integration, and gives students the chance to research and collaborate using online technology. The students' instructions list several websites that provide information on numbering systems, game design, and graphics.

The following are other examples of free Internet resources that can be used to support this project:

<http://www.moodle.org>

An Open Source Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). Moodle has become very popular among educators around the world as a tool for creating online dynamic websites for their students.

<http://www.wikispaces.com/site/for/teachers> or <http://pbworks.com/content/edu+overview>

Allows you to create a secure online Wiki workspace in about 60 seconds. Encourage classroom participation with interactive Wiki pages that students can view and edit from any computer. Share class resources and completed student work.

<http://www.docs.google.com>

Developmental Math—An Open Program

Instructor Guide

Allows students to collaborate in real-time from any computer. Google Docs provides free access and storage for word processing, spreadsheets, presentations, and surveys. This is ideal for group projects.

<http://why.openoffice.org/>

The leading open-source office software suite for word processing, spreadsheets, presentations, graphics, databases and more. It can read and write files from other common office software packages like Microsoft Word or Excel and MacWorks. It can be downloaded and used completely free of charge for any purpose.

Rubric

Score	Content	Presentation/Communication
4	<ul style="list-style-type: none"> • The solution shows a deep understanding of the problem including the ability to identify the appropriate mathematical concepts and the information necessary for its solution. • The solution completely addresses all mathematical components presented in the task. • The solution puts to use the underlying mathematical concepts upon which the task is designed and applies procedures accurately to correctly solve the problem and verify the results. • Mathematically relevant observations and/or connections are made. 	<ul style="list-style-type: none"> • There is a clear, effective explanation detailing how the problem is solved. All of the steps are included so that the reader does not need to infer how and why decisions were made. • Mathematical representation is actively used as a means of communicating ideas related to the solution of the problem. • There is precise and appropriate use of mathematical terminology and notation. • Your project is professional looking with graphics and effective use of color.
3	<ul style="list-style-type: none"> • The solution shows that the student has a broad understanding of the problem and the major concepts necessary for its solution. • The solution addresses all of the mathematical components presented in the task. • The student uses a strategy that includes mathematical procedures and some mathematical reasoning that leads to a solution of the problem. • Most parts of the project are correct with only minor mathematical errors. 	<ul style="list-style-type: none"> • There is a clear explanation. • There is appropriate use of accurate mathematical representation. • There is effective use of mathematical terminology and notation. • Your project is neat with graphics and effective use of color.
2	<ul style="list-style-type: none"> • The solution is not complete indicating that parts of the problem are not understood. • The solution addresses some, but not all of the mathematical components presented in the task. • The student uses a strategy that is partially 	<ul style="list-style-type: none"> • Your project is hard to follow because the material is presented in a manner that jumps around between unconnected topics. • There is some use of appropriate mathematical representation.

Developmental Math—An Open Program

Instructor Guide

	<p>useful, and demonstrates some evidence of mathematical reasoning.</p> <ul style="list-style-type: none"> Some parts of the project may be correct, but major errors are noted and the student could not completely carry out mathematical procedures. 	<ul style="list-style-type: none"> There is some use of mathematical terminology and notation appropriate to the problem. Your project contains low quality graphics and colors that do not add interest to the project.
1	<ul style="list-style-type: none"> There is no solution, or the solution has no relationship to the task. No evidence of a strategy, procedure, or mathematical reasoning and/or uses a strategy that does not help solve the problem. The solution addresses none of the mathematical components presented in the task. There were so many errors in mathematical procedures that the problem could not be solved. 	<ul style="list-style-type: none"> There is no explanation of the solution, the explanation cannot be understood or it is unrelated to the problem. There is no use or inappropriate use of mathematical representations (e.g. figures, diagrams, graphs, tables, etc.). There is no use, or mostly inappropriate use, of mathematical terminology and notation. Your project is missing graphics and uses little to no color.

Developmental Math—An Open Program

Instructor Guide

Unit 1 – Correlation to Common Core Standards

Unit 1: Whole Numbers

Common Core Standards

Unit 1, Lesson 1, Topic 1: Place Value and Names for Whole Numbers

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.

Unit 1, Lesson 1, Topic 2: Rounding Whole Numbers

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.

Unit 1, Lesson 1, Topic 3: Comparing Whole Numbers

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
------------------------	---------------	------------------------

Developmental Math—An Open Program

Instructor Guide

CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.
---------------------------	--------------	--

Unit 1, Lesson 2, Topic 1: Adding Whole Numbers and Applications

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.1.	Make sense of problems and persevere in solving them.
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-1.	Make sense of problems and persevere in solving them.
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.

Unit 1, Lesson 2, Topic 2: Subtracting Whole Numbers and Applications

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.1.	Make sense of problems and persevere in solving them.
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-1.	Make sense of problems and persevere in solving them.
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.

Unit 1, Lesson 2, Topic 3: Estimation

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
------------------------	-----------------	------------------------

Developmental Math—An Open Program

Instructor Guide

CATEGORY / CLUSTER	MP.8.2.	Reason abstractly and quantitatively.
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	MP.8.7.	Look for and make use of structure.
CATEGORY / CLUSTER	MP.8.8.	Look for and express regularity in repeated reasoning.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-2.	Reason abstractly and quantitatively.
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	MP-7.	Look for and make use of structure.
CATEGORY / CLUSTER	MP-8.	Look for and express regularity in repeated reasoning.
STRAND / DOMAIN	CC.N.	Number and Quantity
CATEGORY / CLUSTER	N-Q.	Quantities
STANDARD		Reason quantitatively and use units to solve problems.
EXPECTATION	N-Q.3.	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Unit 1, Lesson 3, Topic 1: Multiplying Whole Numbers and Applications

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.2.	Reason abstractly and quantitatively.
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	MP.8.7.	Look for and make use of structure.
CATEGORY / CLUSTER	MP.8.8.	Look for and express regularity in repeated reasoning.

Developmental Math—An Open Program

Instructor Guide

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-2.	Reason abstractly and quantitatively.
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	MP-7.	Look for and make use of structure.
CATEGORY / CLUSTER	MP-8.	Look for and express regularity in repeated reasoning.
STRAND / DOMAIN	CC.N.	Number and Quantity
CATEGORY / CLUSTER	N-Q.	Quantities
STANDARD		Reason quantitatively and use units to solve problems.
EXPECTATION	N-Q.3.	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Unit 1, Lesson 3, Topic 2: Dividing Whole Numbers and Applications

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.1.	Make sense of problems and persevere in solving them.
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-1.	Make sense of problems and persevere in solving them.
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.

Unit 1, Lesson 4, Topic 1: Properties and Laws of Whole Numbers

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Developmental Math—An Open Program

Instructor Guide

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.

Unit 1, Lesson 4, Topic 2: The Distributive Property

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.

Unit 1, Lesson 5, Topic 1: Understanding Exponents and Square Roots

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.
STRAND / DOMAIN	CC.EE.8.	Expressions and Equations
CATEGORY / CLUSTER		Work with radicals and integer exponents.
STANDARD	EE.8.2.	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that square root of 2 is irrational.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.

Unit 1, Lesson 5, Topic 2: Order of Operations

Developmental Math—An Open Program **Instructor Guide**

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	CC.MP.8.	Mathematical Practices
CATEGORY / CLUSTER	MP.8.3.	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	CC.MP.	Mathematical Practices
CATEGORY / CLUSTER	MP-3.	Construct viable arguments and critique the reasoning of others.