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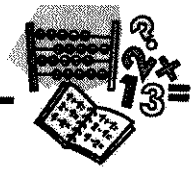
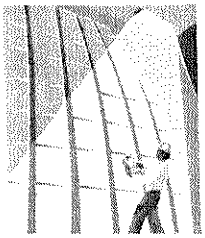
Math 9 K&E

Whole Numbers (B)

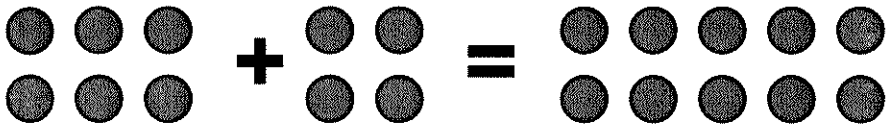


Adding Whole Numbers

Adding numbers and quantities are skills used in many workplace situations, such as warehouse work.



Many strategies can be used to add numbers, such as drawings, mind math, manipulatives, calculators or pencil and paper.



6	+	4	=	10

Whatever method you use, it is important to understand the process of addition.

Think About ...

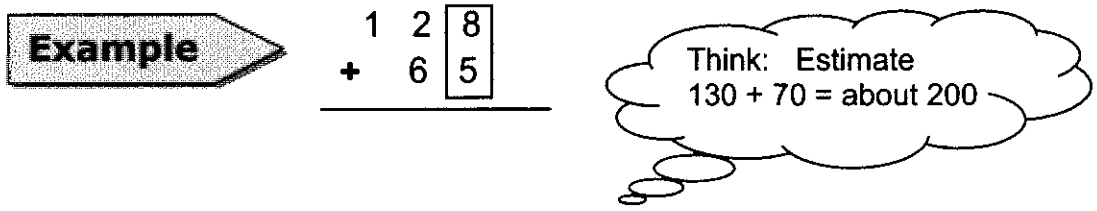
In groups, think of different times you have used addition at home or in your community.

Discuss how your life would be different if you were not able to add whole numbers in your head.

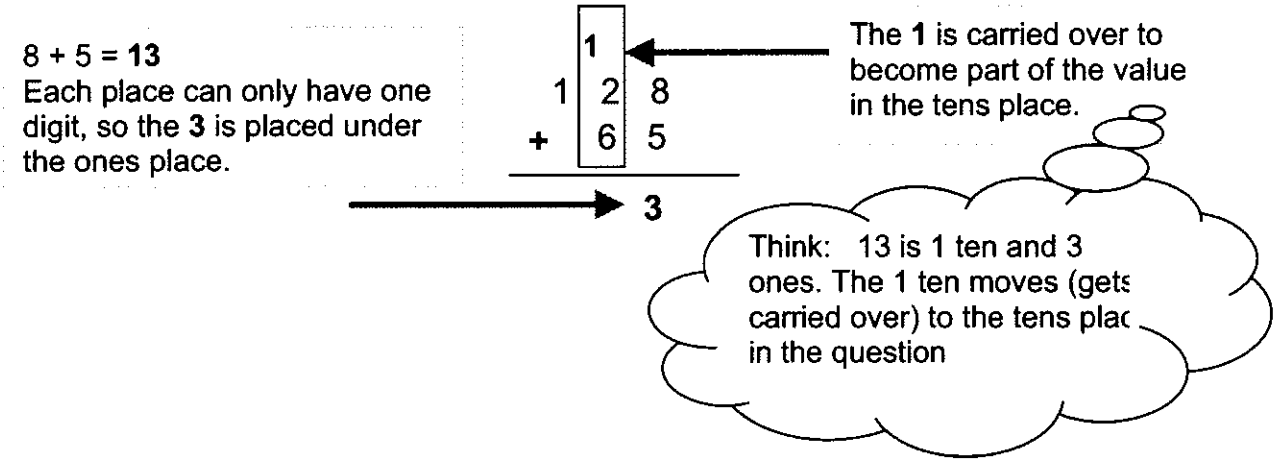
The Process of Addition

When using the pencil and paper method to add two numbers, follow these steps.

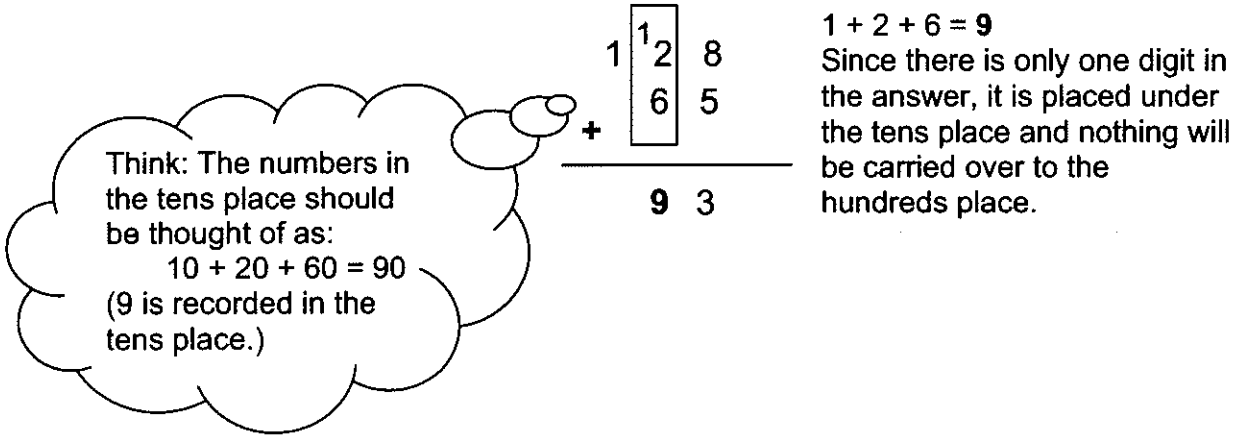
1. Place the numbers so that one number is above the other and the numbers in the **ones place** align.



2. Starting at the right, add the values of the numbers in the ones place.



3. Next, add the values in the **tens place**.



4. Next, add the values in the **hundreds place**.

1 + 0 = **1**
Since the second number, 65, does not have a digit in the hundreds place, we say that it has 0 in the hundreds place.

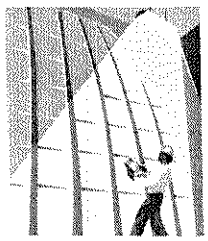
$$\begin{array}{r} {\scriptstyle 1} \\ 128 \\ +\ 65 \\ \hline 193 \end{array} \longrightarrow 128 + 65 = \mathbf{193}$$

Think: The numbers in the hundreds place should be thought of as:
100 + 0= 100
(1 is recorded in the hundreds place.)

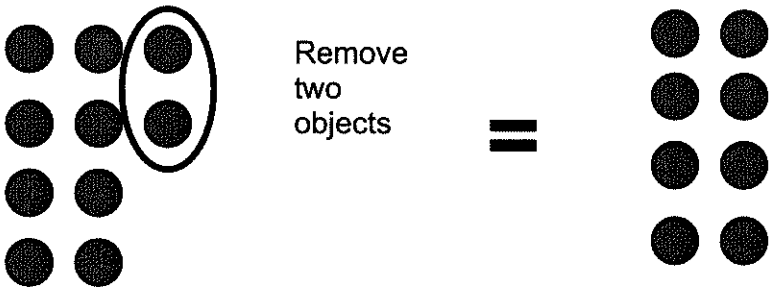
To add larger numbers, repeat the same steps for each additional place. The process for adding decimal numbers is similar.

Subtracting Whole Numbers

As boxes are removed from inventory, a warehouse worker will subtract the number of boxes removed from the previous total to calculate the number of boxes left in inventory.



Many strategies can be used to subtract numbers, such as drawings, mind math, manipulatives, calculators or pencil and paper.



1	0	–	2	=	8

Whatever method you use, it is important to understand the process of subtraction.

The Process of Subtraction

When using the pencil and paper method to subtract one number from another, follow these steps.

1. Place the numbers so that one number is above the other and the numbers in the **ones place** align.

Example

$$\begin{array}{r} 5\ 8\ 7 \\ -\ \ 9\ 2 \\ \hline \end{array}$$

Think: Estimate
590 – 90 = about 500

2. Starting at the right, subtract the values of the numbers in the ones place.

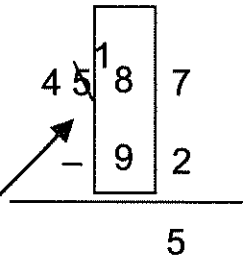
7 – 2 = **5**
Each place can only have one digit, so the **5** is placed under the ones place.

$$\begin{array}{r} 5\ 8\ \boxed{7} \\ -\ \ 9\ \boxed{2} \\ \hline \end{array}$$

→ **5**

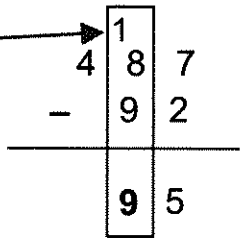
3. Next, subtract the values in the **tens place**.

8 – 9 = ?
If the second number (the number under the first number) is **LESS** than the value of the first number, you must borrow **1** from the place to the **LEFT**.
In the example, 1 is borrowed from 5, leaving **4** in the hundreds place.



Think: 80 – 90 cannot be done so you need to borrow from the hundreds place. You borrow 1 from the hundreds so 80 + 100 = 180 .
(1 is recorded in front of the 8 in the tens place to show 180.)

The 1 is placed in the tens place in front of 8, so that 8 becomes 18.
18 – 9 = **9**

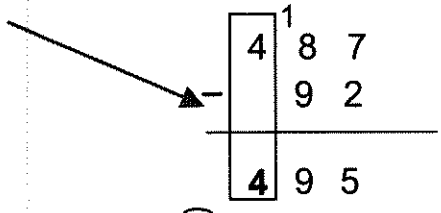


Think: 180 – 90 = 90
(9 is recorded in the tens place.)

4. Next, subtract the values in the **hundreds place**.

$4 - 0 = \mathbf{4}$

Since the second number, 92, does not have a digit in the hundreds place, we say that it has 0 in the hundreds place.



$587 - 92 = \mathbf{495}$

Think: 400 – 0 = 400
(4 is recorded in the hundreds place.)

To subtract larger numbers, repeat the same steps for each additional place value. The process for subtracting decimal numbers is similar.

Fact Families

Remember that addition and subtraction are related operations.

Fact families show how addition and subtraction sentences are related. Addition sentences can be written two ways:

496 + 241 = **737**

241 + 496 = **737**

Subtraction sentences can be written two ways:

737 – 496 = 241

737 – 241 = 496

Together, these four mathematical sentences make a **fact family.**

496 + 241 = 737
241 + 496 = 737
737 – 496 = 241
737 – 241 = 496

The numbers in this fact family are: 241, 496 and 737.

Verifying Answers in Subtraction

When you subtract, you can verify whether your answers are right using a variety of methods, such as opposite operations, mental mathematics, calculator, manipulatives and diagrams.

Example The grocery store has 90 000 units in stock.

If the store sells 47 000 units of the food product in stock, how many will they have remaining according to their computer?

The store manager calculated in his mind. The number 47 000 is close to 50 000. He thought 90 000 – 50 000 equals 40 000.

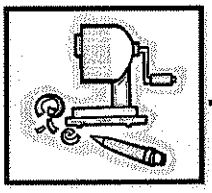
The difference between the 50 000 rounded number and the 47 000 original number is 3 000. So, 40 000 + 3 000 equals a remaining 43 000 units.

9	0	0	0	0	-	4	7	0	0	0

He checked his answer on the computer calculator. It displayed a result of

43 000

His mental calculation was correct.



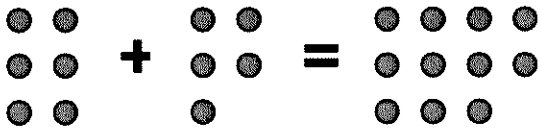
Practice: Addition and Subtraction

1. Fill in each of the blanks with numbers between 0 and 10 so that the addition equation is correct.

	6	5	☐
	8	☐	5
+			
	☐	7	3
☐	1	5	1

2. Write the addition statements represented by the following diagrams in numbers and in words.

a)



b)

3. Write the following addition statements in words.

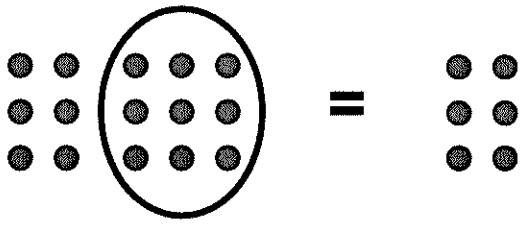
a) **19 + 50 = 69**

b) **1250 + 420 = 1670**

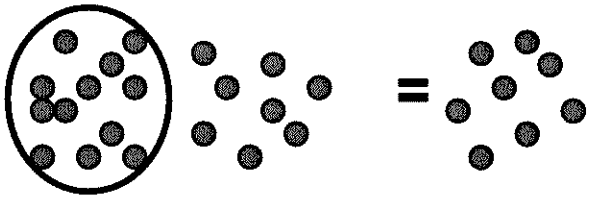
c) **635 + 472 = 1107**

4. Write the subtraction statements represented by the following diagrams in numbers and in words.

a)



b)



5. Write the following subtraction statements in words.

a) **456 – 250 = 206**

b) **3490 – 275 = 3215**

c) **12 460 – 234 = 12 226**

6. Complete these fact families:

a) 365 + _____ = 706

_____ + 365 = 706

706 – 341 = _____

_____ – 365 = 341

b) 841 – 469 = _____

841 – 372 = _____

372 + _____ = 841

469 + 372 = _____

7. For each of the following subtraction questions, prove that the answers are correct using one of the following methods: opposite operation, mental mathematics, calculator, manipulatives or diagrams. Be prepared to explain the strategy you used.

a) 25 – 20 = 5

b) 40 – 10 = 30

c) 100 – 65 = 35

d) 450 – 150 = 300

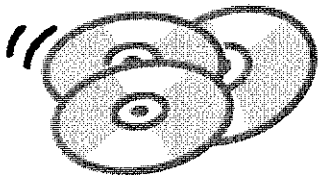
e) 347 – 207 = 140

f) 96 – 84 = 12

g) 151 – 69 = 82

8. Yesterday's cafeteria sales totalled $864.00. Rory has $389.00 left after paying the food supply company. How much did he pay the company for the cafeteria foods? Verify your answer by writing the fact family for this problem.

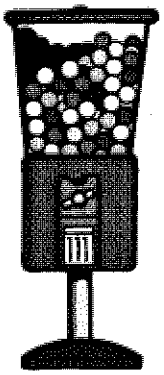
9. Haley and Tasha have decided to become roommates. They are excited as, together, they will have an impressive CD collection. In total, they will have 237 CDs. If 114 of these CDs belong to Haley, how many CDs does Tasha have?



10. St. Albert, Stony Plain and Spruce Grove are close to the city of Edmonton. The combined population of these four centres is approximately 723 343. The population of Edmonton is 648 284, the population of Stony Plain is 8 274 and the population of Spruce Grove is 15 069. What is the population of St. Albert?

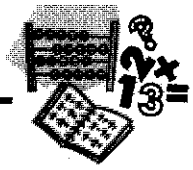
11. The local video store is having a contest. You can win three free DVD rentals if you can solve the gumball puzzle. Next to the container of gumballs, you see the following information.

> There are 835 gumballs in the container.
> There are 485 more red gumballs than blue gumballs.
> Guess the correct number of red and blue gumballs and win a free DVD rental.



12. Michelle began to save the caps from the bottles of soda pop she drank. There were two kinds of caps: caps worth 5 points and caps worth 2 points. So far, Michelle has collected 21 caps, totalling 57 points. How many 5-point and 2-point caps does Michelle have?

Multiplying Whole Numbers



Many strategies can be used to multiply numbers, such as

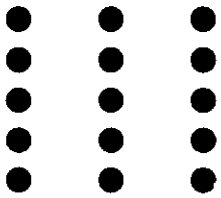
1. paper and pencil
2. Base 10 blocks (manipulatives)
3. grids and geoboards.

Whatever method you use, it is important to understand the process of multiplication.

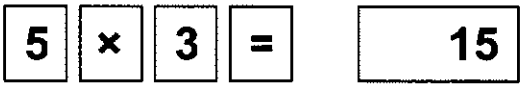
Example

The head chef of a classy restaurant was asked to prepare meals for 3 groups of 5 customers each. How many meals will he have to prepare in total?

The diagram shows 3 groups of 5.



Entering 5 × 3 = on a calculator displays the answer 15.



The **product** is the answer to a multiplication question.

MULTIPLICAND × MULTIPLIER = PRODUCT

Which is the same as:

FACTOR × FACTOR = MULTIPLE

The position of the factors can be changed without changing the answer.

E.g. 5 × 3 = 15
3 × 5 = 15

Multiplying Using Paper and Pencil

When using the pencil and paper method to multiply two numbers, follow these steps.

1. Place the numbers so that one number is above the other and the numbers in the ones place are aligned.

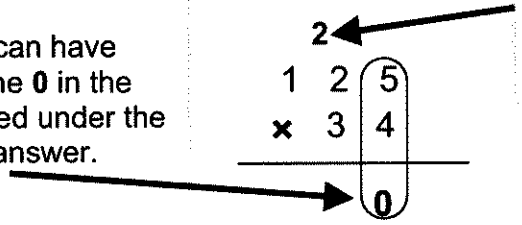
Example

$$\begin{array}{r} 125 \\ \times\ 34 \\ \hline \end{array}$$

– Multiplicand
– Multiplier

2. Multiply the digit in the ones place of the multiplier by the digit in the ones place of the multiplicand.

$4 \times 5 = \mathbf{20}$
The answer is 20.
Each place value can have only one digit so the **0** in the ones place is placed under the ones place in the answer.

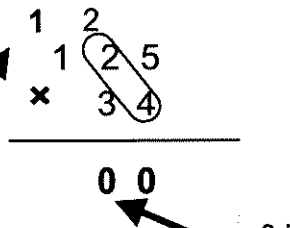


2 from 20 is carried over to become part of the value of the next place.

3. Multiply the digit in the ones place of the multiplier by the digit in the tens place of the multiplicand. ADD the value of any carried digits to this total.

$4 \times 2 = \mathbf{8}, + 2 = \mathbf{10}$

4 multiplied by 2 equals 8. Add the carried 2 to 8, and the answer is 10.



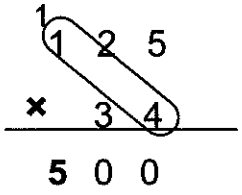
1 from 10 is carried over to the hundreds place.

0 is written below the tens place.

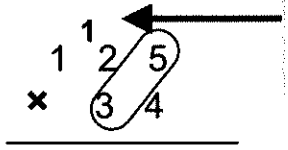
4. Multiply the digit in the ones place of the multiplier by the digit in the hundreds place of the multiplicand. ADD the value of any carried digits to this total.

$4 \times 1 = 4, + 1 = 5$

4 multiplied by 1 equals 4. Then add the carried 1 to 4, and the answer is 5.



5. Multiply the digit in the tens place of the multiplier by the digit in the ones place of the multiplicand.



1 from 15 is carried over to become part of the value of the next place.

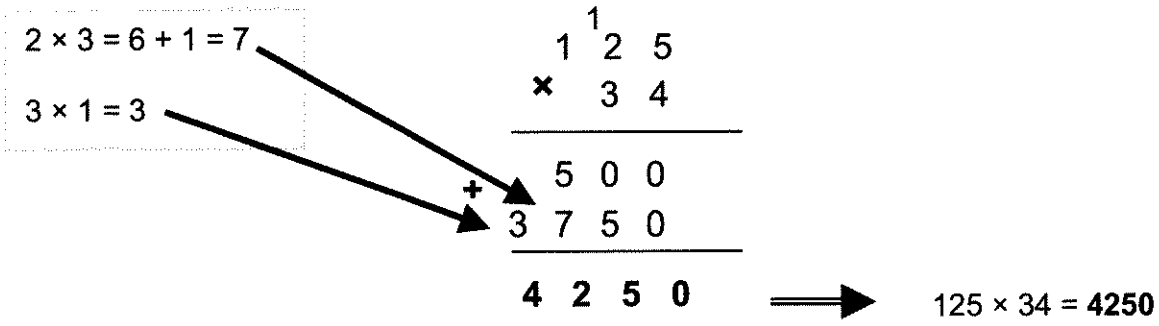
$3 \times 5 = \mathbf{15}$

Each place can only have one digit. 5 is placed under the tens place.

To show that the tens place of the multiplier is being multiplied, a zero is placed in the ones position to hold the place value.

6. Repeat steps 3 and 4 using the figure in the tens place of the multiplier.

7. Add the results together to get the final answer.



Multiplication can be expressed in numeric and word forms.

Numeric form: 125 × 34 = 4250

Word form: One hundred twenty-five *times* thirty-four *equals* four thousand two hundred fifty.

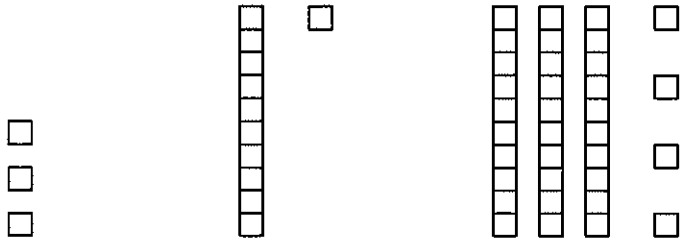
Multiplying Using Manipulatives

You can also multiply two numbers by using manipulatives or "Base 10 blocks."

Ones place value blocks look like this: □

Tens place value blocks (strips) look like this:

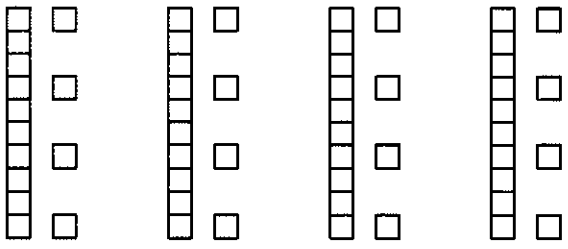
The numbers **3**, **11**, and **34** are represented as follows.



3 **11** **34**

When multiplying using base 10 blocks, the **multiplier** indicates how many identical groups of base 10 blocks you need.

Example What is the product of **14 × 4** using base 10 blocks?



= 56

The blocks are grouped to show 4 sets of 14.

Multiplying Using 10 X 10 Grids or Geoboards

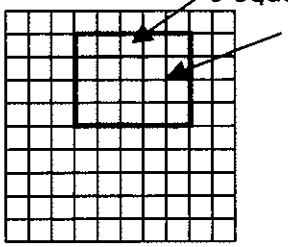
You can use grids or geoboards to represent multiplying two numbers.

On a grid, use a pencil to shade or outline the multiplicand and multiplier.

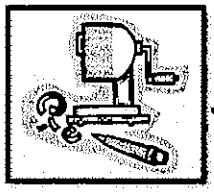
On a geoboard, use elastics to represent the multiplicand and multiplier.

The **product** of the multiplication question is the **number of squares inside the rectangle** (or square) outlined by the pencil or elastic.

Example What is the product of **5 × 4**?

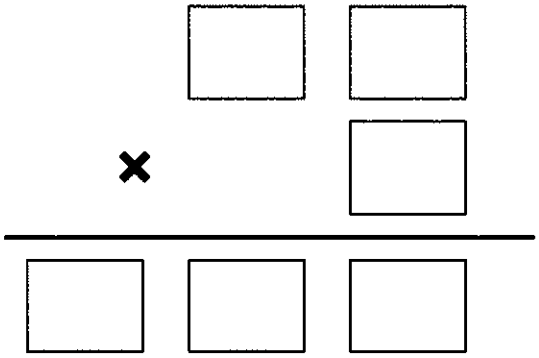


→ The product of 5 × 4 is 20.



Practice: Multiplying Whole Numbers

1. Complete the multiplication challenge below by filling in each box with a number between 1 and 6. Each number can only be used once.



2. Kelly raked 32 bags of leaves. She earned $2 for each bag. How much money did Kelly earn raking leaves?

3. Prithi makes friendship bracelets and sells them. It costs Prithi $1 to make each bracelet and she sells them for $4 each. If Prithi sells 12 bracelets, how much money has she made?

4. Challenge a classmate to demonstrate multiplication using grid paper and geoboards.

5. Peter makes $4.00 per child for each hour that he baby-sits. If he baby-sits 3 children for 6 hours, how much money will Peter make?

6. Replace W with a number to make the product correct.

$$\begin{array}{r} W2 \\ \times \quad 7W \\ \hline 6396 \end{array}$$

With a partner, create several similar problems and challenge your classmates to solve for the missing numbers.

7. Multiply the following using pencil and paper. Show your work. Be prepared to explain how you solved the problems.

   a. 207 × 51
   b. 469 × 15
   c. 328 × 12

8. Write the multiplication statements represented by the following counters in numeric and word forms.

   a. 

   Numeric form: _____

   Word form: _____

   b. 

   Numeric form: _____

   Word form: _____

9. Write each multiplication statement in word form.

   a. $918 \times 26 = 23\,868$

   b. $774 \times 12 = 9288$

10. For each of the following multiplication questions, prove that the answers are correct using one or more of the following methods: grids, geoboards, calculator, manipulatives or diagrams. Be prepared to explain the strategy you used.

    a. $3 \times 3 = 9$

    b. $10 \times 10 = 100$

    c. $8 \times 11 = 88$

    d. $6 \times 7 = 42$

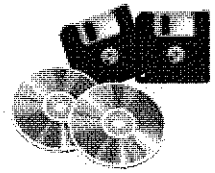
    e. $8 \times 11 = 88$

    f. $7 \times 3 = 21$

    g. $4 \times 9 = 36$

    h. $9 \times 3 = 27$

Multiplying by Multiples of 10 Using Mind Math



Many items in retail stores are packaged in groups of 10 or multiples of 10.

- For example, blank floppy discs or compact discs can often be purchased in packages of 10.
- Floor or wall tiles may be packaged in 10s, 50s or 100s.

When estimating, numbers are often **rounded** to the nearest tens place value (a multiple of ten) to make calculations easier to perform in your head.

Examples

A) Approximately how many golf balls are there all together if each box holds 12 golf balls and there are 4 boxes in total?

Round 12 to 10.

Mentally multiply 4 × 10 = **40.**

There are approximately 40 golf balls.

B) How do you calculate the GST in your mind on a product worth $24.00?

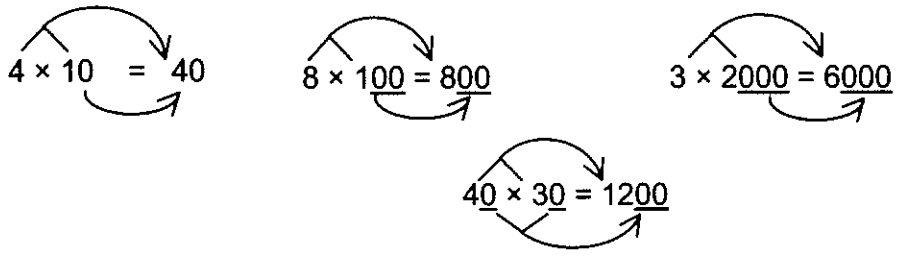
Round 7% to 10%.

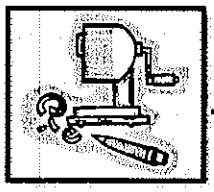
Multiply 24 × 10 = **240**.

Move the decimal two spaces to the left.

The GST on a $24.00 item is approximately $2.40.

To mentally multiply by a multiple of **10**, multiply the digits of each number together and then add one zero to the answer for each zero in the original question.



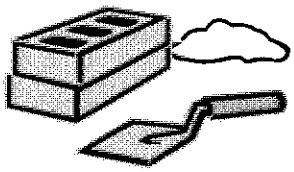


Practice: Multiplying Multiples of 10

1. Create a variety of multiplication questions using multiples of 10. Try the mind method of using multiples of 10 to estimate or solve. Challenge your classmates to a variety of mind math problems.

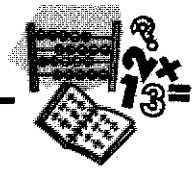
2. Duc's class is holding a multicultural fair at school. Students will bring food from their cultures and Duc is going to make spring rolls. If each person will eat 3 spring rolls and 150 people are expected to pass through the fair, how many spring rolls will Duc need to make?

3. John needs 124 bricks for each row of a barbeque he is building. His plans indicate that his barbeque is 16 rows in total. How many bricks will John need?



4. Gillian is landscaping City Centre Park and needs 105 plants for each garden. There are 32 gardens in the park. How many plants will she need?

Powers



When the same number is multiplied by itself again and again, it is called **repeated multiplication**.

Example In the following charts, the numbers 3 and 4 are multiplied by themselves.

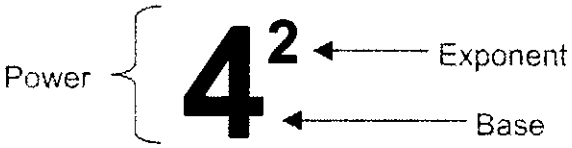
Multiplication	Answer
3×3	9
$3 \times 3 \times 3$	27
$3 \times 3 \times 3 \times 3$	81

Multiplication	Answer
4×4	16
$4 \times 4 \times 4$	64
$4 \times 4 \times 4 \times 4$	256

Another way of writing repeated multiplication is by using **powers**.

What is a power?

A power is an abbreviated (short) way of writing a number.
A power looks like:



4^2 means that 4 is multiplied by itself 2 times.
$4^2 = 4 \times 4 = 16$

Each part of the power has a special name.

The **BASE** is the number that will be multiplied by itself again and again.

The **EXPONENT** represents the number of bases to be multiplied.

The **POWER** refers to the base and exponent written as shown above.

Power is also known as the **exponential form** of a number.

Placing powers into the tables we worked with earlier provides a better understanding of what powers represent.

Repeated Multiplication	Power	Answer
3×3	3^2	9
$3 \times 3 \times 3$	3^3	27
$3 \times 3 \times 3 \times 3$	3^4	81

Repeated Multiplication	Power	Answer
4×4	4^2	16
$4 \times 4 \times 4$	4^3	64
$4 \times 4 \times 4 \times 4$	4^4	256

There are names for commonly used exponents.

Power	Exponent	Name	Examples
4^2	2	squared	6^2 , 9^2
4^3	3	cubed	6^3 , 9^3

4^2 can be expressed four ways:

four to the second power

or

four squared

or

four exponent two

or

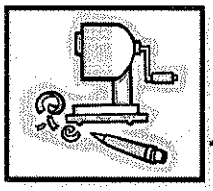
four to the power of two

Think About ...

Find examples of numbers with exponents in your science text book, other science reference book or on the Internet.

What would the numbers look like if they were written out?

Why do you think they are written with exponents?

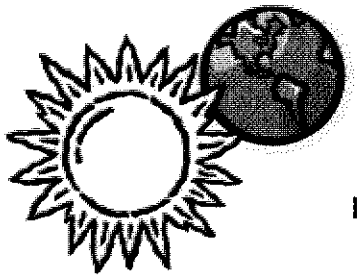


Practice: Working with Powers

1. Review powers by completing the chart below.

Power	Repeated Multiplication	Answer
5^2	5×5	25
	$6 \times 6 \times 6$	
10^3		
4^5		
	$3 \times 3 \times 3 \times 3$	
10^2		
15^2		
	$7 \times 7 \times 7$	
8^3		
	9×9	

Powers of Ten and Scientific Notation



Large numbers such as the speed of light and the distance from the Earth to the Sun are often represented using an abbreviated form.

In science, we refer to the speed of light as:

3×10^8 m/s.

This is the abbreviated form of 300 000 000 metres per second.

Powers of 10 are used to estimate and reduce the size of large numbers to make them easier to work with.

A **power of 10** is a power with a **base of 10.**

$$10^{\square}$$

← The exponent can be any number

Power of 10	Repeated Multiplication	Answer
10^2	10×10	100

The exponent is 2. There are 2 zeros in the answer.

For example:

- $10 \times 10 \times 10 = 1000$, and can also be represented as 10^3.
- $10 \times 10 \times 10 \times 10 \times 10 = 100\,000$, and can also be represented as 10^5.

Multiples of 10 can be represented as powers of 10.

Examples

A) 7000 is 7×1000 and can be represented as 7×10^3.
B) 20 000 is $2 \times 10\,000$ and can be represented as 2×10^4.

Scientific Notation

Scientific notation is a way of writing numbers in powers of 10 and is used when communicating large numbers.

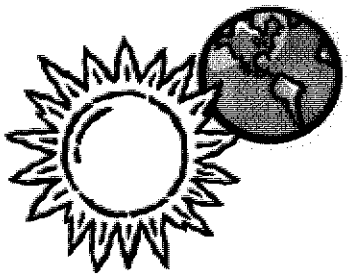
Example

The distance between Earth and the Sun is approximately 150 000 000 000 m. This number is abbreviated as:

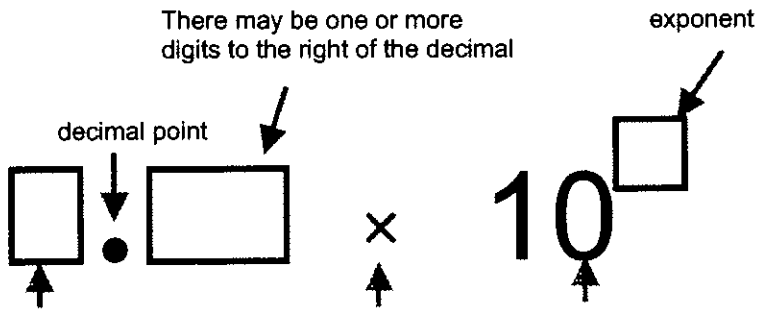
$$1.5 \times 10^{11}\ \text{m}$$

This number represents a scientific notation.

Numbers in scientific notation look like this example.



In general, scientific notation looks as follows.



Example 1.275×10^3 (original number = 1275)

Notice that in representing numbers in scientific notation:

- there is only one number in front of the decimal point
- there may be several numbers to the right of the decimal point.

Writing Numbers in Scientific Notation Using Repeated Multiplication

Example What is 1275 in scientific notation?

$127.5 \times 10 = 1275$
$12.75 \times 10 \times 10 = 12.75$
$1.275 \times 10 \times 10 \times 10 = 1.275$

There are three 10's being multiplied.

Therefore: $1275 = 1.275 \times 10^3$ in scientific notation

Writing Numbers in Scientific Notation by Moving the Decimal Point

This is a good mind math method. Some people call it a shortcut.

Example What is 1275 in scientific notation?

- In all whole numbers, the decimal point is to the right of the last digit—we do not place it unless it is needed.
- The decimal point is located behind 5.

  1275.

- Move the decimal point to the LEFT until there is only one number to the left of the decimal point.

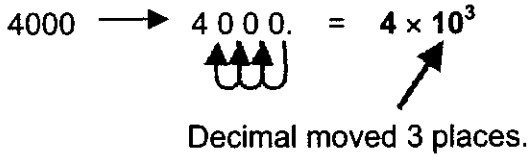
  1275. → 127.5 → 12.75 → 1.275

- Next, COUNT the number of times you moved the decimal point to the left (3 times in the example). This number is your exponent in the power of 10.

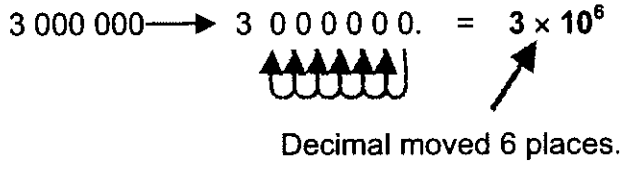
Therefore: 1 2 7 5. = 1.275×10^3 in scientific notation

Examples

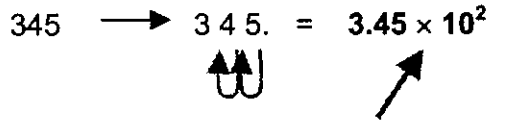
A) What is 4000 in scientific notation?



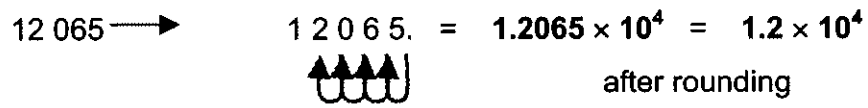
B) What is 3 000 000 in scientific notation?

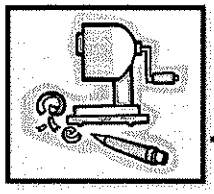


C) What is 345 in scientific notation?



D) What is 12 065 in scientific notation rounded to the nearest tenth?





Practice: Working with Powers of Ten

1. Do you notice a pattern between the number of zeros following the one, and the exponent? Explain this pattern to your teacher or a classmate.

2. Write each number in repeated multiplication and as a power of 10.

Number	Repeated Multiplication	Power of 10
1 000		10^3
10 000		
100 000	$10 \times 10 \times 10 \times 10 \times 10$	
1 000 000		

3. Maddy was examining the population of cities in Alberta. She found the following statistics:

Calgary – 876 519
Edmonton – 648 284
Grande Prairie – 35 962
Lethbridge – 68 712
Medicine Hat – 50 512
Red Deer – 68 308

Maddy created a chart in which she rounded each number and identified each population as a power of 10.

Cities	Rounded Populations (to the nearest 10 000)	Populations in Powers of 10
Calgary	880 000	8.8×10^6
Edmonton	650 000	6.5×10^4
Grande Prairie	40 000	4×10^4
Lethbridge	70 000	7×10^4
Medicine Hat	50 000	5×10^5
Red Deer	70 000	7×10^4

Luckily, when Maddy rechecked her work before handing it in, she identified three errors. Can you find and correct her three errors? (Hint: The errors are not in the rounded numbers.)

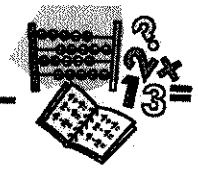
4. The chart below is a result of Census 2001. It shows the population of each of Canada's provinces and territories. Rewrite each population figure in scientific notation. Round each number to one digit to the right of the decimal point.

Province/Territory	Population	Scientific Notation
British Columbia	3 907 738	
Alberta	2 974 807	
Saskatchewan	978 933	
Manitoba	1 119 583	
Ontario	11 410 046	
Quebec	7 237 479	
New Brunswick	729 498	
Nova Scotia	908 007	
Prince Edward Island	135 294	
Newfoundland	512 930	
Yukon Territory	28 674	
Northwest Territories	37 360	
Nunavut	26 745	

5. Rewrite each figure below in scientific notation. Round each number to one digit to the right of the decimal point.

Number	Scientific Notation
14 532 739	
27 466 570	
39 774 129	
47 453 982	
73 283 465	
96 374 102	
137 845 923	
177 299 374	
187 378 069	
566 734 292	
1 456 292 349	
3 744 239 129	
12 373 460 595	

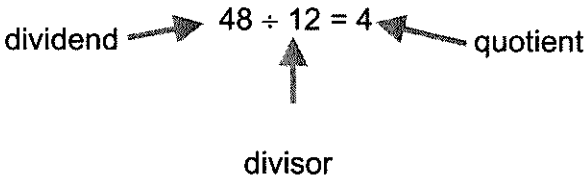
Dividing Whole Numbers



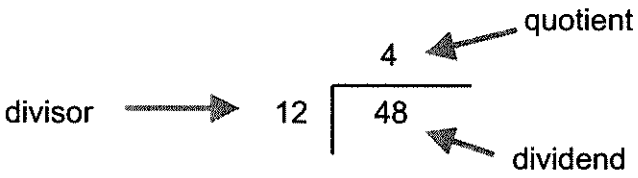
Chad makes 48 cookies to share with 12 friends. How many cookies will each friend receive? To find the answer, you need to use division.

The division statement **48 ÷ 12** can be represented using the following methods.

In number form:



OR



The **dividend** is the number being divided.

The **divisor** is the number doing the dividing.

The **quotient** is the answer to a division question.

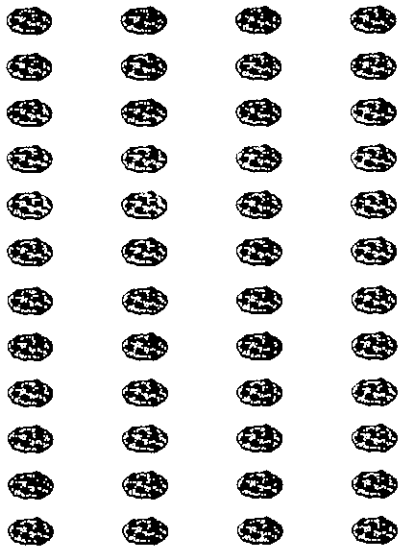
In word form: Forty-eight divided by twelve equals four.

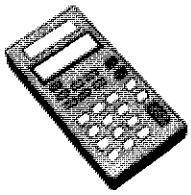
OR

Twelve divided into forty-eight equals four.

Many strategies can be used when dividing numbers, such as drawing, mind math, manipulatives, calculators or pencil and paper.

Example The diagram shows 48 cookies organized into 4 groups of 12. The quotient is 4.





Entering 48 ÷ 12 = on a calculator displays the answer of 4.

4 8 ÷ 1 2 = 4

Whatever method you use, it is important to understand the process of division.

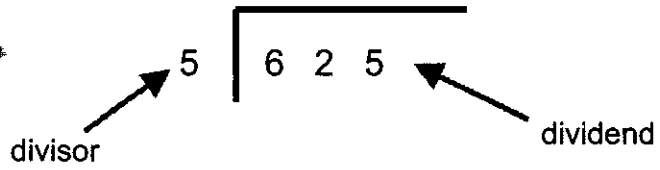
The Process of Division

Dividing Using Paper and Pencil

When using the pencil and paper method to divide numbers, follow these steps.

1. Place the numbers so that the dividend is under the division sign and the divisor is in front of the division sign as shown below.

Example



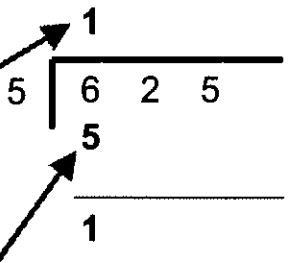
2. Ask yourself how many times (think multiplication) will the divisor go into the dividend without going over.

$5 \times 1 = 5$
$5 \times 2 = 10$ (too high)

Five will divide into six one time without going over.

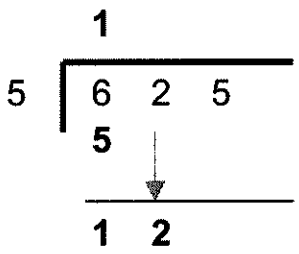
Place **1** directly above 6 in 625, since only the six was being divided by the divisor of five. This number now becomes part of the answer to the question.

Five, the product of 5×1, is placed under 6 in 625 and is subtracted from the six, resulting in **1**.



If the divisor will not divide into the value of the dividend during **Step 2**, place a **zero** (0) in the quotient and bring down the next digit from the dividend.

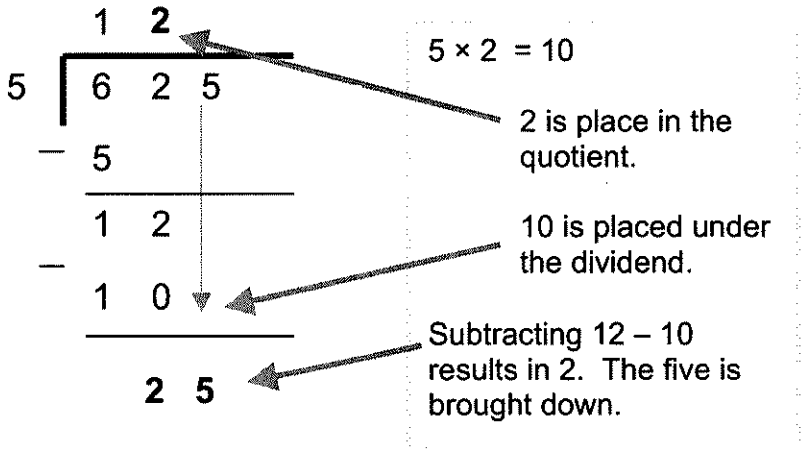
3. Bring down the next digit in the dividend.

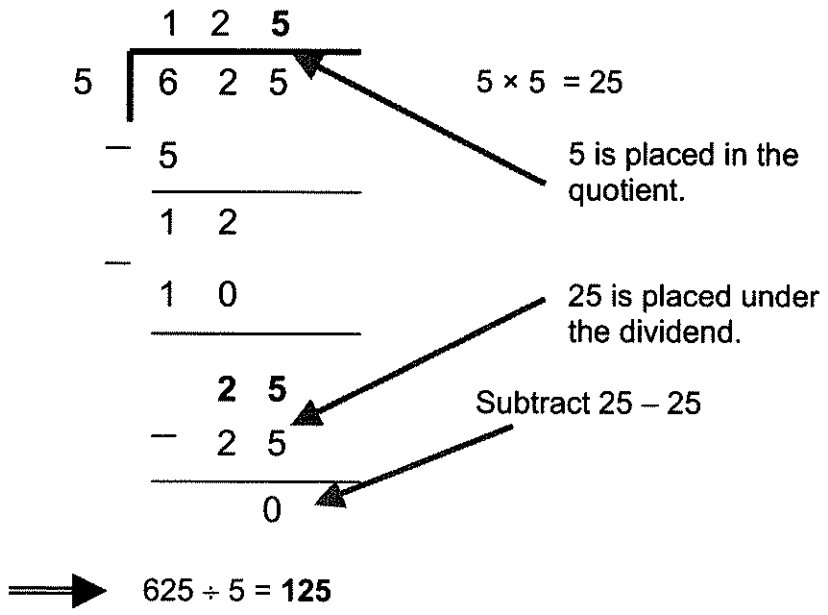


4. Now divide 5 into 12. Estimate how many times 5 will divide into 12.

$5 \times 2 = 10$
$5 \times 3 = 15$ (too high)

5. Repeat **Steps 2** and **3** until the final answer is reached.



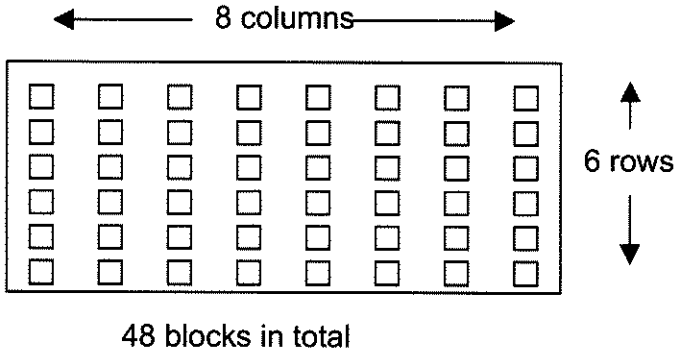


Dividing Using Manipulatives

You can also divide two numbers by using manipulatives or "Base 10 blocks."

Example What is the quotient of **48 ÷ 8**?

1. Count 48 blocks. Place them in 8 columns (8 is the divisor).
2. The quotient is the number of rows of blocks. Place blocks evenly into each column.



48 blocks in total

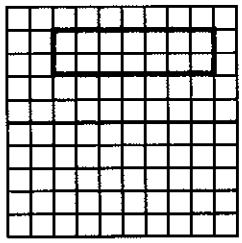
Dividing Using 10 × 10 Grids or Geoboards

Grids or geoboards can be used to represent the division of numbers. Use a pencil or an elastic to create a rectangle or square with a total number of squares inside equal to the dividend. The length of the rectangle must be equal to the value of the divisor.

The **quotient** of the division statement is the **number of rows.**

Example What is the quotient of **14 ÷ 7**?

columns



rows

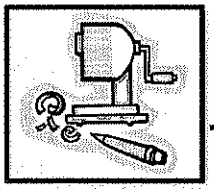
→ The quotient of 14 ÷ 7 is 2.

Dividing Using Hints for Dividing

There are a number of general rules that can help you determine whether a number is divisible by another number.

Example A number can be divided by 5 if it ends in 0 or 5. Therefore, 75 is divisible by 5.

These rules are listed in Hints for Dividing.



Practice: Dividing Whole Numbers

1. Write the numeric and word forms to represent the following counters.

   a.

   Numeric form: _____

   Word form: _____

   b.

   Numeric form: _____

   Word form: _____

2. Write each division statement in words.

   a. $144 \div 12 = 12$

   b. $96 \div 3 = 32$

3. Use hints for dividing or another method to determine whether or not the following are evenly divisible. Be prepared to explain your method.

   a. Is 14 divisible by 2?

   b. Is 34 divisible by 6?

   c. Is 90 divisible by 3?

   d. Is 126 divisible by 9?

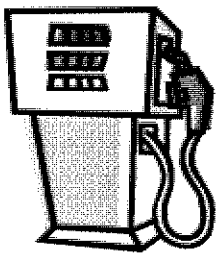
   e. Is 38 divisible by 5?

   f. Is 86 divisible by 3?

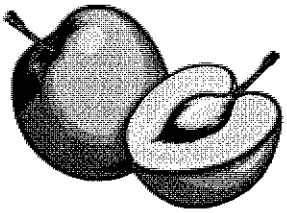
   g. Is 142 divisible by 6?

   h. Is 2450 divisible by 2?

4. Jackie keeps track of her gas use. Her gas tank holds 64 litres of gas. If Jackie can drive a total of 576 kilometres on one tank of gasoline, how many kilometres can she drive per litre?



5. Janine organizes afternoon snacks for the children at the daycare centre. Today's snack is plums. There are 16 children in the daycare centre and 48 plums. How many plums will each child get?

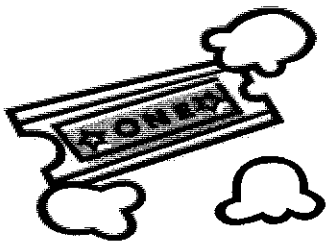


6. Kenji receives $2.50 for each bag of leaves that he rakes. If Kenji earned $40.00, how many bags of leaves did he rake?

7. Challenge a classmate to demonstrate division using grid paper and geoboards.

8. Kristi works at a flower shop. A customer comes in and orders 98 petunias. If each flat holds 7 petunias, how many flats will Kristi have to prepare?

9. Bernard wants to take friends to a movie. He has $48.00. How many friends can he take if each ticket costs $8.00?



Dividing by Multiples of 10 Using Mind Math

You can estimate when you divide two numbers. When estimating, numbers can be **rounded** to a multiple of 10 to make calculations easier to perform in your head.

Example

Sixty-two candies are to be divided between 19 students. Approximately, how many candies will each student receive?

Round 19 people to **20.**

Round 62 candies to **60.**

Mentally divide 60 ÷ 20 = **3**

Each student will receive 3 candies.

When you are dividing by 10 or multiples of 10, such as 20, 80, 1000, you can remove one zero from the dividend and divisor for each zero in the divisor. Removing the zeroes makes the process of division easier.

Examples

A) 90 ÷ 30 =

90	÷	30 =
(9 × 10)		(3 × 10)
(9 ~~× 10~~)		(3 ~~× 10~~)
(9 ~~× 10~~)		(3 ~~× 10~~)
10	÷	10 = 1
9Ø	÷	3Ø =
9	÷	3 = 3 × 1 = **3**

You can remove the 10 from both numbers because the 10s divide and equal 1.

The answer is the same: 3.

B) 14Ø ÷ 1Ø, so 14 ÷ 1 = 14

C) 60Ø ÷ 1Ø, so 60 ÷ 1 = 60

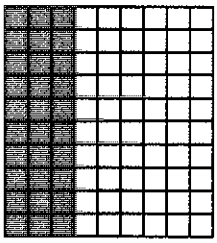
D) 32ØØ ÷ 4ØØ, so 32 ÷ 4 = 8

Removing the zero is the same as moving the decimal in each dividend to the left.

Another way of dividing multiples of 10 is with pictures.

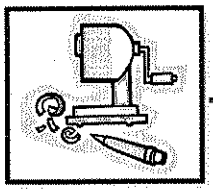
Example

90 divided into groups of 30 = 3 groups



9 divided into groups of 3 = 3

90 ÷ 30 is the same as 9 ÷ 3 = 3



Practice: Dividing Multiples of 10 Using Mind Math

1. Angelina has received her first pay cheque. She has earned $280.00. If Angelina earns $7.00 per hour, how many hours did she work?

2. Use mind math strategies to solve the following. Explain the strategy you used in words.

   a. 300 ÷ 60

   b. 1800 ÷ 300

   c. 2400 ÷ 80

3. Indicate how you would mentally divide each of the following numbers and be prepared to explain the process you used. The first question is an example.

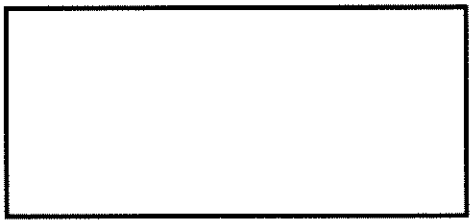
   a. 8400 ÷ 20

   840ø ÷ 2ø = 420

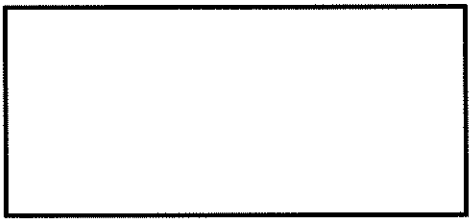
   I removed the zero from 20 and removed one zero from 8400. Then I divided 2 into 840.

   b. 960 ÷ 30

c. $1240 \div 40$



d. $36\,000 \div 60$



Verifying Answers in Division

When you are dividing, you can verify whether your answers are right using a variety of methods, such as opposite operations, mental mathematics, calculator, manipulatives and diagrams.

Example Harvesting wheat crops is done with a combine.

If the area of farmland to be combined is 2 000 000 m^2 and each pass of the combine covers 5000 m^2, how many passes will Corey take to finish combining?

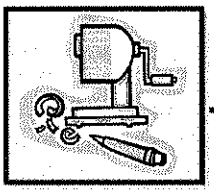
Corey calculated in her mind. The divisor has 3 zeros, so she removed 3 zeros from the dividend. She divided 5 into 2000 and got 400.

She checked her answer on a calculator by entering the following:

2	0	0	0	0	0	0	÷	5	0	0	0	=

The calculator displayed a result of: 400

Corey's mental calculation of 400 passes was correct!



Practice: Verifying Answers in Division

1. For each of the following division questions, prove that the answers are correct using one of the following methods: opposite operation, mental mathematics, calculator, manipulatives or diagrams. Be prepared to explain the strategy you used.

   a. $16 \div 2 = 8$

   b. $49 \div 7 = 7$

   c. $30 \div 6 = 5$

   d. $8 \div 4 = 2$

   e. $100 \div 25 = 4$

   f. $66 \div 3 = 22$

   g. $40 \div 8 = 5$

   h. $52 \div 2 = 26$

2. Rewrite each multiplication statement as a division statement.
   E.g., **7 × 6 = 42, 42 ÷ 7 = 6**

   a) $4 \times 3 = 12$ _____

   b) $7 \times 5 = 35$ _____

   c) $6 \times 1 = 6$ _____

   d) $9 \times 2 = 18$ _____

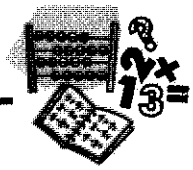
   e) $4 \times 8 = 32$ _____

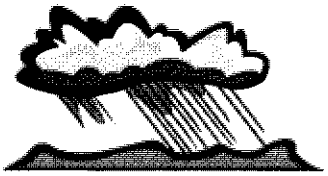
3. Solve the following word problem. Check the accuracy of your solution using the opposite operation.

   Jenny earns $7.50/h and worked for 12 hours.
   How much money did Jenny earn?

Solution	Check

Calculating Averages





Calculating averages helps people make everyday decisions.

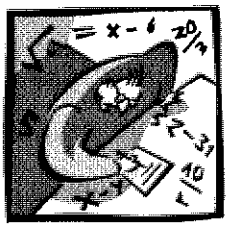
For example, knowing how much rain has fallen on average for the month will help farmers determine if they need to water their fields.

Calculating and comparing weekly running speed averages over a period of several weeks will help a runner decide whether or not to increase training.

To find the average of a set of numbers:

1. Find the **SUM** of the numbers.
2. **DIVIDE** the sum by the number of values given.

Example



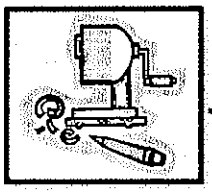
For the past 3 days, a rain gauge has recorded the following amounts of precipitation:

14 mm 16 mm 24 mm

What is the average precipitation over the 3 days?

14 + 16 + 24 = **54**
54 ÷ 3 = **18**

The average amount of precipitation for the 3 days is 18 mm.



Practice: Calculating Averages

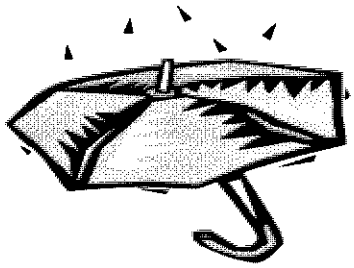
1. Over a period of 1 week, a student recorded the amount of time (in hours) spent reading and studying.

   5 2 3 2 2 3 4

   What is the average amount of time the student spent reading and studying for the week?

2. Calculate the overall average for these marks in four subject areas.

Math	**70%**
Language Arts	**64%**
Science	**72%**
Social Studies	**58%**



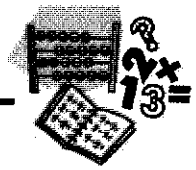
3. It has been raining for the past 5 days. The amount of precipitation is measured each day. The results are shown below:

   10 mm 24 mm 28 mm 12 mm 16 mm

   What is the average rainfall over the 5 days?

4. With a partner, discuss the use of averages in your lives and in familiar workplaces.

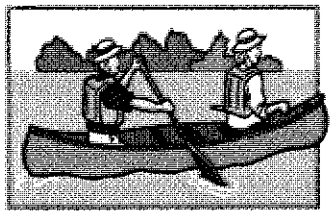
Rounding Whole Numbers



Why round numbers?

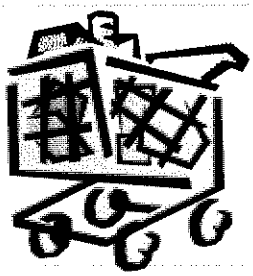
When exact numbers are not needed, numbers are often rounded to give approximate values and quantities. Rounding also helps us estimate.

Temperature:



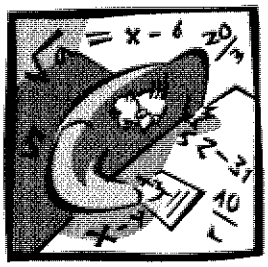
Daily temperatures are often rounded to the nearest degree Celsius.

E.g., 25.7°C is generally reported as 26°C



Money:

People often use rounding and estimating at a store to make sure they have enough money to pay for items before they get to the cashier.



Using large numbers:

- Newspapers often round large numbers to take up less space. They may print $10M rather than $10 490 721.00.
- When adding or subtracting large numbers mentally, it is easier to round them first!

Think About ...

For the next week, find examples of when you use or hear rounded numbers when talking to friends, family and other people in your community.

Discuss in groups when and how rounding is used in the workplace.

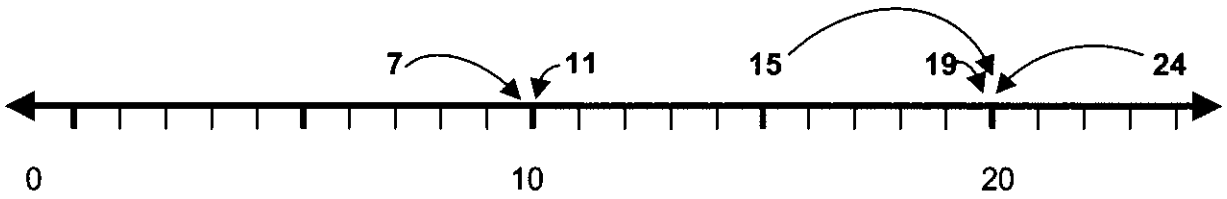
Rounding Using Number Lines

A **number line** has numbers placed in order along a straight line.
Number values increase from left to right.

Check out Hints for Rounding for more rounding strategies.

Rounding to the nearest 10

Example Round the following numbers to the nearest 10:
11 7 19 15 24



Where are the numbers on the number line?

The numbers 7 and 11 are close to 10 on the number line.
The numbers 19 and 24 are close to 20 on the number line.
The number 15 is exactly in the middle between the 10 and 20.

Rounding to the nearest 10

7 and 11 are both closer to 10 than they are to 0 or 20.

- 7 rounds up to 10
- 11 rounds down to 10

19 and 24 are both closer to 20 than to 0 or 10.

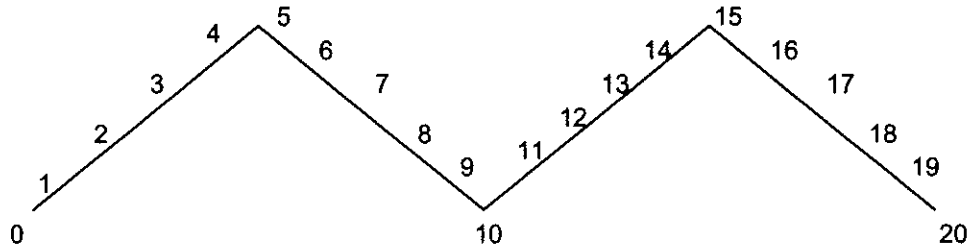
- 19 rounds up to 20
- 24 rounds down to 20

What about 15?

If a number is *exactly* half way, round to the larger of the two numbers.

- 15 rounds up to 20 because it is exactly half way between 10 and 20.

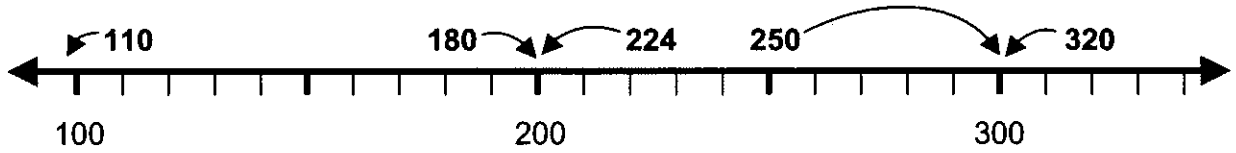
Another way to think about rounding is to pull the number line up into a mountain.



- Any number below 5 rolls down the hill to the left and rounds down.
- Any number 5 and above rolls down the hill to the right and rounds up.

Rounding to the nearest 100

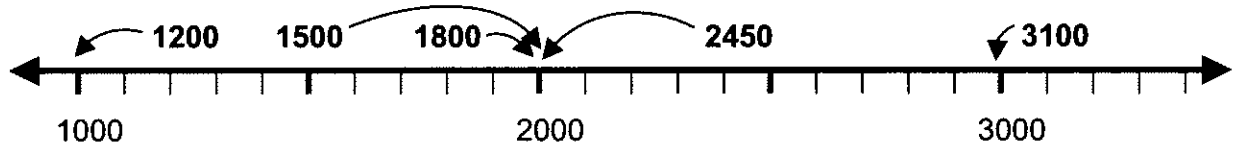
Example Round the following numbers to the nearest 100:
110 180 320 250 224



- 110 rounds down to 100
- 180 rounds up to 200
- 224 rounds down to 200
- 320 rounds down to 300
- 250 rounds up to 300 because it is exactly half way between 200 and 300.

Rounding to the nearest 1000

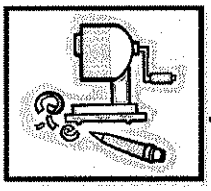
Example Round the following numbers to the nearest 1000:
1200 1800 3100 2450 1500



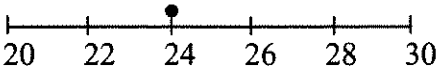
- 1200 rounds down to 1000
- 1800 rounds up to 2000
- 2450 rounds down to 2000
- 3100 rounds down to 3000
- 1500 rounds up to 2000 because it is exactly half way between 1000 and 2000.

Rounding to larger numbers

When rounding numbers to the nearest 10 000, 100 000, 1 000 000 and beyond, the same methods are used for rounding to the nearest 10, 100 and 1000.



Practice: Rounding

Use a number line or other method to round each number to the nearest 10.	
1. 24 → 20	
2. 55	
3. 87	
4. 66	
5. 193	

Use a number line or other method to round each number to the nearest 100.	
6. 342	
7. 459	
8. 112	
9. 749	
10. 1123	

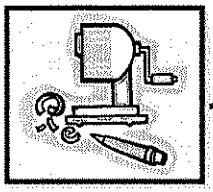
Use a number line or other method to round each number to the nearest 1000.	
11. 4600	
12. 9250	
13. 2730	
14. 3800	
15. 23 400	

Use a number line or other method to round each number to the nearest 10 000.	
16. 64 000	
17. 29 050	
18. 72 300	
19. 83 000	
20. 335 400	

Use a number line or other method to round each number to the nearest 1 000 000.	
21. 3 450 950	
22. 7 234 734	
23. 9 499 999	
24. 1 900 000	
25. 6 540 100	

26. Round each number in the chart below to the indicated place value. For each column, go back to the original number on the left. Two examples are shown for you.

	Round to the nearest					
Number	**1 000 000**	**100 000**	**10 000**	**1000**	**100**	**10**
23 549 214	24 000 000	23 500 000	23 550 000	23 549 000	23 549 200	23 549 210
6387			10 000	6000	6400	6390
72						
32749						
310 056						
7 328 074						
462						
3472						



Practice: Rounding Problems

1. Tommas has two savings accounts. In the first one, he has $324.08 and in the second he has $896.54. He also has $245.76 in a chequing account.

   a. Use **rounding to 100** to estimate the amount of money Tommas has all together.

$324.08	rounds to $300
$896.54	rounds to $900
$245.76	rounds to $200

   Rounding to 100, Tommas has an estimated $1400 in his three accounts.

   b. Calculate the exact amount in his accounts. How close is the estimation to the real value of his accounts?

   c. Discuss these questions with classmates:
   - In what situations would Tommas need to know the exact amount of money in his accounts?
   - When do you need exact numbers, and when would estimated and rounded numbers be appropriate? Think about situations in your life.

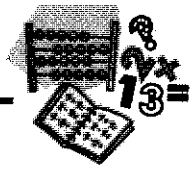
2. After receiving her baby-sitting money, Shelly went shopping. Shelly had a total of $90.00 in her wallet. Use rounding and estimation to determine the items that she can purchase so that she spends close to, but not more than $90.00.
   Create at least two combinations of items.

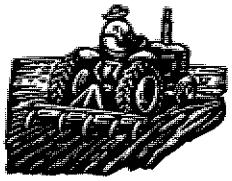
Sweater – $24.56	Capri Pants – $32.98
Sunglasses – $12.45	Blazer – $33.40
Jeans – $56.98	Watch – $26.99
Hat – $8.99	Shoes – $18.95
T-shirt – $16.78	Boots – $53.59

3. Taylor's parents are thinking about buying a recreational trailer to park out at the lake for the summer. There were 4 trailers in which they were interested. The first trailer cost $54 753, the second cost $19 403, the third was $48 265 and the fourth trailer was $32 581. How much is each trailer rounded to the nearest 10 000?

4. Check out the use of large numbers in newspapers, magazines, tables in atlases and other information sources. Discuss the use of rounded numbers and exact numbers in the information that you find.

Estimating Whole Numbers





How long will this farmer take to plow the field?

How long will it take a runner to run 5 km?

If you made a thoughtful or "educated" guess as to how long it would take the runner and the farmer, you just made an estimate!

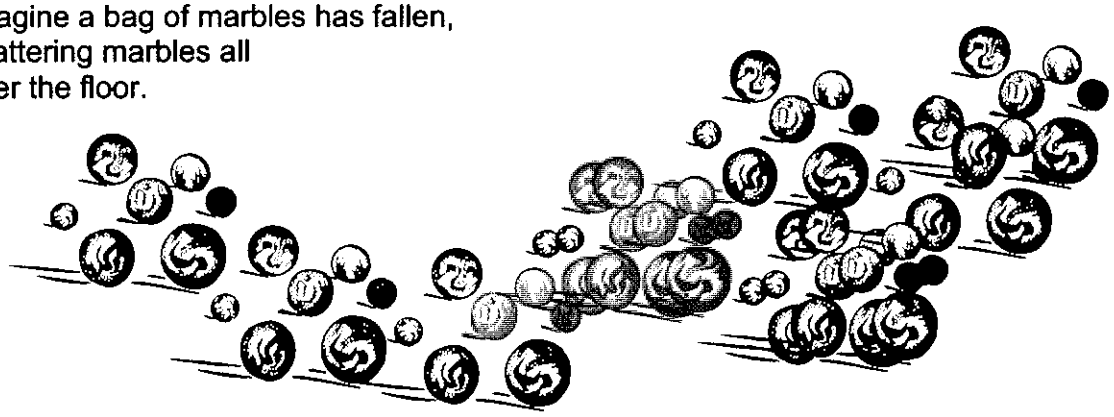
Estimates are based on educated guesses and also on rounding. The more practice we have at guessing quantities and amounts, the more accurate our estimates will become.

Estimates are used in lots of different ways. For example:

- In science, estimates are often used to help determine populations of wildlife in certain communities, such as national parks.
- In social studies, estimates are used to determine populations of countries and distances between cities.
- When we go to stores, we often use rounding strategies to help estimate the total cost of our purchases.

Strategies for Estimating

Imagine a bag of marbles has fallen, scattering marbles all over the floor.



How would you estimate how many marbles were scattered on the floor?

Numbers can be estimated using a variety of strategies. Practice is required to get close estimates.

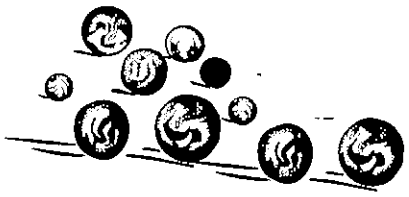
Observe and Guess

Look at a group of objects and guess.

For example, you may have guessed that about 70 marbles were scattered.

Group Objects

Group objects, count the number in a group and use that group to estimate the total number.



Here are 10 marbles

There looks to be about 7 or 8 groups of this size.
10 × 7 = **70 marbles** 10 × 8 = **80 marbles**

There are between 70 and 80 marbles.

Rounding

You can also use rounding to estimate numbers and to help you solve problems.

Example You want to buy the following 4 CDs. Approximately how much money will you need?

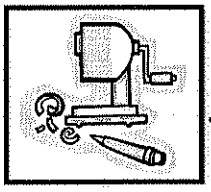
CD #1 is $16.47	round to $15.00
CD #2 is $14.80	round to $15.00
CD #3 is $15.09	round to $15.00
CD #4 is $18.99	round to $20.00
	approx. $65.00

The closer an estimate is to the actual answer, the better the estimate.

Think About ...

Discuss with your classmates situations when close estimates are important and when they are less important.

Think of times throughout the day, week or month that you use estimation rather than real values. For example, do you sometimes estimate time, distance or amounts?



Practice: Estimating

1. Jose's social studies class is going on a number of field trips to investigate municipal governments. The students will visit a different city each day. The following represents their travel schedule and times.

   Day 01 – St. Paul to Edmonton, 3 hours and 5 minutes.

   Day 02 – Edmonton to Red Deer, 1 hour and 45 minutes.

   Day 03 – Red Deer to Lethbridge, 3 hours and 35 minutes.

   Day 04 – Lethbridge to Medicine Hat, 1 hour and 10 minutes.

   Day 05 – Medicine Hat to St. Paul, 6 hours and 20 minutes.

   Estimate the amount of time that students will spend traveling.

2. Sheri took the following number of hours to read each of the five books listed below.

Novel	Number of Pages	Hours
Glow Girl	210	6 h
Careers and You	75	2 ½ h
Smiles and Tears	190	5 ½ h
The Stolen Car Mystery	300	8 h
Rex	52	2 h

   Estimate the number of hours each that Sheri will need to read *Cradle Song*, 67 pages, and *Nellie Mc Clung*, 270 pages.

3. You will need approximately 100 objects, such as toothpicks, drinking straws, buttons or similar sized objects for these activities.

   a. Pick up a handful of objects. Estimate the number of objects and then count them to find the actual number. Record your results below.

ESTIMATED number	**ACTUAL** number

   b. Pick up two handfuls of objects. Estimate the number of objects and then count them to find the actual number. Record your results below.

ESTIMATED number	**ACTUAL** number

   c. Try to pick up exactly 45 objects without counting.

   Record the actual number.

ACTUAL number

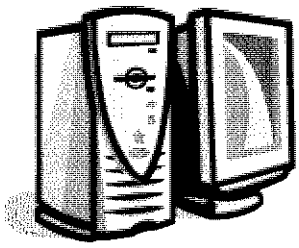
   d. Try to pick up exactly 60 objects without counting.

   Record the actual number.

ACTUAL number

4. Complete a variety of similar activities.
   Think about your accuracy and discuss this with classmates.

5. Use a computer to create a small shape. Create **100** copies of your shape scattered over the page. Be sure not to have any shapes overlapping.



Use an appropriate **tool** to create **circles or outlines** to help you estimate.

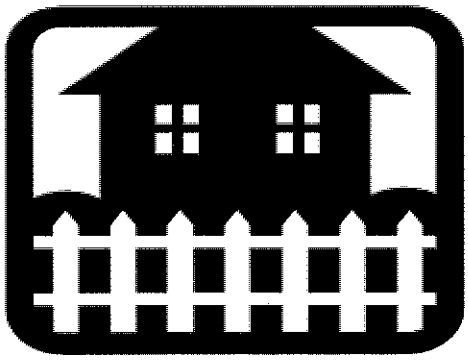
   a. Try to circle exactly **15 objects** without counting.

   b. Try to circle exactly **40 objects** without counting.

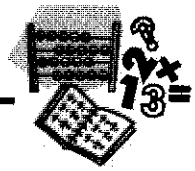
   c. Circle a number of objects and estimate the number you circled.

   d. With a partner, challenge each other to estimate a variety of quantities, and compare your estimate and accuracy.

6. With your teacher's approval, take a walk around the school or school yard and estimate a variety of distances or objects. For example, estimate:
   - the number of windows in the school
   - the number of fence posts around the school yard
   - the distance from school doors to the soccer field
   - the number of vehicles in the parking lot or on the street near the school.



Estimating Sums and Differences



We do not always need to find the exact answer to an addition or subtraction problem. Sometimes, a close approximation or estimate gives us enough information to help us make decisions.

When estimating, numbers are rounded to make calculations easier to work with. Estimating and rounding help with mental math.

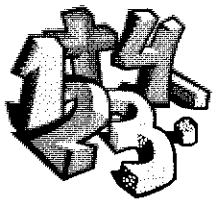
Estimates become **less accurate** as you round to **greater place values** (e.g., tens, hundreds, one thousands).

AND

Estimates become **more accurate** as you round to **lesser place values** (e.g., ones, tenths, hundredths).

Example While shopping for clothes, you pick out the following items:

$24 belt
$32 shirt
$68 jeans.



About how much money will these items cost?

Rounding to the nearest $5.00.

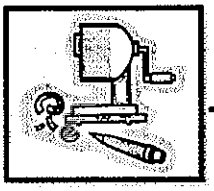
$24 belt.....rounds to..... $25.00
$32 shirt.....rounds to.....$30.00
$68 jeans....rounds to.....$70.00

25 + 30 + 70 = 125 The approximate cost of the belt, shirt and jeans is $125.00.

The **actual** amount of the three items is:

$24.99 belt
$33.95 shirt
+ $64.99 jeans
$123.93

The actual cost of the belt, shirt and jeans is $123.93.



Practice: Estimating Sums and Differences

1. Tony is interested in purchasing a car. He decides to use estimation to help develop a budget. Monthly car payments for Tony will be $296.45 and the cost of his insurance will be $145.89 per month.

If Tony can afford a maximum cost of $500 each month, estimate whether or not he has enough money to afford the car payments, insurance and other expenses.

Calculate the actual cost. How much over or under Tony's estimated budget is the actual cost?

2. Hal's grocery list includes the following items: milk ($2.97), eggs ($1.86), bread ($1.09), cheese ($5.99), luncheon meat ($1.03), apples ($3.51), celery ($3.49) and pickles ($4.32). Estimate the cost of Hal's grocery list.

   Hal has exactly $20.00 in his pocket. Does he have enough to purchase all the items on his list?