

Mathematics Level 1

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Level 1 Mathematics Introduction

The teaching of math has changed to a more student-centred approach. The emphasis on computation has changed to an emphasis on problem-solving abilities. This means that there has been a move away from rote memorization to a more inquiry-based approach. This change grew out of the work of Piaget that supports the idea that the development of critical thinking requires the movement from the concrete to the more abstract.

There is also increasing attention paid to how mathematical knowledge is gained and used outside the classroom. Adults enter programs with already-developed mathematics strategies. As a result, there needs to be an emphasis on real-life situations in these programs.

The basic operations of addition, subtraction, multiplication, and division are used extensively in all levels of mathematics. If learners are to take responsibility for their own learning, they must have confidence and competence in their ability to complete these operations with whole numbers.

Learning Outcomes

Level 1A

Upon successful completion of the units, students will be able to

- add and subtract whole numbers as a foundation for more advanced mathematical concepts
- apply addition and subtraction of whole numbers to real-life problems
- recognize basic two-dimensional geometric shapes
- use common measuring tools to perform basic linear measurement
- compare basic liquid and solid measurements.

Level 1B

Upon successful completion of the units, students will be able to

- add and subtract whole numbers as a foundation for more advanced mathematical concepts
- multiply and divide whole numbers as a foundation for more advanced mathematical concepts
- apply addition, subtraction, multiplication and division of whole numbers to real-life problems

- use a calculator to verify answers to basic operations in addition, subtraction, multiplication, and division
- use common measuring tools to perform basic linear measurement
- compare basic liquid and solid measurements
- recognize basic three-dimensional geometric shapes.

Notes



Level 1A and 1B

Level 1 is usually divided into two sections to facilitate the delivery of the outcomes. This is meant to assist tutors/instructors in deciding which of the demonstrations need to be accomplished before others. The demonstrations may not differ except in complexity. These demonstrations do not need to be delivered in sequence.

In this section the outcomes may be divided into Levels 1A and 1B, or both levels may share an outcome.

In this document, the terms “learner” and “student” and the singular “he” and “she” are used interchangeably.

Resources marked with an asterisk (*) can be found in the Learning Resource Centres. The resources listed under each outcome provide support for that particular outcome. More general resources, those that cover a number of learning outcomes, and those that deal with specific learners’ needs are found in the Resource Guide that accompanies the curriculum.

In the Teaching Strategies/Learning Activities Sections, teacher-directed activities and strategies are indicated with  and learner activities and strategies are preceded with .

For additional resources that support the learning outcomes, refer to the *Resource Guide for the Adult Learning Program Curriculum*.

For additional strategies and activities for assessing the learning outcomes, consult the *Assessment Guide to the Adult Learning Program Curriculum*.

Unit 1 Whole Numbers

Learning outcome: The student adds and subtracts whole numbers as a foundation for more advanced mathematical concepts.

Level 1A

Demonstration of learning outcome

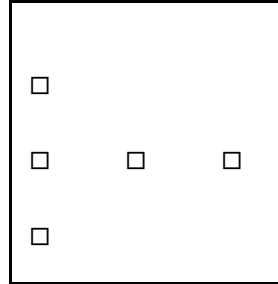
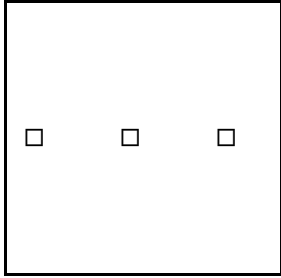
The student will be able to

- define mathematical terms--add, subtract, sum, difference, place value, digit
- use place value to organize numbers in sets (1, 10, 100)
- read and write numbers up to 100
- read and write number words to 10
- count by 1's, 2's, 5's, and 10's up to 100
- count backwards from 10
- locate whole numbers to 10 on a number line
- identify and extend number patterns
- recognize the signs for addition and subtraction
- explain the concepts of addition and subtraction using concrete materials (manipulatives).
- explain the concepts of addition and subtraction using a number line
- identify number place values to the hundreds
- round numbers to the nearest tens, hundreds
- add and subtract single numbers up to 10
- use a pictograph to solve addition problems
- add numbers of two digits without carrying
- subtract numbers of two digits without borrowing
- recognize the math words that indicate the correct operation
- read and solve simple word problems by using addition and subtraction skills
- use a step-by-step plan for solving problems.

Teaching Strategies/Learning Activities

- Give the learner an addition or subtraction problem. Have her **draw the problem**.

Margaret had 3 pieces of gum. Jim gave her 5 more. How many pieces of gum does she have now?



_____ pieces of gum in all.



Draw representations of number place values.

tens	ones
1	7








=

17

tens	ones
2	3

=

23

-  Make a **pictograph** as a class. On the board list several types of pets. Put a check beside each type of pet or pets each student has. Provide the students with a grid. Label the left-hand side “Types of Pet.” Label the horizontal rows “Pets Owned.” Draw pictures of the animals. Draw as many pictures of the same animal as there are check marks for that animal. Ask the students to look at the grid and name the pet that is the most popular, the least popular. (You can replace pets with any category of objects the class is most likely to have in common.)
-  Provide the learner with timed **addition and subtraction drills**. Have her complete the drills regularly and compare them. The objective of the activity is to do the drills faster with fewer mistakes. Make sure that all the drills have the same number of questions. It is helpful if the first drills contain questions that cover a limited number of options, e.g., the numbers add up to five or less. A sample drill is in the Activities section.
-  Review with the learner the **math words** on page 11 in the Activities section. Practice using math words with “What Should I Do?” in the Activities section.
-  Review with the learner the **strategies for solving word problems** in the Activities section.
-  Use graph paper or wide lined paper to help learners **line up their figures** during computation.
-  Have learners **highlight or circle the number of the question** they are solving to differentiate that number from the numbers in their computation.
-  Complete “**Count by 2's, 5's and 10's**” in the Activities section.

Assessment

- Before designing assessment tools and strategies, you should review the Assessing Mathematics section in the Assessment Guide to the Curriculum.
- Using **one-to-one student interviews and conferences** in evaluating math skills are effective but time-consuming strategies. See the Assessment Guide for a list of sample questions to use in math conferences.

- A sample of a **weekly math self-assessment activity** can be found in the Activities section.
- **Traditional testing** methods are often used in math. For an in-depth explanation of when and how to use the different forms of traditional testing, refer to the Assessment Guide.

If you are using tests for assessment purposes, you should ask yourself the following questions:

- Do I use test results as only one piece of information about an individual?
- Do I know why I am recommending the test and how it will help my learner?
- Do I know the strengths and weaknesses of the test I have chosen?
- Do I prepare my learner for testing and outline what he or she may be expected to know?
- Do I make sure that any misconceptions my learner has about testing are clarified before proceeding?
- Do I try to assess the degree of test anxiety my learner is experiencing?
- Do I note any unusual behaviours my learner demonstrated during testing and take them into consideration when I interpret test results?
- Do I follow the ethics and standards for effective test usage?
- Do I interpret test results to my learners as thoroughly and sensitively as I can?
- Do I have my learner summarize his or her understanding of the test results to make sure he or she understands?

Hall, Terri Lyn and Sarah Mahoney (1996). *An Instructor's Guide to Designing Classroom Quizzes*. Kingston, ON: Literacy Link Eastern Ontario, p.6.

Resources

* *Breakthrough to Math: Books 1, 2, 3 and 6, Understanding Numbers, Adding Whole Numbers, Subtracting Whole Numbers, and Word Problems with Whole Numbers*. Syracuse NY: New Readers Press.

* *Math Stories: Addition and Subtraction* (1992). Syracuse, NY: New Readers Press.

* *Number Sense: Whole Number Addition and Subtraction* (1990). Chicago: Contemporary.

* *Mastering Math: Levels A and B* (1994). Austin, TX: Steck-Vaughn (Teacher's Edition).

Websites:

The Math Forum

<http://forum.swarthmore.edu/>

A large collection of excellent math resources, from news to teaching resources. Includes Ask Dr. Math, a question and answer service for students.

Math.com

<http://www.math.com/>

Lesson plans, career resources, homework help, puzzles, and quizzes.

Sunfun

<http://webhome.idirect.com/~sumfun/>

A directory of math sites. Includes sections on humorous math games and tricks, teacher resources, math information, and tools and software.

The Numeracy Homepage

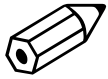
<http://www2.wgbh.org/MBCWEIS/LTC/CLC/numintro.html>

Links, puzzles, and numeracy activities for adults.

Curious and Useful Math

<http://personal.cfw.com/~clayford/>

Multiplication and division tricks, famous math tales, word problems, and other curious and useful math oddities.



Tutor/Instructor Notes

Math Anxiety is common among adults because

1. Some had poor teachers who couldn't explain concepts, were overly critical of mistakes, were inflexible, only allowed one method, did not encourage creativity, or didn't like math but were forced to teach it
2. Some fear making mistakes. In math you need to make lots of mistakes to learn.
3. Math is often too abstract. This is a disadvantage to the concrete thinker who likes to solve problems by doing.
4. Math was taught in isolation. There was no application to life or work.

Using Manipulatives

Manipulatives are concrete objects that are used to develop skills and concepts in mathematics. The manipulatives should be meaningful to the learner. Coins are good manipulatives. Pennies, dimes, and loonies can be used to practise number computations with ones, tens, and hundreds. Provide the learners with coins, and then ask them to construct different amounts using the coins in different ways. For example \$2.55 can be made up of one twonie, 5 dimes, and 1 nickel or 2 loonies, 2 quarters, and 5 pennies. Coins can also be used to determine place value. They can trade 10 pennies for a dime or 10 dimes for a loonie.

Learners can practise addition by counting manipulatives. For example, if the question is $6 + 4$, the learner would start with 6 objects and add 2 more. They would then count the total to arrive at the correct amount. Counting can also be used to demonstrate that if one pair is known, two pairs are actually known, e.g., $7 + 5 = 5 + 7$.

A **counting up strategy** can be used for addition. With the question $6 + 5$, the learner starts with the larger number 6 and adds one number at a time, 5 times, while counting aloud 7, 8, 9, 10, 11. A **counting down strategy** can be used for subtraction except that instead of adding on objects, the objects are taken away. For the question $54 - 6$, the learner starts with the larger number and takes away the second number counting down by one 6 times -- 53, 52, 51, 50, 49, 48.

Activities

Math Words	8
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Count by 2's, 5's, and 10's	13

Math Words

Addition

altogether	in all	total
amount	sum	

Mark worked 5 shifts last week. He worked 4 shifts this week. How many shifts did he work **altogether**?

For lunch you ordered a chicken sandwich for \$3.50, a milkshake for \$1.50, and a chocolate chip cookie for \$.50. How much did you spend **in all**?

John's job is to pack boxes in a warehouse. He packed 25 boxes on Monday, 35 boxes on Tuesday, and 22 boxes on Wednesday. What was the **total** number of boxes he packed in the three days?

Subtraction

difference	remain	left	decrease
fewer	greater than	greater	less
less than	more	more than	
increase	reduce	fewer than	

Tom earns \$6 an hour. His sister earns \$8 an hour. How much **more** does his sister earn in an hour than he does?

Martha's rent changed from \$320 a month to \$355 a month after the landlord renovated the apartment building. How much did her rent **increase**?

What Should I Do?

1. A coat that I like at Sears originally cost \$85.00. It went on sale this week for \$68.00. How much was the price **reduced**?

I should add subtract.

2. George used to get paid \$6.25 an hour at the ACME factory. He recently got a raise to \$6.68 an hour. How much of an **increase** did he get per hour?

I should add subtract

3. Hazel needed to buy Christmas presents for her family. She paid \$10.95 for earrings for her sister, \$12.99 for a tape for her brother, and \$29.95 for a coffee maker for her mother. How much did Hazel spend **altogether** for the presents?

I should add subtract

4. When the cooking class began in September, there were 16 students in the class. By January, 6 students had dropped out of the class. How many students **remained**?

I should add subtract

5. You are out for lunch with friends. You have \$8.00 in your wallet. You order a chicken sandwich for \$2.95, an order of onion rings for \$2.25, and a Coke for \$0.98. What would be the **total** of your bill? Will you have enough money?

I should add subtract

6. You buy a chair for \$125 from Beautiful Homes. The company charges you \$15 to deliver it to your apartment. How much did the chair cost you **in all**?

I should add subtract

7. The town of Clear Springs has a population of 1,265 and the town of Cedar Falls has a population of 4,608. How much **greater** is the population of Cedar Falls than Clear Springs?

I should add subtract

Strategies for Solving Word Problems

Read and think about the problem. What is being asked? Picture in your mind the information that you are given. Reread to make sure that you completely understand the question.

Decide how to find the answer. What information do you know? What do you need to know? What operation(s) are you going to use? Are there any clue words?

Decide what numbers to use. Write out the facts you know. Use a diagram if necessary.

Work the problem. Does your answer make sense?

Make a final statement or mark the correct answer. Check to make sure that you used the correct units.

Clue Words

Addition: total, add, increase, in all, perimeter

Subtraction: difference, exceed, more than, decrease

Multiplication: area, volume,

Division: average

Addition Drill

Name: _____

Date: _____

6	5	2	5	4	8
$+3$	$+7$	$+6$	$+4$	$+1$	$+4$
-	-	-	-	-	-

8	9	4	4	2	9
$+9$	$+2$	$+6$	$+8$	$+7$	$+4$
-	-	-	-	-	-

4	9	5	4	7	3
$+5$	$+5$	$+2$	$+7$	$+4$	$+2$
-	-	-	-	-	-

3	8	1	8	6	6
$+8$	$+2$	$+6$	$+3$	$+5$	$+0$
-	-	-	-	-	-

8	9	2	5	0	7
$+5$	$+3$	$+8$	$+3$	$+9$	$+8$
-	-	-	-	-	-

1	9	5	7	3	9
$+4$	$+6$	$+8$	$+7$	$+3$	$+7$
-	-	-	-	-	-

8	6	6	2	8	7
$+8$	$+4$	$+9$	$+5$	$+7$	$+9$
-	-	-	-	-	-

Time: _____

Number of Mistakes _____

Math Self-Assessment

Weekly Response Sheet

Name _____

1. What are the two most important things you have learned in the last week?
2. What kind of math problems do you continue to find difficult?
3. What would you like more help with?
4. How do you feel about math at the moment? Circle all those that describe your feelings.

Interested Relaxed Worried Confident

Bored Rushed Confused
5. What is the biggest worry that you have about math at the moment?
6. How can we improve math class?

Count by 2's, 5's, and 10's

Count by **2's** and circle the numbers in **red** as you count.

Count by **5's** and circle the numbers in **green** as you count.

Count by **10's** and circle the numbers in **blue** as you count.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	17	18	19	20	21
22	23	24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39	40	41
42	43	44	45	46	47	48	49	50	

Learning outcome: The student applies addition and subtraction of whole numbers to real-life problems.


Level 1A

Demonstration of learning outcome


The student will be able to


- use estimating skills to figure out real life costs (restaurant check, grocery bill)
- use subtraction to compare prices, temperature, or to count stock
- estimate, count, and record the value up to \$10 of coins and bills
- read and write money amounts using two forms of notation (\$0.78 and 78¢)
- calculate correct change from a cash transaction up to \$10
- fill in a bank deposit slip and a withdrawal slip
- fill in a postal money order
- write a cheque
- read time on 24-hour and 12-hour time clocks.


Teaching Strategies/Learning Activities

 Collect a number of menus from local restaurants. Have the learner **order a meal** from the menu. He may not be able to calculate the HST and the tip at this time, but he needs to be able to estimate what these would be. A variation would be to give the learner a certain amount to spend and have her order without going over the limit. Have the learner compare the same meal at different restaurants.


You could also ask specific questions related to the menu. For example, What is the most expensive thing on the menu? Which costs more, the _____ or the _____? Learners can order a meal for the whole family, or for themselves and a friend. Compare the prices of meals on menus to buying food items from grocery stores and making your own.


 Collect samples of deposit slips, bank cheques, and postal money orders for the students to practise filling out. It is preferable to use **authentic forms** rather than reproduced forms in workbooks.

 Sometimes students will understand a problem better if they **draw a picture** of it.

 To motivate the learners to learn to **tell time**, brainstorm all the occasions in their lives where they need to tell time. Provide an example of a clock face and a digital clock. Make a cardboard model of a clock face with moveable hands. Use the model to practice where the hands of the clock should be positioned for a variety of times. (Use a brass fastener to attach the hands at the centre of the clock.) Discuss the concepts of clockwise and counterclockwise.

You should only attempt to teach the hour and the half hour at first. Position the arms and ask the learner to tell you the time. You give the learner a time and ask her to move the hands of the model to the appropriate positions. Change the time on the digital clock and ask the learner to tell you the time. Reinforce this with the practice sheets. (Plastic models of clocks are often available at dollar stores.)

 Compare prices (subtraction) using **catalogues**.

 Use the **24 hour clock table** in the Activities section to convert from the 12-hour clock to the 24-hour clock.

 Practise “**Taking Food Orders**” in the Activities section.

 Review “**Counting and Making Change**” in the Activities section.

Assessment

- **Think-Aloud Assessment**

Have the learner talk through what they are thinking as they complete a math problem. This may require some prompting and questioning by the teacher. It will allow the teacher to assess how the learner approaches the task, the strategies he uses, and whether he is monitoring the process. This will help the teacher identify errors in thinking or practice that can be immediately remedied. For example, a student may be choosing the wrong operation, making an error in computation, missing a step in a process or responding without thinking.

Resources

The best materials for this outcome are real-life samples of forms and examples of real-life math uses. Many of the activities allow the learner to practice and demonstrate competence not only in mathematics but also in life-skills reading.

* Donn Mosenfelder (1987). *Money Math*. New York, NY: Educational Design.

This book has clearly laid-out exercises on counting money, adding and subtracting money, and rounding and estimating, but the sample coins, bills, and forms are American. There is a good section on using the calculator.

Activities

The 24-Hour Clock	18
Taking Food Orders	19
Making and Counting Change	20

The 24-Hour Clock

1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.
1:00	2:00	3:00	4:00	5:00	6:00
7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 a.m.
7:00	8:00	9:00	10:00	11:00	12:00
1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.
13:00	14:00	15:00	16:00	17:00	18:00
7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	12 p.m.
19:00	20:00	21:00	22:00	23:00	24:00

Taking Food Orders

At the Quick Take-Out on Highway 425, two buses pulled in and placed the following orders:

Bus 10

9 hamburgers
 8 fishburgers
 2 cheeseburgers
 3 fried clams
 9 fries
 3 onion rings
 8 Cokes
 3 diet Cokes
 2 7-Ups
 8 chocolate shakes
 7 vanilla shakes

Bus 11

8 hamburgers
 10 fishburgers
 2 cheeseburgers
 6 fried clams
 10 fries
 5 onion rings
 7 Cokes
 6 diet Cokes
 5 7-Ups
 8 chocolate shakes
 3 vanilla shakes

1. They ordered how many? $9 + 8 = 17$
- | | | |
|-------|-------|-------------------|
| _____ | 17 | Hamburgers |
| _____ | _____ | Cheeseburgers |
| _____ | _____ | Fried clams |
| _____ | _____ | Fries |
| _____ | _____ | Onion rings |
| _____ | _____ | Cokes: Diet |
| _____ | _____ | Cokes: Regular |
| _____ | _____ | 7-Up |
| _____ | _____ | Shakes: Chocolate |
| _____ | _____ | Shakes: Vanilla |

2. They ordered how many more hamburgers than fishburgers?
3. They ordered how many soft drinks in all?
4. How many more chocolate milkshakes than vanilla milkshakes did they order?

Making and Counting Change

Counting Small Change

Always start with the biggest coins. Add the next biggest, then the next and so on. Count aloud or in your head.

You empty your pockets and you have 2 quarters, 4 dimes, 3 nickels, and 6 pennies. You want to count your change.

In order to do this you will have to practice adding in your head by 25s, 10s, 5s and 1s.

Making Change

Always start with the amount owed. Then use your coins to build up from the amount owed.

You buy a chocolate bar that costs \$ 1.37 for your friend. She gives you a toonie. You owe her 63 cents change. You have 1 quarter, 5 dimes, 3 nickels, and 5 pennies. Count out the change you would give her.

First you start with \$1.37. Then you give her give her 3 pennies to build to \$1.40. Then you give her a dime to build to \$1.50. Then you give her 1 quarter to build to 1.75. Then you give her 1 dime to built to 1.85. Then 1 dime to build to 1.95. Then a nickel to build to 2.00.

Learning outcome: The student adds and subtracts whole numbers as a foundation for more advanced mathematical concepts.

Level 1B

Demonstration of learning outcome

The student will be able to

- read, order, and write numbers up to a thousand
- read and write number words to one hundred
- count by 1's, 2's, 5's, 10's, 20's, 25's and 100's to 1,000
- list numbers in ascending and descending order and determine the median
- locate whole numbers to 100 on the number line
- identify number place values to the thousands
- round numbers to the nearest thousand
- compare numbers using symbols for greater than, less than
- add numbers with several digits by carrying
- subtract numbers with several digits by borrowing
- read and solve word problems by applying addition and subtraction skills
- use a step-by-step plan for solving problems.

Teaching Strategies/Learning Activities



Have the students practice identifying which of two numbers is bigger. Start with smaller numbers of two digits.


Which is bigger? 564 or 574


First they should start on the left of the number. If that digit is the same, go to the next digit. The first digit on the left in both numbers is 5. Continue until they find two digits that are different. The next two digits are 6 and 7. The larger of these two digit will identify which number is bigger. Therefore 574 is bigger than 564.



You can create **number patterns** by counting forward and backward on a number line.

For example, when you count forward by 2, you create a pattern. Each number is two more than the number before it (2 4, 6, 8, 10, 12...). When you count backward by 3, you also create a pattern. Each number is 3 less than the number before it (16, 13, 10, 7, 4, 1).

 A **number line** can be used to compare numbers. As you move to the right, the numbers get larger, and as you move to the left, the numbers get smaller.

 **Collect samples of statistics that could be used for exercises.** Statistical information using numbers that are relevant to students can be obtained from local public libraries and municipal offices. Learners will be more motivated to work with large numbers if they can relate them to their lives. An example is "Population of Nova Scotian Counties (1991)" in the Activities section.

Resources

Most math text books cover similar skills and the choice of texts usually depends on the personal preferences of teachers. No text will likely provide sufficient practice for basic skills, and therefore any text will have to be supplemented with practice sheets or other texts. The following are some texts that cover the outcomes in Level 1 and that are available in the Learning Resource Centres

*Lassiter, Karen (1993). *Math Matters for Adults: Whole Numbers*. Steck-Vaughn.

This is a comprehensive text that covers most of the skills required to meet the Level 1 outcomes; however, it is published in the United States and the examples are American. The text includes skill practice, real-life applications, and problem-solving techniques. There is a skills inventory at the beginning and the end of the book. Each unit has several reviews throughout, as well as an end-of-unit review. There is a glossary with examples. The book also contains answers and explanations for the problems.

*Enright, Brian E. (1987) *Solve Book 1, Whole Numbers*. North Billingham, MA: Curriculum Associates.

This book outlines the steps in problem-solving. It has practice tests and sections on creating your own problems and using a calculator to check comprehension. There is a teacher's guide that provides a detailed description of how to teach each of the steps. The sample problems are American in context, but they could easily be revised to include Canadian content. The reading level of this text is too advanced for Level 1A but might be useful for support material for 1B outcomes.

Activities

Population of Nova Scotian Counties (1991) 24

Population of Nova Scotian Counties (1991)

Annapolis	23,641
Antigonish	19,226
Cape Breton	120,098
Colchester	47,683
Cumberland	34,284
Digby	21,250
Guysborough	11,724
Halifax	330,846
Hants	37,843
Inverness	21,620
Kings	56,317
Lunenburg	47,634
Pictou	9,651
Queens	12,923
Richmond	11,260
Shelburne	17,343
Victoria	8,708
Yarmouth	27,891

a) What is the difference between the population of Halifax County and the total population of the other counties?

b) What is the total population of the four counties in Cape Breton? Which has the largest population? Which has the smallest? What is the difference between these two?

c) Arrange the counties in descending order from the largest population to the smallest.

e) Calculate the median population.

f) In 1991, the town of Bridgewater had a population of 7,248. In 1986, the population was 6,617. In 1991, the town of Kentville had a population of 5,506. In 1986, the population was 5,208. Which town has grown the most?

Learning Outcome: The student multiplies and divides whole numbers as a foundation for more advanced mathematical concepts.

Level 1B

Demonstration of learning outcome

The student will be able to

- define the terms product, quotient, divisor, remainder
- recognize symbols for multiplication and division
- explain the concepts of multiplication and division using concrete materials (manipulatives)
- know the multiplication tables up to 10
- multiply and divide by 10, 100, 1000
- multiply a number by one, two, and three digits
- divide a number by one, two, and three digits
- find the average or mean number
- read and solve word problems using multiplication skills
- read and solve word problems using division skills
- use a step-by-step plan for solving problems
- make a table to solve problems.

Teaching Strategies/Learning Activities



Have the learner **compare the prices** of no-name and brand-name products.



Use **multiplication times table charts**.



Use **mileage charts**.



Use **flash cards**.



Provide student pairs with a copy of the instructions for “**Paired Problem Solving**” from the Activities section, or post a copy in the classroom.



Practice using the “**Test for Divisibility**” in the Activities section.



Use a **number line** to demonstrate multiplication. Have the learner show you a number of multiplication expressions on the number line. You could also draw the multiplication expression on the number line and then ask the learner to provide the written expression.



Multiplying by nines. Place your hands in front of you, palms facing you with thumbs on the outside. From the left thumb, count in the number that you are multiplying by nine. For example, if you are multiplying 9×3 , count in 3 fingers, including your thumb, from the left. Fold down that finger. You will then have 2 fingers left of the folded finger and 7 fingers to the right of the folded finger. All the numbers to the left of the folded finger represent 10's and all the numbers to the right represent ones. Therefore the answer is 27.



Demonstrate **multiplication** using a deck of cards. There are four suits: spades, hearts, diamonds, and clubs. Figure out how many cards are in each suit--Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King. There are 13 cards in each suit.

4 suits with 13 cards $4 \times 13 = 52$ cards in a deck.

Royal cards. Each suit has three royal or face cards: jack, queen, king

There are 4 suits with 3 royal or face cards $4 \times 3 = 12$ royal cards.

Resources

* *Breakthrough to Math: Books 4, 5, and 6, Multiplying Whole Numbers, Dividing Whole Numbers, and Word Problems with Whole Numbers.* Syracuse NY: New Readers Press.

* *Math Stories: Multiplication and Division* (1992). Syracuse, NY: New Readers Press.

This is a good source of additional word problems for practice; however, many of the problems have American content. There is a teacher's guide.

* *Number Sense: Whole Number Multiplication and Division* (1990). Chicago: Contemporary Books.

* *Mastering Math: Levels C, D and parts of E and D* (1994). Austin, TX: Steck-Vaughn

Activities

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Paired Problem-Solving

1. Read the problem silently and carefully.
2. Discuss together what the problem asks you to find.
3. Discuss what information has been given to you in the problem.
4. Estimate what you think is the answer.
5. Discuss and then agree on the best way to solve the problem.
6. Separate and solve the problem.
7. Compare your answers.
8. Write the answers you agree on in the correct form.
9. If your answers are not the same, review together how each of you got the answer.
10. If you still cannot agree on the answer, ask your teacher for help.

Test for Divisibility

Divisor	Test	Examples
2	The number must be even and end in 0, 2, 4, 6, or 8	60 184 372 36
3	The sum of the digits must be divisible by 3	69: $6 + 9 = 15$ $15 \div 3 = 5$ 768: $7 + 6 + 8 = 21$ $21 \div 3 = 7$
4	The number of the last two digits must be divisible by 4	87, 236: $36 \div 4 = 9$ 792: $92 \div 4 = 23$
5	The last digit must be 5 or 0.	640 4,355
6	The number must be even and the Sum of the digits must be divisible by 3.	8532 $8 + 5 + 3 + 2 = 18$
8	The number of the last three digits must be divisible by 8. Numbers ending in 3 zeros	86,712: $712 \div 8 = 89$ 135,000
9	The sum of the digits must be divisible by 9.	613,845 $7 + 1 + 3 + 8 + 4 + 5 = 27$ $27 \div 9 = 3$
10	The last digit must be 0	430 528,960

Learning Outcome: The student applies addition, subtraction, multiplication and division of whole numbers to real-life problems.







Level 1B

Demonstration of learning outcome

The student will be able to

- make purchases of, and change for, items up to \$100
- calculate time and distance
- take inventory
- calculate unit price
- order materials and take orders
- keep records of bank transactions (cheques, debit cards).

Teaching Strategies/Learning Activities

-  Use a **tide table**. Discuss who needs to know when to expect a high tide or a low tide. Discuss how the tide affects the creatures that live on a beach. If possible, visit a beach to observe the tides and tidal pools.
-  Sample **Inventory** Question: a restaurant receives some new cutlery: 150 soup spoons, 200 steak knives, 130 fish forks, 135 dessert spoons, and 135 dessert forks. How many new items of cutlery does this make? The restaurant originally had 234 soup spoons, 186 steak knives, 126 fish forks, 237 dessert spoons, and 197 dessert forks. What are the new totals for each type of cutlery?
-  Have the learner look up the times of their favourite **television** shows using a **schedule** from the newspaper.
-  Use a commercial **calendar** with large spaces for writing on each date. Write in the times of appointments.
-  Use a calculator to find out the **unit price** before mastering division of decimals.
-  Collect **menus from restaurants** and develop exercises such as “Dinner Out with Friends” and “Ordering a Pizza” in the Activities section.



Complete “**Hours of Work**” in the Activities section.



Complete “**Comparing Money**” in the Activities section.

Assessment

When assessing the learner’s ability to solve math problems, you will find that learners who have **difficulties in problem-solving** in this area often:

- do not value accuracy
- are not consistent in interpreting or performing operations
- do not check answers
- cannot visualize the problem
- draw conclusions in the middle of the problem without reading the whole problem
- do not break the problem into parts
- do not proceed in small steps
- do not use the parts of the problem they understand to figure out the more difficult parts
- do not evaluate a solution for reasonableness.

- **Documenting Solutions**

This assessment strategy provides valuable information to the teacher about the students’ ability not only to solve math problems but also to understand and describe their problem-solving process. It gives the students more control over, and a deeper understanding of, their problem-solving strategies. It is best to choose three or four problems at different levels of difficulty: easy, moderate, and challenging.

The students should be instructed to explain step-by-step in writing how they solved the problems. They should work out the problems as completely as possible. When they become stuck, they should indicate where they were and the questions they asked themselves as they attempted to solve the problem.

This strategy allows the teacher to assess and diagnose where the student went wrong, and to discover any fundamental problems in the student’s understanding of basic concepts or principles. Examples of solutions that are well developed and clear examples of reasoning and applying principles should be shared with the class and used as models for problem-solving.

Activities

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Dinner Out With Friends

You are out for dinner with five friends. You decide to order a fixed-price group dinner.

Dinner for six \$48.50

Egg Drop Soup Breaded Jumbo Shrimp Beef Chow Mein Chicken Soo Guy Honey Garlic Spare Ribs Barbecued Pork Fried Rice Fortune Cookies

Find the cost per person for this menu.

In addition, your group decides to order two dishes from the Special Suggestions menu, which is on the next page. They choose one order of Breaded Jumbo Shrimp with Lemon, and one order of Garlic Chicken Wings with Black Bean Sauce. Each person also wants a Spring Roll. What will each person have to pay after these items are added to the bill?

Special Suggestions Menu

Spring Roll	\$ 1.25
Breaded Dry Spareribs	3.95
Deep Fried Spareribs	4.80
Honey Garlic Spareribs	4.95
Garlic Spareribs with Black Bean Sauce	5.95
Honey Garlic Chicken Wings	4.85
Garlic Chicken Wings with Black Bean Sauce	5.85
Beef with Chinese Greens	5.75
Beef with Green Peppers	5.95
Chicken Soo Guy	5.75
Breaded Jumbo Shrimp with Lemon	6.25
Garlic Shrimp with Green Pepper	6.75
Shrimp Fried Rice	3.95
Bar B. Q. Pork with Bean Sprouts	5.95
Bar B. Q. Pork with Chinese Greens	5.85
Bar B. Q. Pork Fried Rice	3.85
Moo Goo Guy Pan	5.95
Cantonese Chow Mein	5.25

If you had decided to order only separate items from the Special Suggestions Menu, what would be the cost of 6 Spring Rolls, 2 orders of Breaded Dry Spareribs, 3 orders of Bar B. Q. Fried Rice, 1 order of Garlic Spareribs with Black Bean Sauce, 3 orders of Beef with Green Pepper, 1 order of Moo Goo Guy Pan and 2 orders of Cantonese Chow Mein?

What is the difference between the fixed price dinner, the fixed price dinner with the added choices from the Special Suggestions Menu and the order from the Special Suggestions Menu? For the whole group? For each person?

Ordering a Pizza

Pizza Menu

INGREDIENTS				
Pepperoni	Green Olives	Anchovies	Mushrooms	
Green Peppers	Hot Peppers	Bacon	Pineapple	
Tomatoes	Extra Cheese	Ham	Salami	
Onions				
BASIC PRICES				
	Sm.	Med.	Large	Ex. Large
Tomato sauce and cheese	4.00	5.00	6.00	7.75
Any 1 extra topping	4.25	5.50	6.75	8.75
Any 2 extra toppings	4.50	6.00	7.50	9.75
Any 3 extra toppings	4.75	6.50	8.25	10.75
Each additional topping	.25	.50	.75	1.00

1. What is the cost for each pizza?
 - a. small with mushrooms and pepperoni
 - b. medium with olives, bacon, and tomatoes
 - c. extra large with salami, green peppers, extra cheese, and green olives

2. Calculate the cost of pizza for each person for each of the following orders:
 - a. A party of 15 people orders 3 extra-large pizzas with onions, pepperoni, and mushroom; 4 medium pizzas with mushrooms, bacon, tomato, and hot peppers.
 - b. A class of 28 students orders 4 extra-large pizzas with pepperoni, bacon, olives, and ham; 2 extra-large pizzas with mushrooms and bacon; 4 medium pizzas with salami, pepperoni, and extra cheese.

Sometimes specials can be misleading:

	Today's Special			
	Sm.	Med.	Large	Ex. Large
Pepperoni, mushrooms, green peppers, and bacon	5.25	7.25	8.25	10.50

3. Compare the cost of the specials to the cost of the regular menu. When is the special really a special?

Hours of Work

1. During one week, you worked 45 hours. If you worked an equal number of hours each day, and you worked for five days, how many hours did you work each day?
2. How long did you work?

Time Clock

Time In 15:30
Time Out 22:40
Time Worked _____

Time In 9:45
Time Out 16:20
Time Worked _____

Time In 9:45
Time Out 4:30
Time Worked _____

Time In 5:00
Time Out 12:30
Time Worked _____

Time Sheet

Monday 4 h 20 min
Tuesday 3 h 30 min
Wednesday 4 h 30 min
Thursday 6 h
Friday 6 h 15 min
Saturday 4 h 25 min
Hours Worked _____

Comparing Money

1. Circle which is worth more:

1 quarter	2 dimes
60 cents	2 quarters
5 nickels	20 pennies
9 dimes	1 loonie
3 quarters	7 dimes

2. What 3 coins would amount to the following?

25 cents
30 cents
36 cents
\$1.26

3. What 4 coins would amount to the following?

16 cents
41 cents
\$1.31

Unit 2 Calculators

Learning Outcome: The student uses a calculator to verify answers to basic operations in addition, subtraction, multiplication, and division.

Level 1B

Demonstration of learning outcome

The student will be able to

- name the parts of a calculator
- press buttons in the right order.

Teaching Strategies/Learning Activities



Calculators are no substitute for knowledge of the basic facts and operations of addition, subtraction, multiplication, and division. Calculators are a more efficient way of doing long, complicated computations once the basic facts and operations have been mastered.

However, calculators can be used effectively in many ways. They should be introduced as early as possible and used throughout all the levels, for the following reasons:

- Calculators are used extensively in society today.
- The use of calculators allows the learners to concentrate on the problem-solving process, rather than the calculations. The emphasis can be placed on selecting the right strategy, rather than on getting the right answer. The calculator can be particularly helpful when doing multi-step problems.
- The learner can use mathematical concepts that are beyond their computational skill. For example, they can figure out the cost per item, even though they may not be able to divide decimal numbers.
- The calculator is a good self-evaluation tool. Learners can check the accuracy of their calculations and know if they need additional help before moving on.
- When working in groups to solve problems, learners can check each other's computations quickly.
- Many operations, such as estimating, can be simplified by using a calculator.



Use a calculator when grocery shopping to keep track of the amount spent.

Assessment

- Have the learners complete computations using a calculator to practice speed and accuracy. You may want to time learners, or have them time each other. A long series of computations can be challenging, e.g., $21+14 \div 7 \times 6+24 \div 9-4 \times 50 \div 4 =$

Resources

*Aronson, Gregg, Echaore, Susan D. And Winifred Ho Roderman(1985). *Using a Calculator*. Hayward, California: Janus Books.

Despite its publication date, this small booklet is an easy-to-read module on using calculators that can be used very effectively with individual learners.

Unit 3 Measurement

Learning Outcome: The student uses common measuring tools to perform basic linear measurement.

Levels 1A and 1B

Demonstration of learning outcome

The student will be able to

- use a ruler, metre stick, tape measure for linear measurement
- use mathematical language to describe dimensions (height, length, width)
- recognize standard units of measurement in both metric and SI systems
- recognize and use the abbreviations for linear units of measurement
- explain the relationship between common units of measurement (centimetres to metres, inches to feet)
- select the most appropriate unit to measure length
- calculate the perimeter of a straight-sided figure.

Teaching Strategies/Learning Activities



Use retail **mail order catalogue** size **charts**, drapery charts.



Visually **compare different units** of measurement. Students should recognize the relationship between the units. Which is longer or shorter?



Calculate the **distance** from point to point in miles and kilometres using a road map scale.



Perimeter must be calculated when putting molding around a room or window, fencing around a lot, decorative trim on a sewing project, and when purchasing edging for a garden. Have the learners find as many examples as they can in their everyday lives for calculating perimeter. Use these examples to build word problems.



Have the learner find **examples** of the different types of linear measurement in flyers, catalogues, and advertisements.

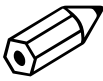
Assessment

For the measurement outcomes, the emphasis should be on assessing whether the learner can recognize and conceptualize the different units of measurement, rather than on computation.

Many linear measurements require that learners are able to use fractions and decimals which they are not expected to master at this level. You may want to teach them how to use measuring tools that involve fractions and decimals, but you should not assess them on computation if it requires fractions and decimals.

Resources

* Hall, Terri Lynn, Rintoul, Randy and Tri-County Literacy Council. *Metric Unit: A Guide to the Metric System for the Adult Literacy Learner*. Literacy Link Eastern Ontario.



Tutor/Instructor Notes

The kinds of measuring tools used should be chosen based on the specific interests and needs of individual learners. Some learners will be comfortable with the metric system, but many may have almost no experience with metric measurement. At this level, the objective is to familiarize the learner with the two systems using concrete samples and authentic activities.

Unit 4 Geometric Shapes

Learning Outcome: The student compares basic liquid and solid measurements.

1A and 1B

Demonstration of learning outcome

The student will be able to

- identify the similarities and differences in measurement between two objects
- use mathematical language to describe dimensions (weight, volume)
- recognize the common standard units of capacity (grams, kilograms, ounces and pounds)
- recognize and use the abbreviations for capacity units of measurement
- use a measuring cup and a measuring spoon
- compare litres, quarts, pounds, and kilograms
- use a weight scale.

Teaching Strategies/Learning Activities



Identify the unit of measurement you would use to measure the weight of a truck, a bar of soap, a bag of potatoes.



Practise **measuring ingredients** by preparing a recipe.



Using a spring platform **scale** to weigh a variety of items. You can then make a chart illustrating the information, plot weights on a number line, or list items in ascending or descending order.



With **volume**, it is very easy to be fooled by the shape of the container. To prove that the shape of the container does not alter the volume, find some empty containers (such as drink cartons and bottles) which are marked with the same volume. Fill one of them up with water and then pour the water from one container to another.

- ☞ Give learners an opportunity to get the “feel” of different units of liquid and solid measurement. Have a collection of various sized containers and packages available.

Assessment

For the measurement outcomes, the emphasis should be on assessing if the learner can recognize and conceptualize the different units of measurement, rather than on computation. Ask questions that require the learner to compare and contrast, to predict, to identify, and to classify.

Resources

The resources for this unit can be found in the tutor/teacher’s and the learner’s homes.

Learning outcome: The student recognizes basic two-dimensional geometric shapes.

Level 1A

Demonstration of learning outcome

The student will be able to

- recognize a square
- recognize a rectangle
- recognize a triangle
- recognize a circle
- compare and sort two-dimensional shapes.

Teaching Strategies/Learning Activities



Have the learner **identify** different two-dimensional shapes in his or her environment.



Sort two-dimensional figures according to a number of attributes, e.g., size, number of sides or any other attributes.

Assessment

- The intention of this outcome is to prepare the learner for geometrical concepts related to two-dimensional figures (e.g., perimeter and area). It is not necessary for the learner at this stage to do any mathematical computations related to these areas.

Learning Outcome: The student recognizes basic three-dimensional geometric shapes.

Level 1B

Demonstration of learning outcome

The student will be able to

- recognize a cube
- recognize a prism
- recognize a cone
- recognize a cylinder
- recognize a pyramid
- compare and sort three-dimensional shapes.

Teaching Strategies/Learning Activities



Have the learner look around the room to find **real-life examples of solid figures**. Look for the following shapes: cubes, prisms, cones, pyramids, and cylinders. Make a list. Which type of solid figure has the most examples in the classroom? You can complete this activity by having a learner check his kitchen cupboard, workshop, or grocery store.



Have a collection of wooden solids available as samples. Ask the learner to describe each one without using the name of the solid. This makes her focus on attributes.



Construct three-dimensional figures using paper and cardboard.

Assessment

For this outcome, the emphasis should be on assessing whether the learner can recognize and conceptualize the different geometric shapes. Ask questions that require the learner to describe, to compare and contrast, to predict, to identify, and to classify.