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Some Elementary Hints in Mathematics

M. S. M. Dahlan
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Representation of Numbers in a Place-Value Table

How to write a number in Standard Form and Expanded Form

<table>
<thead>
<tr>
<th>Thousands Zone</th>
<th>Ones (Units) Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>H  T  O</td>
<td>H  T  O</td>
</tr>
<tr>
<td>2  3  8</td>
<td>9  6  1</td>
</tr>
</tbody>
</table>

How to write a larger number

<table>
<thead>
<tr>
<th>Millions Zone</th>
<th>Thousands Zone</th>
<th>Ones Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>H  T  O</td>
<td>H  T  O</td>
<td>H  T  O</td>
</tr>
<tr>
<td>6  4  9</td>
<td>3  5</td>
<td>7  3  4</td>
</tr>
</tbody>
</table>

Word Name: Sixty-four million nine hundred and thirty-five thousand seven hundred and thirty four.

Standard Form: 64 935 734
Expanded Form: 60,000,000+4,000,000+900,000+30,000+5,000+700+30+4

Representation of Decimal Numbers

<table>
<thead>
<tr>
<th>Thousands</th>
<th>Hundreds</th>
<th>Tens</th>
<th>Ones</th>
<th>Tents</th>
<th>Hundredths</th>
<th>Thousandths</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
Standard Form: 2 192.167
Expanded Form: 2 000 + 100 + 90 + 2 + 0.1 + 0.06 + 0.007

Estimation of Decimal Numbers

Estimate: 3.78 + 5.97 round to the nearest whole number

\[ 3.78 + 5.97 \]
\[ \downarrow \quad \downarrow \]
\[ 4 + 6 = 10 \]

Estimate: 6.249 – 0.819

\[ 6.249 - 0.819 \]
\[ \downarrow \quad \downarrow \]
\[ 6 - 1 = 5 \]

Integers

All the integers can be written as a set of \{…-4, -3, -2, -1, 0, 1, 2, 3, 4…\}.

The \ldots, called ellipses, means that the set continues without end, following the same pattern.

The positive integers are often written without + sign. So +2 and 2 are the same. On the number line, 0, is considered the starting point with the positive numbers to the right and negative numbers to the left. Zero is neither negative nor positive.
The arrows show that the numbers continue without end. -4 is read "negative 4" and +2 is read "positive 2". To graph an integer, you locate the number and draw as a dot at that point on the line. Letters are sometimes used to name points on a number line. The integers that correspond to the letter is called the ordinates of that particular point.

Example: Graph points A, B, C and D on a number line. Their corresponding ordinates are 8, -3, -7 and 3 respectively.

Adding integers with same sign:

The sum of two positive integers is positive
The sum of two negative integers is negative

Example: i) 3 + 2 = 5  ii) (-6) + (-2) = (-8)

Representing the above two examples on a number line
Subtracting integers

The opposite of an integer is called its additive inverse.

Example: If a number is 6, its additive inverse is (-6).
If a number is -7 its additive inverse is +7.

Property of integers and additive inverse:

The sum of an integer and its additive inverse is 0.

<table>
<thead>
<tr>
<th>Arithmetic</th>
<th>Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 + (-6) = 0</td>
<td>X + (-X) = 0</td>
</tr>
</tbody>
</table>

Some Pattern of Properties

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7 x 2</td>
<td>1 x 3.5</td>
<td>1 x 0.004</td>
</tr>
<tr>
<td>14</td>
<td>3.5</td>
<td>0.004</td>
</tr>
<tr>
<td>7 x 20</td>
<td>10 x 3.5</td>
<td>10 x 0.004</td>
</tr>
<tr>
<td>140</td>
<td>35</td>
<td>0.04</td>
</tr>
<tr>
<td>7 x 200</td>
<td>100 x 3.5</td>
<td>100 x 0.004</td>
</tr>
<tr>
<td>1400</td>
<td>350</td>
<td>0.4</td>
</tr>
<tr>
<td>7 x 2000</td>
<td>1000 x 3.5</td>
<td>1000 x 0.004</td>
</tr>
<tr>
<td>14000</td>
<td>3500</td>
<td>4</td>
</tr>
</tbody>
</table>

Some Properties of Addition

Commutative property of addition: The order of Addends does not change the sum.

3 + 4 = 4 + 3

Associative Property of addition: The ways the Addends are grouped does not change the sum.

(2 + 1) + 5 = 2 + (1 + 5)
Identity Property: The sum of any number and zero equals the number.
\[ 5 + 0 = 5 \text{ and } 0 + 5 = 5 \]

Example: Solve \(12 + (48 + 8)\)

\[
12 + (48 + 8) = 12 + (8 + 48)
\]

Commutative Prop. \(= (12 + 8) + 48\)

Associative Prop. \(= 20 + 48\)

\(= 68\)

Some Properties of Multiplication

Commutative Property of Multiplication

The order of the factors does not change the Product
\[ 6 \times 8 = 8 \times 6 \]

Associative Property of Multiplication

The way the factors are grouped does not change the product
\[ 5 \times (8 \times 7) = (5 \times 8) \times 7 \]

Zero Property of Multiplication

The product of any factor and zero equals zero. \(49 \times 0 = 0\)
Hindu Lattice Multiplication

In the 12th century, mathematicians in India used a lattice method to multiply. This is the lattice method for $5 \times 876 = 4380$.

Step 1. Place the factors outside the grid

$$
\begin{array}{ccc}
8 & 7 & 6 \\
5 & & \\
\end{array}
$$

Step 2. Find the products of $5 \times 8$, $5 \times 7$, $5 \times 6$

$$
\begin{array}{ccc}
8 & 7 & 6 \\
5 & 0 & 5 & 0 \\
4 & 3 & 3 & \\
\end{array}
$$

Step 3. Write the sum of the diagonals. Start from right.

$$
\begin{array}{ccc}
8 & 7 & 6 \\
5 & 0 & 5 & 0 \\
4 & 3 & 3 & 0 \\
4 & 3 & 8 & \\
\end{array}
$$

Therefore the answer is 4380

Solve: $342 \times 25$

$$
\begin{array}{ccc}
3 & 4 & 2 \\
5 & & \\
2 & & \\
\end{array}
$$

$731 \times 36$

$$
\begin{array}{ccc}
7 & 3 & 1 \\
6 & & \\
3 & & \\
\end{array}
$$
**Division**

47 divided by 3 = 47/3

The answer of 47/3 is 15 R 2

Therefore the dividend = quotient x divisor + remainder

**Squaring of Larger Numbers when the Unit Place values are 5**

Example 1: 25 x 25

Step 1: Multiply the unit place number of the multiplicand by the unit place number of the multiplier. That is 5 x 5 = 25

Step 2: Multiply the unit place number of the multiplicand by the next consecutive number that occurs after the tenth place number of the multiplicand. That is 2 x 3 = 6. Therefore the answer is 25 x 25 = 625

Example 2 65 x 65

Therefore the answer is 4225
Example 3  \[ 125 \times 125 \quad 5 \times 5 = 25 \quad 12 \times 13 = 156 \]
Therefore the answer is 15625

**Classification of Triangles**

What is a triangle? A triangle is a 3-sided closed plane figure bounded by straight lines.

**Classification of triangles by the lengths of the sides**

- **Equilateral triangle**: All 3 sides the same length
- **Isosceles triangle**: 2 sides the same length
- **Scalene triangle**: No sides the same length

**Identification of triangles by the kind of angles**

- **Right-angled triangle**: 1 right angle
- **Acute-angled triangle**: 3 acute angles
- **Obtuse-angled triangle**: 1 obtuse angle
Classification of Quadrilaterals

Quadrilaterals: a four sided closed plane figure bounded by straight lines.

- **Square**
  - 4 right angles
  - 4 equal sides in length

- **Rectangle**
  - 4 right angles
  - Opposite side equal in length

- **Parallelogram**
  - Opposite side equal in length
  - Opposite sides parallel

- **Rhombus**
  - All sides equal in length
  - Opposite sides parallel

- **Trapezium (Trapezoid)**
  - Only one pair of parallel sides

- **Kite**
  - 2 pairs of equal adjacent sides
Application of BODMAS sequence in mathematical calculation

To accurately solve mathematical problems with multiple operations a specific sequence is being followed. This process is called BODMAS sequence.

| B  | Bracket       |
| O  | Of            |
| D  | Division      |
| M  | Multiplication|
| A  | Addition      |
| S  | Subtraction   |

Example: solve 3 x 60/4 + 1/3 of (25 - 10) - 5

Step 1: do the operations given within the brackets

\[ 3 \times \frac{60}{4} + \frac{1}{3} \text{ of } (25 - 10) - 5 \]

Step 2: do the operation containing ‘of’ \( 3 \times \frac{60}{4} + \frac{1}{3} \text{ of } 15 \) - 5

Step 3: do the division \( 3 \times \frac{60}{4} + 5 - 5 \)

Step 4: do the multiplication \( 3 \times 15 + 5 - 5 \)
Step 5: do the addition \[ 45 + 5 - 5 \] Step 5

Step 6: do the subtractions \[ 50 - 5 \] Step 6

Therefore the answer is 45

**Powers and Exponents**

<table>
<thead>
<tr>
<th>Generation</th>
<th>family tree</th>
<th>number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>P</td>
<td>1</td>
</tr>
<tr>
<td>Parents</td>
<td>FM</td>
<td>1 \times 2 = 2</td>
</tr>
<tr>
<td>Grand parents</td>
<td>FM FM</td>
<td>2 \times 2 = 4</td>
</tr>
<tr>
<td>Great-grand parents</td>
<td>FM FM FM FM</td>
<td>2 \times 2 \times 2 = 8</td>
</tr>
<tr>
<td>Great-great-grand Parents</td>
<td>FM FM FM FM</td>
<td>?</td>
</tr>
</tbody>
</table>

Study the pattern in the number column of the table. What is the next value would be? When two or more numbers are multiplied, these numbers are called factors of the product. When the same factor is repeated, you may use an exponent to simplify the notation.

\[ 16 = 2 \times 2 \times 2 \times 2 \rightarrow 2^4 \] four is the exponent

An expression like \( 2^4 \) is called a power and is read; 2 to the power 4 or '2 to the fourth power'. The 2 in this expression is the base.

Powers are often used to write a product in a shorter form.

Example: \[ 3 \times 4 \times 4 \times 3 \times 4 \times 3 \times 3 = 4^3 \times 3^4 \]
Variables and Expressions

In mathematics we also use substitution. Let us consider the numerical expression 5 + 6. It has a value of 11. However, the expression x + 4 does not have a value until a value for x is given. But when you substitute the value x = 10 or put 10 in place of x in the expression, it becomes 10 + 4, which is equal to 14.

In order to evaluate, or find the value of a numerical expression, we need to follow an order of operations. That is you need to know which operation to do first when there is more than one operation in the expression.

<table>
<thead>
<tr>
<th>Order of operations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do all operations within grouping symbols first; start with innermost grouping symbols.</td>
</tr>
<tr>
<td>2. Do all powers before other operations.</td>
</tr>
<tr>
<td>3. Next, do all multiplications and division in order from left to right</td>
</tr>
<tr>
<td>4. Then do all addition and subtraction.</td>
</tr>
</tbody>
</table>

Example: evaluate \((4 + 8) / 3 \times 5 + (2^2 + 7)\)

You may have to follow the order of operations to do this step. Do operations in the parentheses first.

\[
(4 \times 8)/3 \times 5 + (2^2 + 7) = 12/3 \times 5 + 11 = 4 \times 5 + 11 = 20 + 11 = 31
\]
Algebra is a language of symbols. In algebra, we use letters, called variables to represent unknown quantities. In the expression \( x + 4 \), \( x \) is a variable. Expressions that contain variables are called algebraic expressions.

In order to evaluate algebraic expressions, you must know how to read expressions.

\[
\begin{align*}
3a & \quad \text{means} \quad 3 \times a \\
ab & \quad \text{means} \quad a \times b \\
5x2y & \quad \text{means} \quad 5 \times 2 \times x \times y \\
a[b(cd)] & \quad \text{means} \quad a \times (b \times c \times d) \\
t/3b & \quad \text{means} \quad t/(3 \times b)
\end{align*}
\]

Substitution

Algebraic Expressions: Expressions involving algebraic symbols.

\[
\begin{align*}
2x + 3 & \quad \text{an expression with one variable.} \\
5x + 2y + 1 & \quad \text{an expression with two variables.}
\end{align*}
\]

Solving expressions with one variable

Example: find the value of \( 2x + 1 \), when \( x = 3 \)
Substitute the numerical values 3 for the algebraic symbol \( x \) or variable.

\[
\begin{align*}
2x + 1 &= 2 \times 3 + 1 \\
&= 6 + 1 \\
&= 7
\end{align*}
\]
Solving expressions in two variables

Example: find the value of $3a - 2b$, when $a = 5$ and $b = 3$
Let us substitute the values of $a$ and $b$
Then $3a - 2b = 3 \times 5 - 2 \times 3$
$$= 15 - 6$$
$$= 9$$

Substitution related to equations

Example: in the equation $y = 6m - 2$ find the value of $y$
when $m = \frac{1}{2}$. Let us substitute the value $m = 1/2$ in the equation
Then $y = 6m - 2$
$$= 6 \times \frac{1}{2} - 2$$
$$= 3 - 2$$
$$= 1$$

Example: Evaluate $x + y - 4$ if $x = 5$ and $y = 3$
First replace each variable in the expression with its value.
Then use the order of operations.
$$x + y - 4 = 5 + 3 - 4$$
$$= 8 - 4$$
$$= 4$$

Example: Evaluate $2a + 3b$ if $a = 4$ and $b = 12$
$$2a + 3b = 2(4) + 3(12)$$
$$= 8 + 36$$
$$= 44$$

Example: Evaluate $b^2 / 3a$ if $b = 6$ and $a = 3$
The bar, which means division, is also a grouping symbol.
Evaluate the expressions in the numerator and denominator separately before dividing.
Equations

A situation that can be represented by a mathematical sentence with an equal sign is called an equation.

Equation 50 - 30 = y
The value that makes sentence (statement) true is called the solution of that equation. In the above equation 50 - 30 = y, 20 is the solution of that equation. The process of finding the solution is called solving the equation.

Some equations do not have the variable alone on one side of the equal sign. For example, let us look at the equation 45 + a = 64

Try 19 for value of a
Then you get 45 + 19 = 64
    64 = 64 true

Addition Property of Equality:
If you add the same number to each side of an equation, then the sides remain equal.

<table>
<thead>
<tr>
<th>Arithmetic</th>
<th>Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 = 5</td>
<td>a = b</td>
</tr>
<tr>
<td>5 + 2 = 5 + 2</td>
<td>a + c = b + c</td>
</tr>
<tr>
<td>7 = 7</td>
<td></td>
</tr>
</tbody>
</table>
Subtraction Property of Equality:

If you subtract the same number from each side of an equation, then the sides remain equal.

<table>
<thead>
<tr>
<th>Arithmetic</th>
<th>Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 = 5</td>
<td>a = b</td>
</tr>
<tr>
<td>5 - 2 = 5 - 2</td>
<td>a - c = b - c</td>
</tr>
<tr>
<td>3 = 3</td>
<td></td>
</tr>
</tbody>
</table>

Examples:

1. solve \( y - 34 = 15 \)
   \[
   y - 34 + 34 = 15 + 34 \\
   y = 49
   \]

2. solve \( p + 17 = 48 \)
   \[
   p + 17 - 17 = 48 - 17 \\
   p = 31
   \]

Solving statement problems

Kanthi is thinking of a number. She divides her number by 4 and subtract 6. The result is 3. What number is Kanthi thinking of?

Let us think → divided by 4 → subtract 6 → result is 3. Kanthi's number as \( y \)

Now let us write the equation:

\[
\frac{y}{4} - 6 = 3 \\
\frac{y}{4} - 6 + 6 = 3 + 6 \\
\frac{y}{4} = 9 \\
4 \times \frac{y}{4} = 9 \times 4 \\
y = 36
\]
Writing Expressions and Equations

<table>
<thead>
<tr>
<th>Verbal Phrase</th>
<th>Algebraic Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 more than a number</td>
<td>n + 8</td>
</tr>
<tr>
<td>A number decreased by 10</td>
<td>m − 10</td>
</tr>
<tr>
<td>The sum of twice a number and four</td>
<td>2y + 4</td>
</tr>
<tr>
<td>A number divided into 5 groups</td>
<td>m / 5</td>
</tr>
</tbody>
</table>

Verbal statements may be translated into equations. The equations can often be used to solve a problem.

<table>
<thead>
<tr>
<th>Verbal Statement</th>
<th>Algebraic Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three is five more than a number</td>
<td>3 = a + 5</td>
</tr>
<tr>
<td>Four times a number is one hundred</td>
<td>4n = 100</td>
</tr>
</tbody>
</table>

Example:

Ravi has Rs.5 more than the twice the amount Kapila has. Ravi has Rs.15. Write an equation to represent this problem.

Let y = the amount Kapila has

Twice the amount Kapila has → 2y
Rs.5 more than that → 2y + 5
Ravi’s amount, Rs.15, equal this → 2y + 5 = 15

How to find the value of y

\[
\begin{align*}
2y + 5 &= 15 & \text{equation} \\
2y + 5 - 5 &= 15 - 5 & \text{subtract 5 from each side} \\
2y &= 10 & \\
y &= 5 & \text{divide each side by 2}
\end{align*}
\]
Prime Factorization

In mathematics, we use factoring to separate a number into smaller parts. The basic elements of a number are its factors. When a whole number greater than 1 has exactly two factors, 1 and itself, it is called a prime number. For example, 5 is a prime number since it has two factors, 1 and 5.

Any whole number, except 0 and 1, that is not prime can be written as a product of prime numbers. When a whole number greater than 1 has more than two factors, it is called a composite number. For example 6 is a composite number since it has four factors, 1, 2, 3 and 6.

The numbers 0 and 1 are neither prime nor composite. Notice that 0 has an endless number of factors and that 1 has only one factor, itself.

To find the prime factors of any composite numbers begin by expressing number as a product of two factors. Then continue to factorize until all the factors are prime. When a number is expressed as a product of factors that are all prime, The expression is called the prime factorization of the number.

Example:  
\[84 = 2 \times 2 \times 3 \times 7\]
\[90 = 2 \times 3 \times 3 \times 5\]

The diagrams below each show a different way to find the prime factorization of 24. These diagrams are called factor trees.
Every number has a unique set of prime factors. Notice that the bottom row of "branches" in each factor tree is the same except for the order in which the factors are written.

**Greatest Common Factor**

The greatest of the factors common to two numbers is called the greatest common factor (GCF) of the numbers. You can use prime factorization to find the GCF. Consider the prime factorization of 84 and 90 below.

The integers 84 and 90 have 2 and 3 as common factors. The product of these prime factors, 2 x 3 or 6 is the GCF of 84 and 90.

**Example:** Use prime factorization to find the GCF of 84, 126 and 210.
Write each number as a product of prime factors.
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84 = 2 x 2 x 3 x 7
126 = 2 x 3 x 3 x 7
210 = 2 x 3 x 5 x 7 the common factors 2, 3, and 7
Thus, the GCF is 2 x 3 x 7 or 42.

Least Common Multiple (LCM)

The least of the common multiple of two or more numbers is called the least common multiple (LCM)

Example: Find the LCM of 2, 4 and 6
Method 1: Multiples of 2 = 0, 2, 4, 6, 8, 10, 12 ..........
Multiples of 4 = 0, 4, 8, 12, 16, 20, ........
Multiples of 6 = 0, 6, 12, 18, 24, 30, ........
Common multiples are 12, 24, 36, 48, .........
Therefore LCM is 12
Method 2: Prime factorization can be used to find the LCM of a set of numbers.
A common multiple contains all the factors of each number in the set. The LCM contains each factor the greatest number of times it appears in the set.

\[
\begin{align*}
2 &= 2 \times 1 \\
4 &= 2 \times 2 \\
6 &= 2 \times 3
\end{align*}
\]

\[
\begin{align*}
21 &= 3 \times 7 \\
25 &= 5 \times 5 \\
9 &= 3 \times 3
\end{align*}
\]

\[
\begin{align*}
The greatest power of 3 is 3^2 & \\
The greatest power of 5 is 5^2 & \\
The greatest power of 7 is 7^1
\end{align*}
\]
Therefore the LCM of 21, 25, 9 is $3^2 \times 5^2 \times 7^1 = 1575$

Method 3: find the LCM of 6, 8, and 12

\[
\begin{array}{c|ccc}
2 & 6, 8, 12 \\
2 & 3, 4, 6 \\
3 & 3, 2, 3 \\
2 & 1, 2, 1 \\
1, 1, 1 \\
\end{array}
\]

Go on dividing the set of numbers by prime factors

Then you get $2 \times 2 \times 2 \times 3$

Therefore the LCM is 24

**Perimeter and Area**

The perimeter of a geometric plane figure is the sum of the measures of all sides. To find the perimeter of the rectangular piece of glass you can add up the length of all the sides or you can use an equation. The equation for the perimeter of any rectangle is $P = 2a + 2b$ where 'a' represents the length and 'b' represents the width.

Example: 11 cm

\[
\begin{array}{c|c}
4 & P = 2a + 2b \\
\hline
11 & = 2(11) + 2(4) \\
\hline
\end{array}
\]

\[
\begin{array}{c|c}
\hline
\end{array}
\]

\[
\begin{array}{c|c}
\hline
\end{array}
\]

\[
\begin{array}{c|c}
\hline
\end{array}
\]

\[
\begin{array}{c|c}
\hline
\end{array}
\]

A square is a special rectangle in which the lengths of all sides are equal. The values for $a$ and $b$ in the perimeter equation are the same number. For this reason, the perimeter equation for a square is often written as $P = 4s$, where 's' is the length of a side.
Squares and rectangles are special types of parallelograms. Each pair of opposite sides of a parallelogram are parallel and have the same length.

To find the perimeter of a parallelogram, you add the length of the sides.

Example:

\[ P = 2a + 2b \]
\[ = 2(7) + 2(6) \]
\[ = 14 + 12 \]
\[ = 26\text{cm}. \]

To find the perimeter of a triangle, you add the length of all 3 sides.

Example:

\[ P = 8 + 9 + 6 = 23\text{cm} \]
The area of a geometric plane figure is the measure of the surface enclosed by the figure. The area of any rectangle can be found by multiplying the length and width.

- **Rectangle**: $A = ab$
- **Square**: $A = x^2$
- **Parallelogram**: $A = bh$
- **Trapezium**: $A = \frac{1}{2}(a + b).h$

**Use of Venn Diagrams to Solve Problems.**

Example: There are 27 students in a class. 14 of them are members of the Tennis Club, 7 are members of the Basketball Club. 3 of them are members of both the Tennis Club and Basketball Club. How many students are not in either Club.

To solve the above problem you can use a Venn Diagram to show the above information as follows.
Add to find the number of students in either Clubs or in both Clubs. \(4 + 3 + 11 = 18\)

subtract to find the total number of students who are not in either Club. \(27 - 18 = 9\)

Now try this problem

Number of students passed in Maths, Science, and English is represented in the above Venn Diagram. Find the following data by using the above diagram.
Some Elementary Hints in Mathematics

1. Number of students passed in Maths?
2. Number of students passed in all 3 subjects?
3. Numbers of students passed in Maths and English?
4. Number of students passed in Science and Maths only?

Main Representational Values in Statistics

Example: Grade nine students were asked how many times they have eaten ice-cream last week.
the results were 3, 0, 1, 1, 5, 2, 0, 1, 8
Write the numbers in order from the least to the greatest.

0, 0, 1, 1, 1, 2, 3, 5, 8
the Range is the difference between the greatest and the least number.

8 - 0 = 8

the Mode is the number that occurs most often.
Therefore the mode is 1

The Median is the middle number, if they are arranged in ascending (increasing) or descending (decreasing) order. Since the data has a nine numbers the middle number is the fifth one. Therefore the median also one here.

0, 0, 1, 1, 2, 3, 5, 8

if there are two middle numbers in a group of data to find the median of

0, 1, 2, 3, 5, 6, 7, 7, 8, 9 add the two middle numbers and divide the number by 2.
Hence $5 + 6 = 11$ \[11 / 2 = 5.5\] therefore the median is 5.5

**Mean**: the sum of data divided by the number of data. When we consider the above example the mean = 
\[(0+1+2+3+5+6+7+7+8+9)\] divided by 10 \(=48 / 10\) Hence the answer is 4.8

**Representation of Data in a Frequency Table**

These are often used in statistics. Statistics is a branch of mathematics that deals with collecting, organizing and analyzing data.

One type of table used in statistics is a **frequency table**. A frequency table tells how many times each piece of data occurs in a set of information.

The table below shows the result of a survey done by a sports club regarding some games:

<table>
<thead>
<tr>
<th>Game</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soccer</td>
<td><img src="soccer_tally" alt="Tally" /></td>
<td>21</td>
</tr>
<tr>
<td>Hockey</td>
<td><img src="hockey_tally" alt="Tally" /></td>
<td>22</td>
</tr>
<tr>
<td>Cricket</td>
<td><img src="cricket_tally" alt="Tally" /></td>
<td>18</td>
</tr>
<tr>
<td>Tennis</td>
<td><img src="tennis_tally" alt="Tally" /></td>
<td>19</td>
</tr>
</tbody>
</table>

When statisticians study the data and make conclusions from the numbers they are observing, we call it **data analysis**. Some times when there is a wide range of data, statisticians will group the data into intervals.
In a large set of data, such as exam results, it is helpful to separate the data into four equal parts called **quartiles**.

**Interquartile Range:**

The inter quartile range is the range of the middle half of data.
Example:
Step 1. Find the median of the data since the median separate the data into halves.

3, 3, 5, 6, 6, 7, 10, 10, 12, 12, 14, 16, 17, 20

\[
\text{Median} \downarrow
\]

Step 2. Find the median of the upper half. This number is called **Upper Quartile**, indicated by UQ.

Step 3. Find the median of the lower half. This number is called the **Lower Quartile**, indicated by LQ.

\[
\text{LQ} \downarrow \text{median} \downarrow \text{UQ}
\]

Therefore the interquartile Range = UQ - LQ = 14 - 6 = 8

According to the above data the interquartile Range is 8.
Construction of Bar Graphs

In a bar graph the data are represented in the form of bars.

Horizontal Axis represents the languages chosen
Vertical Axis represents the number of students

Use the above graph to answer the following questions.

1. What language is mostly spoken by the six graders?
2. How many students have chosen French?
3. How many students have chosen Russian?
4. How many students are in grade six?
5. What is the difference between the number of students who have chosen English and the number of students who have chosen German?
The Metric System

The metric system was created by a French scientist in the late 18th century as a standard Measurement. The United State is the only large nation of the world that does not commonly use this system. the Metric system is a decimal system, that means it is based on 10.

The standard unit of length in the Metric system is the meter (m). the standard of capacity is the liter (L) and the standard unit of mass is the gram (g).

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilo-</td>
<td>k</td>
<td>1000</td>
<td>1km = 1000m</td>
</tr>
<tr>
<td>hecto-</td>
<td>h</td>
<td>100</td>
<td>1hL = 100L</td>
</tr>
<tr>
<td>deca-</td>
<td>da</td>
<td>10</td>
<td>1dag = 10g</td>
</tr>
<tr>
<td>deci-</td>
<td>d</td>
<td>0.1</td>
<td>1dg = 0.1g</td>
</tr>
<tr>
<td>centi-</td>
<td>c</td>
<td>0.01</td>
<td>1cm = 0.01m</td>
</tr>
<tr>
<td>milli-</td>
<td>m</td>
<td>0.001</td>
<td>1mL = 0.001L</td>
</tr>
</tbody>
</table>
The diagram below shows how you change one unit to another by multiplying or by dividing.

- kilo (km) \( \times 10 \) hecto- (hm) \( \times 10 \) deka- (dam) \( \times 10 \) meter (m) \( \times 10 \) deci- (dm) \( \times 10 \) centi (cm) \( \times 10 \) milli (mm)

- divided by 10 divided by 10 divided by 10 divided by 10 divided by 10 divided by 10
Relationship between units of measurement in the metric system

When you multiply by 10, 100 and 1000 you can determine the answer by moving the decimal point right as many places as there are zeros in the multiplier.

\[ 100 \times 6.54 = 654. = 654 \]
\[ 1000 \times 6.54 = 6540. = 6540 \]

When you divide by 10, 100, and 1000 you move the decimal point left as many places as you have zeros in the divisor.

\[ 78 / 1 = 78 \]
\[ 78 / 10 = 7.8 = 7.8 \]
\[ 78 / 100 = 0.78 = 0.78 \]
\[ 78 / 1000 = 0.078 = 0.078 \]
<table>
<thead>
<tr>
<th>English Term</th>
<th>Sinhala Term</th>
<th>English Term</th>
<th>Sinhala Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute</td>
<td>විශ්ලේෂණය</td>
<td>Base</td>
<td>මලිනය/පිහිටයේය</td>
</tr>
<tr>
<td>Adjacent</td>
<td>හොඳය</td>
<td>Basis</td>
<td>මලිනය</td>
</tr>
<tr>
<td>Addition</td>
<td>අන්තර්ගතාව</td>
<td>Basic</td>
<td>මලිනය</td>
</tr>
<tr>
<td>Adjustment</td>
<td>අදායමය</td>
<td>Bearing</td>
<td>ගිස් කොටස්</td>
</tr>
<tr>
<td>Additive Bond</td>
<td>කොටස් කොටස්</td>
<td>Bisector</td>
<td>පුළුවල් කොටස්</td>
</tr>
<tr>
<td>Additive Inverse</td>
<td>කොටස් කොටස්</td>
<td>Bisection</td>
<td>පුළුවල් කොටස්</td>
</tr>
<tr>
<td>Algebraic</td>
<td>අලගබාලිය</td>
<td>Binary</td>
<td>නුවත්ලනය</td>
</tr>
<tr>
<td>Algebraic Expression</td>
<td>අලගබාලිය කොටස්</td>
<td>Bilateral</td>
<td>නුවත්ලනය</td>
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<tr>
<td>Algebraic Function</td>
<td>අලගබාලිය කොටස්</td>
<td>Bar Graph</td>
<td>නුවත්ලනය</td>
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<tr>
<td>Allied Angles</td>
<td>අලගබාලිය කොටස්</td>
<td>Binomial</td>
<td>නුවත්ලනය</td>
</tr>
<tr>
<td>Alternate Angle</td>
<td>අලගබාලිය කොටස්</td>
<td>Capacity</td>
<td>නුවත්ලනය</td>
</tr>
<tr>
<td>Altitude</td>
<td>කොටස් කොටස්</td>
<td>Circle</td>
<td>නුවත්ලනය</td>
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<tr>
<td>Angle of Depression</td>
<td>අලගබාලිය කොටස්</td>
<td>Circumference</td>
<td>නුවත්ලනය</td>
</tr>
<tr>
<td>Angle of Elevation</td>
<td>අලගබාලිය කොටස්</td>
<td>Corresponding Angle</td>
<td>නුවත්ලනය</td>
</tr>
<tr>
<td>Anti-clockwise (Counter Clockwise)</td>
<td>අලගබාලිය කොටස්</td>
<td>Congruent</td>
<td>නුවත්ලනය</td>
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<td>Approximate</td>
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<td>Curve</td>
<td>නුවත්ලනය</td>
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<tr>
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<td>Curvature</td>
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<tr>
<td>Axis</td>
<td>කොටස් කොටස්</td>
<td>Chord</td>
<td>නුවත්ලනය</td>
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<tr>
<td>Axis of Symmetry</td>
<td>අලගබාලිය කොටස්</td>
<td>Component</td>
<td>නුවත්ලනය</td>
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<tr>
<td>Axis of Rotation</td>
<td>කොටස් කොටස්</td>
<td>Composite</td>
<td>නුවත්ලනය</td>
</tr>
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<td>අලගබාලිය කොටස්</td>
<td>Co-ordinate</td>
<td>නුවත්ලනය</td>
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<tr>
<td>Arithmetic Progression</td>
<td>කොටස් කොටස්</td>
<td>Concave</td>
<td>අගමොත්කම්</td>
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<tr>
<td>Arms of an Angle</td>
<td>කොටස් කොටස්</td>
<td>Convex</td>
<td>අගමොත්කම්</td>
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<tr>
<td>English Word</td>
<td>Sinhala Word</td>
<td>English Word</td>
<td>Sinhala Word</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------</td>
<td>------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Complex</td>
<td>දැක්විණාසියාව</td>
<td>Equal</td>
<td>පැවතියේයි</td>
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<td>Sinhala Word</td>
<td>English Word</td>
<td>Sinhala Word</td>
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<tr>
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<td>--------------</td>
<td>---------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Height</td>
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<td>Lamina</td>
<td>කොටස්</td>
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<td>Hemisphere</td>
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<td>Linear</td>
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<td>Hexagon</td>
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<td>Least Common Multiple</td>
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<td>Line</td>
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<td>Integers</td>
<td>වැලිය</td>
<td>Mean</td>
<td>වැලිය</td>
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<td>Infinity</td>
<td>වැලිය</td>
<td>Median</td>
<td>වැලිය</td>
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<td>Intersection</td>
<td>වැලිය</td>
<td>Mode</td>
<td>වැලිය</td>
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<tr>
<td>Inverse</td>
<td>වැලිය</td>
<td>Maximum</td>
<td>වැලිය</td>
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<td>Inequality</td>
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<td>Minimum</td>
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<tr>
<td>Irrational Numbers</td>
<td>වැලිය</td>
<td>Monomial</td>
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<tr>
<td>Isosceles Triangle</td>
<td>වැලිය</td>
<td>Multiple</td>
<td>වැලිය</td>
</tr>
<tr>
<td>Improper Fraction</td>
<td>වැලිය</td>
<td>Matrix</td>
<td>වැලිය</td>
</tr>
<tr>
<td>Interior Angle</td>
<td>වැලිය</td>
<td>Magnitude</td>
<td>වැලිය</td>
</tr>
<tr>
<td>Intercept</td>
<td>වැලිය</td>
<td>Numerator</td>
<td>වැලිය</td>
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<td>Interest</td>
<td>වැලිය</td>
<td>Numerical</td>
<td>වැලිය</td>
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<tr>
<td>Intermediate</td>
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<td>Negative</td>
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<tr>
<td>Inter - Quartile Range</td>
<td>වැලිය</td>
<td>Notation</td>
<td>වැලිය</td>
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<td>Irregular</td>
<td>වැලිය</td>
<td>Nomenclature</td>
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<td>වැලිය</td>
<td>Gradient</td>
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<td>English Word</td>
<td>Sinhala Word</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Octagon</td>
<td>ඔක්තොගන්</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opposite Angle</td>
<td>ඔපප්පිස්ට්ඝ වූදා</td>
<td></td>
<td></td>
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<tr>
<td>Ordered Pair</td>
<td>ඔර්ද්ද දූල වූදා</td>
<td></td>
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</tr>
<tr>
<td>Origin</td>
<td>ඔොරින්</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtuse Angle</td>
<td>ඔබොටස් ආංග්ගලය</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtuse Angled Triangle</td>
<td>ඔබොටස් ගල්ලාංගලය ආංග්ංගලය</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Octahedron</td>
<td>ඔක්තොහෝඩාන්</td>
<td></td>
<td></td>
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<tr>
<td>Odd Numbers</td>
<td>ඔජංග්ගලය</td>
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<tr>
<td>Parallel</td>
<td>මුලිකය</td>
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<td>Parallelogram</td>
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<td></td>
<td></td>
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<td>Percentage</td>
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<td></td>
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<tr>
<td>Perfect</td>
<td>ඉප්පෝජය</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentagon</td>
<td>දොන්ජය</td>
<td></td>
<td></td>
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<tr>
<td>Perimeter</td>
<td>විකල්පය</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perpendicular</td>
<td>විකල්පය</td>
<td></td>
<td></td>
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<tr>
<td>Pictogram</td>
<td>පිටකම් ආකාරය</td>
<td></td>
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<td>Probability</td>
<td>වියඟාහාය</td>
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<tr>
<td>Product</td>
<td>ආකාරය</td>
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**SOLIDS**

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Mr. M.S.M. Dahlan
Mr. M.S.M. Dahlan is a veteran teacher in mathematics who has almost 35-year experience in teaching mathematics in government schools. And also he has taught in an atoll school in the Republic of Maldives for two years.

Mr. Dahlan has served as a Project Officer attached to the Matara District Educational Development Project (MEDP) funded by SIDA, from 1993 to 1995.

He has served in the Subject Specialist Panel of the Text Books Evaluation Committee of the Educational Publication Department, Isurupaya, Battaramulla. In addition to that he was a resource person attached to the Bilingual Education Programme of the National Institute of Maharagama.

He retired from government service in 2008 after a commendable service at St. Thomas’ College Matara for over fifteen years and presently attached to the Academic Staff of Ceylinco-Sussex College, Matara.