### WEEKS LEARNING AREA

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<th>Weeks</th>
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<td>Number Bases</td>
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### LEARNING OBJECTIVES

**Number Bases**

Students will be taught to:

1. Understand and use the concept of number in base two, eight and five.

### LEARNING OUTCOMES

Students will be able to:

1. **State zero, one, two, three, ..., as a number in base:**
   - a) two
   - b) eight
   - c) five

2. **State the value of a digit of a number in base:**
   - a) two
   - b) eight
   - c) five

3. **Write a number in base:**
   - a) two
   - b) eight
   - c) five
   in expanded notation.

### SUGGESTED TEACHING & LEARNING ACTIVITIES

Use models such as a clock face or a counter which uses a particular number base. Number base blocks of twos, eights and fives can be used to demonstrate the value of a number in the respective number bases.

**For example:**

![Number Base Blocks](chart.png)

Discuss:
- digits used
- place values in the number system with a particular number base.

### GENERICS

<table>
<thead>
<tr>
<th>ICT</th>
<th>Conceptual</th>
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### CCTS

Cooperative learning

### MORAL VALUES

Systematic, Rational, Accurate

### POINTS TO NOTE / VOCABULARY

- Emphasise the ways to read numbers in various bases.
- Examples:
  - $101_2$ is read as “one zero one base two”
  - $7205_8$ is read as “seven two zero five base eight”
  - $4325_5$ is read as “four three two five base five”

- Numbers in base two are also known as binary numbers.
- Examples of numbers in expanded notation:
  - $10110_2 = 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$
  - $325_8 = 3 \times 8^2 + 2 \times 8^1 + 5 \times 8^0$
  - $3041_5 = 3 \times 5^3 + 0 \times 5^2 + 4 \times 5^1 + 1 \times 5^0$

- Expanded notation
## CHAPTER 1– NUMBER BASES

### LEARNING OBJECTIVES

**Students will be taught to:**

- iv) convert a number in base:
  - a) two
  - b) eight
  - c) five
  to a number in base ten and vice versa.
- v) convert a number in a certain base to a number in another base.

---

**Students will be able to:**

- (vi) Perform computations involving:
  - a) addition
  - b) subtraction
  of two numbers in base two

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### SUGGESTED TEACHING & LEARNING ACTIVITIES

Number base blocks of twos, eights and fives can also be used here. For example, to convert $10_{10}$ to a number in base two, use the concept of least number of blocks ($2^3$), tiles ($2^2$), rectangles ($2^1$) and squares ($2^0$).

In this case, the least number of objects needed here are one block, zero tiles, one rectangle and zero squares. So, $10_{10} = 1010_2$.

Discuss the special case of converting a number in base two directly to a number in base eight and vice versa. For example, convert a number in base two directly to a number in base eight through grouping of three consecutive digits.

Perform repeated division to convert a number in base ten to a number in other bases. For example, convert $714_{10}$ to a number in base five:

\[
\begin{array}{c}
5)714 \\
\underline{5)142} \\
\underline{5) 28} \\
\underline{5) 5} \\
\underline{5) 1} \\
0--1
\end{array}
\]

\[\therefore 714_{10} = 10324_5\]

Limit conversion of numbers to base two, eight and five only.

---

### GENERICS

ICT
- Contextual learning
- Cooperative learning

**POINTS TO NOTE / VOCABULARY**

Perform repeated division to convert a number in base ten to a number in other bases. For example, convert $714_{10}$ to a number in base five:

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Limit conversion of numbers to base two, eight and five only.

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### POINTS TO NOTE / VOCABULARY

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\[\therefore 714_{10} = 10324_5\]

Limit conversion of numbers to base two, eight and five only.
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<td></td>
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<td>Students will be taught to:</td>
<td>Students will be able to:</td>
<td>Explore graphs of functions using graphing calculator or the Geometer’s Sketchpad.</td>
<td>Constructivism</td>
<td>Concept constructivism</td>
<td>Punctuality</td>
<td>Limit cubic functions to the following forms:</td>
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<tr>
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<td></td>
<td>2.1 Understand and use the concept of graphs of functions.</td>
<td>(i) Draw the graph of a ;</td>
<td>Compare the characteristics of graphs of functions with different values of constants. For example :</td>
<td>Mastery learning</td>
<td>Analysis</td>
<td>Awareness</td>
<td>$y = ax^3$</td>
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<td></td>
<td></td>
<td></td>
<td>a) linear function;</td>
<td>( y = ax + b ) (</td>
<td>y=bax + \frac{y}{a}</td>
<td>)</td>
<td>Self-access learning</td>
<td>Systematic</td>
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<td></td>
<td>where a and b are constants</td>
<td>( y=ax^2 + bx + c ) , where a, b and c are constants, a ( \neq 0 )</td>
<td></td>
<td>Analysing</td>
<td>Neatness</td>
<td>$y = ax^3 + bx + c )</td>
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<td>b) quadratic function;</td>
<td>( y=ax^3 + bx^2 + cx + d ) , where a,b,c and d are constants, a ( \neq 0 )</td>
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<td>Mental visualization</td>
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<td>where a is a ( \neq 0 ) constants,</td>
<td>( y= \frac{a}{x} ) (</td>
<td>y=bax + \frac{y}{a}</td>
<td>)</td>
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<td>Relationship</td>
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<td>c) cubic function :</td>
<td>( \neq 0 ) (</td>
<td>y=bax + \frac{y}{a}</td>
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<td></td>
<td>( y=ax^3 + bx^2 + cx + d ) ,</td>
<td>( y= \frac{a}{x} ) (</td>
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<td>d) reciprocal function :</td>
<td>( y=ax^3 + bx^2 + cx + d ) , where a,b,c and d are constants, a ( \neq 0 )</td>
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<td>( y=ax^3 + bx^2 + cx + d ) ,</td>
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<td>y=bax + \frac{y}{a}</td>
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<td></td>
<td>( y=ax^3 + bx^2 + cx + d ) ,</td>
<td>( y= \frac{a}{x} ) (</td>
<td>y=bax + \frac{y}{a}</td>
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</table>
iv) Sketch the graph of a given linear, quadratic, cubic or reciprocal function.

**Students will be taught to:**

2.2 Understand and use the concept of the solution of an equation by graphical methods.

**Students will be able to:**

i) Find the point(s) of intersection of two graphs.

(ii) Obtain the solution of an equation by finding the point(s) of intersection of two graphs.

(iii) Solve problems involving solution of an equation by graphical method.

Explore using graphing calculator or the Geometer’s Sketchpad to relate the x-coordinate of a point of intersection of two appropriate graph to the solution of a given equation. Make generalization about the point(s) of intersection of the two graphs.

- Self access learning
- Cooperative learning
- Constructivism

**SUGGESTED TEACHING & LEARNING ACTIVITIES**

- Exploring using graphing calculator or the Geometer’s Sketchpad to relate the x-coordinate of a point of intersection of two appropriate graph to the solution of a given equation. Make generalization about the point(s) of intersection of the two graphs.

**POINTS TO NOTE / VOCABULARY**

- To sketch a graph
- To draw a graph

Use the traditional graph plotting exercise if the graphing calculator or the Sketchpad is unavailable.

Involve everyday problems.

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4
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<thead>
<tr>
<th>Students will be taught to:</th>
<th>Students will be able to:</th>
<th>Discuss that if one point in a region satisfies ( y &gt; ax + b ) or ( y &lt; ax + b ), then all point in the region satisfies the same inequalities.</th>
<th>Enquiry-discovery Constructivism</th>
<th>Identifying patterns</th>
<th>Systematic Determination Making inferences</th>
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<tr>
<td>2.3 Understand and use the concept of the region representing inequalities in two variables</td>
<td>i) Determine whether a given point satisfies: ( y = ax + b ) or ( y &gt; ax + b ) or ( y &lt; ax + b )</td>
<td>Use the Sketchpad or graphing calculator to explore points relative to a graph to make generalization about regions satisfying the given inequalities.</td>
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<td>ii) Determine the position of a given point relative to the equation ( y = ax + b )</td>
<td>iii) Identify the region satisfying ( y &gt; ax + b ) or ( y &lt; ax + b )</td>
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<td>iv) Shade the regions representing the inequalities</td>
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<tr>
<td>a) ( y &gt; ax + b ) or ( y &lt; ax + b )</td>
<td>b) ( y \geq ax + b ) or ( y \leq ax + b )</td>
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<td>v) Determine the region which satisfies two or more simultaneous linear inequalities.</td>
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<td></td>
<td>a) ( y = ax + b ) is drawn as a dashed line to indicate that all points on the line are not in the region.</td>
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<td>- For the region representing ( y \geq ax + b ) or ( y \leq ax + b ), the line ( y = ax + b ) is drawn as a solid line to indicate that all points on the line ( y = ax + b ) are in the region.</td>
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<td>3.</td>
<td>TRANSFORMATIONS III</td>
<td>Students will be taught to: 3.1 Understand and use the concept of combination of two transformations.</td>
<td>Students will be able to: i. Determine the image of an object under combination of two isometric transformations.</td>
<td>Relate to transformations in real life situations such as tessellation patterns on walls, ceilings or floors</td>
<td>Constructivism Contextual Learning</td>
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<tr>
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<td>ii. Determine the image of an object under combination of a. two enlargements. b. an enlargement and an isometric transformation.</td>
<td>Explore combined transformation using the graphing calculator, the geometry’s Sketchpad, or the overhead projector and transparencies.</td>
<td>Mastery Learning</td>
<td>Comparing and Differentiating Interpreting Identifying Relation</td>
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<td>iii. Draw the image of an object under combination of two transformations.</td>
<td>Investigated the characteristics of an object and its image under combined transformation</td>
<td>Contextual Learning Multiple Intelligence theory</td>
<td>Drawing Diagrams Identifying Relation</td>
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<td>iv. State the coordinates of the image of a point under combined transformation.</td>
<td>Constructivism Contextual Learning</td>
<td>Identifying Relation Arranging Sequentially</td>
<td>Diligence Accuracy Consistent</td>
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<td>v. Determine whether combined transformation AB is equivalent to combined transformation BA</td>
<td>Multiple Intelligence</td>
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<td>vi. Specify two successive transformation in a combined transformation given the object and the image</td>
<td>Mastery Learning</td>
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<td>vii. Specify a transformation which is equivalent to the combination of two isometric transformations.</td>
<td>Mastery Learning ICT</td>
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|       |               |                      | viii. Solve problems involving transformation. | a. How to make a frieze or strip pattern.  
|       |               |                      |                  | b. Constructing a kaleidoscope. | Mastery Learning ICT | Find all possible solution | Sharing  
|       |               |                      |                  |                                           |           | Using Analogies | Rational  
|       |               |                      |                  |                                           |           | Drawing Diagram | Diligence  
<p>|       |               |                      |                  |                                           |           | Working out Mentally |<br />
|       |               |                      |                  |                                           |           |               |                         |</p>
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<tr>
<td>Matrices</td>
<td>Students will be taught to: 4.1 understand and use the concept of matrix.</td>
<td>Students will be able to: i) form a matrix from given information. ii) Determine : a) the number of rows b) the number of columns c) the order of a matrix iii) Identify a specific element in a matrix.</td>
<td>Represent data in real life situations, for example, the price of food on a menu, in table form and then in matrix form. Use students sitting positions in the classroom by rows and columns to identify a student who is sitting in a particular row and in a particular column as a concrete example.</td>
<td>Contextual learning Constructivism Mastery learning</td>
<td>Arranging sequentially Collecting and handling data Identifying patterns Identifying patterns</td>
<td>Neatness and systematic Accurate Systematic</td>
<td>Emphasize that matrices are written in bracket. Matrix, row matrix, column matrix, square matrix Emphasize that a matrix of order ( m \times n ) is read as ‘an ( m ) by ( n ) matrix’ Use row number and column number to specify the position of an element.</td>
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<p>| 4.2 Understand and use the concept of equal matrices. | i) Determine whether two matrices are equal. ii) Solve problems involving equal matrices. | Discuss equal matrices in terms of : a) the order b) the corresponding elements | Mastery learning | Using algorithm and relationship Comparing and differentiating | Systematic Accurate | Equal matrices Including finding values of unknown elements. |</p>
<table>
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|       |               | 4.3 Perform addition and subtraction on matrices. | i) Determine whether addition or subtraction can be performed on two given matrices.  
ii) Find the sum or the difference of two matrices.  
iii) Perform addition and subtraction on a few matrices.  
iv) Solve matrix equation involving addition and subtraction | Relate to real life situations such as keeping scores of metals, tally or points in sport. | Self-access learning  
Constructivism  
Mastery learning  
Communicating method of learning  
Contextual learning  
Multiple intelligences  
Mastery learning  
Future studies | Comparing and differentiating  
Using algorithm and relationship  
Problem solving | Cooperating  
Rationale  
Confidence  
Systematic | Limit to matrices with not more than three rows and three columns.  
Include finding values of unknown elements/matrix equation |
|       |               | 4.4 perform multiplication of a matrix by a number. | i) Multiply a matrix by a number.  
ii) Express a given matrix as a multiplication of another matrix by a number.  
iii) Perform calculation on matrices involving addition, subtraction and scalar multiplication. | Relate to real life situations such as in industrial productions | Mastery learning  
Constructivism  
Contextual learning  
Self-access learning | Evaluating  
Using algorithm and relationship  
Conceptualizing and finding all possible solutions | Multiplying a matrix by a number is known as scalar multiplication |
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<tr>
<td>4.5</td>
<td></td>
<td>4.5 Perform multiplication of two matrices</td>
<td>iv) Solve matrix equations involving addition, subtraction and scalar multiplication.</td>
<td>Self-access learning Constructivism Self-access learning</td>
<td>Evaluating and problems solving</td>
<td></td>
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<td>Include finding the values of unknown elements</td>
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<td>i. Determine whether two matrices can be multiplied and state the order of the product when the two matrices can be multiplied.</td>
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<td>ii. Find the product of two matrices</td>
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<td>iii. Solve matrix equations involving multiplication of two matrices.</td>
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<td>Relate to real life situations such as finding the cost of a meal in a restaurant.</td>
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<td>For matrices A and B, discuss the relationship between AB and BA.</td>
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<td></td>
<td>• Constructivism</td>
<td>• Identifying patterns</td>
<td>• Determination</td>
<td>The number of columns of first matrix must be same with the number of rows of second matrix.</td>
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<td>• ICT</td>
<td>• Arranging sequentially</td>
<td>• Systematic</td>
<td>The order of the matrices: (m x n) x (n x s) = (m x s)</td>
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<td></td>
<td>• Cooperative Learning</td>
<td>• Recognizing and representing</td>
<td>• Consistent</td>
<td>Limit to matrices with not more than three rows and three columns.</td>
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<td></td>
<td>• Learning</td>
<td>• Making generalization</td>
<td>• Diligence</td>
<td>Limit to two unknown elements.</td>
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<td></td>
<td>• classifying</td>
<td>• Neatness</td>
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<td>WEEKS</td>
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<td>4.6 Understand and use the concept of identity matrix.</td>
<td>i) Determine whether a given matrix is an identity matrix by multiplying it to another matrix.  ii) Write identity matrix of any order. iii) Perform calculation involving identity matrices.</td>
<td>Begin with discussing the property of the number 1 as an identity for multiplication of numbers. Discuss: an identity matrix is a square matrix there is only one identity matrix for each order. Discuss the properties: ( AI = A ) ( IA = A )</td>
<td>• Contextual learning • Constructivism</td>
<td>• Making generalization • Identifying patterns</td>
<td>• Rational • Systematic • Neatness</td>
<td>Identity matrix is usually denoted by ( I ) and is also known as unit matrix. Identity matrix unit matrix. Limit to matrices with no more than three rows and three columns.</td>
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<td>4.7 Understand and use the concept of inverse matrix.</td>
<td>(i) Determine whether a ( 2 \times 2 ) matrix is the inverse matrix of another ( 2 \times 2 ) matrix. a) (ii) Find the inverse</td>
<td>Relate to the property of multiplicative inverse of numbers. For example: ( 2x^{-1} = \frac{1}{2} ) ( x_2 = 1 ) In the example, ( 2^{-1} ) is the multiplicative inverse of 2 and vice versa. Use the method of solving simultaneous linear equations to show that not all square matrices have inverse matrices. For</td>
<td>• Constructivism • Mastery learning</td>
<td>• Comparing • Identifying patterns and relations</td>
<td>• Cooperating • Neatness • Systematic</td>
<td>The inverse of matrix ( A ) is denoted by ( A^{-1} ). Emphasize that: • If matrix ( B ) is the inverse of matrix ( A ), then matrix ( A ) is also the inverse of matrix ( B ), ( AB = BA = I ) • Inverse matrices can only exist for square matrices, but not all square matrices have inverse matrices.</td>
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<td>WEEKS</td>
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<td>SUGGESTED TEACHING &amp; LEARNING ACTIVITIES</td>
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|       |               |                     | matrix of a 2 x 2 matrix using: b) the method of solving simultaneous linear equations a formula. | example, ask student to try to find the inverse matrix of \[
\begin{pmatrix}
3 & 2 \\
6 & 4
\end{pmatrix}
\]. Using matrices and their respective inverse matrices in the previous method to relate to the formula. Express each inverse matrix as a multiplication to the original matrix and discuss how the determinant is obtained | • Constructivism  
• Mastery learning  
• Communication method of learning | • Comparing  
• Identifying patterns and relations | Steps to find the inverse matrix:  
• Solving simultaneous linear equations  
  \[
\begin{pmatrix}
1 & 2 \\
3 & 4
\end{pmatrix}
\begin{pmatrix}
p & q \\
r & s
\end{pmatrix}
= \begin{pmatrix}
1 & 0 \\
0 & 1
\end{pmatrix}
\]
  
  \[p + 2r = 1, 3p + 4r = 0, q + 2s = 0, 3q + 4s = 1\]
  
  where \[
\begin{pmatrix}
p & q \\
r & s
\end{pmatrix}
\]
is the inverse matrix.  
• Using formula  
  \[
A^{-1} = \begin{pmatrix}
d & -b \\
ad - bc & a \\
-c & ad - bc
\end{pmatrix}
\]
or  
\[
A^{-1} = \begin{pmatrix}
d & -b \\
ad - bc & a \\
-c & ad - bc
\end{pmatrix}
\]
### LEARNING OUTCOMES

1. Write simultaneous linear equations in matrix form.
2. Relate to equal matrices by writing down the simultaneous equations as equal matrices first. For example:
   - Write
     - \(2x + 3y = 13\)
     - \(4x - y = 5\)
   - As equal matrices:
     \[
     \begin{bmatrix}
     2 & 3 \\
     4 & -1
     \end{bmatrix}
     \begin{bmatrix}
     x \\
     y
     \end{bmatrix}
     =
     \begin{bmatrix}
     13 \\
     5
     \end{bmatrix}
     \]
   - Which is then expressed as:
     \[
     \begin{bmatrix}
     2 & 3 \\
     4 & -1
     \end{bmatrix}
     \begin{bmatrix}
     x \\
     y
     \end{bmatrix}
     =
     \begin{bmatrix}
     13 \\
     5
     \end{bmatrix}
     \]
   - Discuss why:
     - The use of inverse matrix is necessary. Relate to solving linear equations of type \(ax = b\)
     - It is important to place the inverse matrix at the right place on both sides of the equation.

### SUGGESTED TEACHING & LEARNING ACTIVITIES

1. Use the inverse matrix.
2. Relate to equal matrices by writing down the simultaneous equations as equal matrices first. For example:
   - Write
     - \(5y + 4x = 14\)
     - \(3y + 2x = 5\)
   - Which is then expressed as:
     \[
     \begin{bmatrix}
     5 & 4 \\
     3 & 2
     \end{bmatrix}
     \begin{bmatrix}
     x \\
     y
     \end{bmatrix}
     =
     \begin{bmatrix}
     14 \\
     5
     \end{bmatrix}
     \]

### POINTS TO NOTE / VOCABULARY

- \(A^{-1} = \frac{1}{ad - bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}\) when \(ad - bc \neq 0\).
- \(ad - bc\) is known as the determinant of the matrix \(A\).
- \(A^{-1}\) does not exist if the determinant is zero. Prior to use the formula, carry out operations leading to the formula.

- Limit to two unknowns. Simultaneous linear equations \(ap + bq = h\) \(cp + dq = k\) in matrix form is:
  \[
  \begin{bmatrix}
  a & b \\
  c & d
  \end{bmatrix}
  \begin{bmatrix}
  p \\
  q
  \end{bmatrix}
  =
  \begin{bmatrix}
  h \\
  k
  \end{bmatrix}
  \]
  Where \(a, b, c, d, h\) and \(k\) are constants, \(p\) and \(q\) are unknowns.
### LEARNING OUTCOMES

- (iii) Solve simultaneous linear equations by the matrix method.
- (iv) Solve problems involving matrices.

### SUGGESTED TEACHING & LEARNING ACTIVITIES

- Relate the use of matrices to other areas such as in business or economy, science etc.
- Carry out projects involving matrices using the electronic spreadsheet.

### GENERICS

- Cooperative Learning
- Self-access Learning
- Mastery Learning
- ICT

### CCTS

- Identifying Patterns
- Identifying Relations
- Representing & Interpreting
- Data

### MORAL VALUES

- Rational
- Systematic
- Neatness

### POINTS TO NOTE / VOCABULARY

Where \( A = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \).

The matrix method uses inverse matrix to solve simultaneous linear equations.

**Matrix method**
### WEEKS LEARNING AREA LEARNING OBJECTIVES LEARNING OUTCOMES SUGGESTED TEACHING & LEARNING ACTIVITIES GENERICSS GCTSS MORAL VALUES POINTS TO NOTE / VOCABULARY

**VARIATIONS**

*Students will be taught to:*

5.1 Understand and use the concept of direct variation

*(i)* State the changes in a quantity with respect to the changes in another quantity, in everyday life situations involving direct variation.

*(ii)* Determine from given information whether a quantity varies directly as another quantity.

*(iii)* Express a direct variation in the form of an equation involving two variables.

*(iv)* Find the value of a variable in a direct variation when sufficient information is given.

*(v)* Solve problems involving direct variations for the following cases:

- \( y \propto x \)
- \( y \propto x^2 \)
- \( y \propto x^3 \)
- \( y \propto x^{\frac{1}{2}} \)

Discuss the characteristic of the graph of \( y \) against \( x \) when \( y \propto x \).

Relate mathematical variation to other areas such as science and technology. For example, the Charles' Law or the motion of the simple pendulum.

For the cases \( y \propto x^n \), 

\[ n = 2, 3, \frac{1}{2} \]

discuss the characteristics of the graph of \( y \) against \( x^n \).

- **Contextual Learning**
- **Self-access Learning**
- **Communicating Method of Learning**

- **Identifying relations**
- **Making generalization**
- **Estimating**

- **Rationale**
- **Systematic**
- **Tolerance**
- **Hardworking**

**VOCABULARY:** Direct variation Quantity Constant of variation Variable.
## LEARNING OBJECTIVES

i) State the changes in a quantity with respect to changes in another quantity, in everyday life situations involving inverse variation.

ii) Determine from given information whether a quantity varies inversely as another quantity.

iii) Express a inverse variation in the form of equation involving two variables.

iv) Find the value of a variable in an inverse variation when sufficient information is given.

v) Solve problems involving inverse variation for the following cases:

\[
\frac{1}{x^n} ; \quad \frac{1}{x^2} ; \quad \frac{1}{x^3} ; \quad \frac{1}{x^4}
\]

Discuss the form of the graph of \( y \) against \( \frac{1}{x} \) when \( y \propto \frac{1}{x} \).

Relate to other areas like science and technology. For example, Boyle’s Law.

For the cases \( y \propto \frac{1}{x^n} \), \( n = 2, 3 \) and \( \frac{1}{x^2} \), discuss the characteristics of the graph of \( y \) against \( \frac{1}{x^n} \).

## SUGGESTED TEACHING & LEARNING ACTIVITIES

Discuss the form of the graph of \( y \) against \( \frac{1}{x} \) when \( y \propto \frac{1}{x} \).

Relate to other areas like science and technology. For example, Boyle’s Law.

For the cases \( y \propto \frac{1}{x^n} \), \( n = 2, 3 \) and \( \frac{1}{x^2} \), discuss the characteristics of the graph of \( y \) against \( \frac{1}{x^n} \).

## GENERICS

Contractivism

Communications

Method of learning

Cooperative learning

## CCTS

Making inferences

Representing and interpreting data

Identifying relations

## MORAL VALUES

Rational

Systematic

Accuracy

## POINTS TO NOTE / VOCABULARY

- **VOCABULARY:** Inverse variation

- y varies inversely as x if and only if \( xy = k \) is a constant.

- If \( y \propto \frac{1}{x} \), the relation is written as \( y = \frac{k}{x} \).

- For the cases \( y \propto \frac{1}{x^n} \), limit n to 2, 3 and \( \frac{1}{x^2} \).

- If \( y \propto \frac{1}{x^2} \), then \( y = \frac{k}{x^2} \) where k is the constant of variation.

- Using:
  - \( y = \frac{k}{x} \) or \( \frac{1}{x} \)
  - \( x_1 y_1 = x_2 y_2 \)
  - to get the solution.
### CHAPTER 5 – VARIATIONS

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<th>POINTS TO NOTE / VOCABULARY</th>
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<td>5.3 Understand and use the concept of joint variation.</td>
<td>i) Represent a joint variation by using the symbol ∝ for the following cases:</td>
<td>Discuss joint variation for the three cases in everyday life situations.</td>
<td>Constructivism</td>
<td>Identifying</td>
<td>Cooperation</td>
<td>For the cases</td>
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<td></td>
<td>a) two direct variations.</td>
<td>Relate to other areas like science and technology.</td>
<td>Cooperative learning</td>
<td>relations</td>
<td>Punctuality</td>
<td>$y \propto x^n z^n$, $y \propto \frac{1}{x^n z^n}$</td>
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<td>b) two inverse variations.</td>
<td>For example: $I \propto \frac{V}{R}$ means the current $I$ varies directly as the</td>
<td>Multiple intelligences</td>
<td>comparing and</td>
<td>Systematic</td>
<td>and $y \propto \frac{x^n}{z^n}$, limit $n$ to 2,</td>
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<td>c) a direct variation and an inverse variation.</td>
<td>voltage $V$ and varies inversely as the resistance $R$.</td>
<td>Self-access learning</td>
<td>differentiating</td>
<td>Rational</td>
<td>3, $\frac{1}{z^n}$.</td>
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<td></td>
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<td>ii) Express a joint variation in the form of equation.</td>
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<td>Mastery learning</td>
<td>collecting and</td>
<td></td>
<td>Joint variation</td>
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<td>iii) Find the value of a variable in a joint variation when sufficient information is given.</td>
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<td>handling data</td>
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<td>iv) Solve problems involving joint variation.</td>
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<td>using analogies</td>
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<td>finding all possible solutions</td>
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<td>WEEKS</td>
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</table>
|       | Gradient and area under a graph | Students will be taught to: 6.1 Understand and use the concept of quantity represented by the gradient of a graph. | Students will be able to:  
(i) State the quantity represented by the gradient of a graph.  
(ii) Draw the distance-time graph, given:  
   a) a table of distance-time values.  
   b) a relationship between distance and time.  
(iii) Find and interpret the gradient of a distance-time graph. | Use examples in various areas such as technology and social science.  
Compare and differentiate between distance-time graph and speed-time graph. | Contextual learning | Recognizing and representing | Rationality | Limit to graph a straight line.  
The gradient of a graph represents the rate of change of a quantity on the vertical axis with respect to the change of another quantity on the horizontal axis. The rate of change may have a specific name for example “speed” for a distance time graph. |
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|       |               |                     |                   |                                          |          |      |              |                             |</p>
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<td>6.2</td>
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<td>(iv) Find the speed for a period of time from a distance-time graph.</td>
<td>Use real life situation such as traveling from one place to another by train or by bus.</td>
<td>Constructivism</td>
<td>Recognising and representing</td>
<td>Respect</td>
<td>Include graphs which consist of a combination of a few straight lines. For example:</td>
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<td>(v) Draw a graph to show the relationship between two variables representing certain measurements and state the meaning of its gradient.</td>
<td>Use examples in social science and economy.</td>
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<td>distance, s</td>
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<td>(i) State the quantity represented the area under a graph.</td>
<td>Discuss that in certain cases, the area under a graph may not represent any meaningful quantity. For example: The area under the distance-time graph. Discuss the formula for finding the area under a graph involving; • a straight line which is parallel to the x-axis</td>
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<td>(ii) Find the area under a graph.</td>
<td>Constructivism</td>
<td>Recognising and representing</td>
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<td>(iii) Determine the distance by finding the area under the following types of speed-time-graphs: (a) ( v = k )</td>
<td>Constructivism</td>
<td>Recognising and representing</td>
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<td>AREA</td>
<td>OBJECTIVES</td>
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<td></td>
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<td>(uniform speed)</td>
<td>y = kt + h</td>
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<td>(b) $v = kt$</td>
<td>a combination of the above.</td>
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<td>(c) $v = kt + h$</td>
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<td>(d) a combination of the above.</td>
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<td>(v) Solve problems involving gradient and area under a graph.</td>
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<td>For example:</td>
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<td>Speed, $v$</td>
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<td>time, $t$</td>
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<td>area under a graph</td>
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<td>acceleration-time graph</td>
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<td>uniform speed</td>
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For example:

```
Speed, $v$
```

```
time, $t$
```
<table>
<thead>
<tr>
<th>WEEKS</th>
<th>LEARNING AREA</th>
<th>LEARNING OBJECTIVES</th>
<th>LEARNING OUTCOMES</th>
<th>SUGGESTED TEACHING &amp; LEARNING ACTIVITIES</th>
<th>GENERICS</th>
<th>CCTS</th>
<th>MORAL VALUES</th>
<th>POINTS TO NOTE / VOCABULARY</th>
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<tbody>
<tr>
<td></td>
<td>Probability II</td>
<td>Students will be taught to:</td>
<td>Students will be able to:</td>
<td>Discuss equiprobable sample through concrete activities and begin with simple cases such as a. toss a fair coin b. give a TRUE or FALSE question. Find the probability. Use tree diagrams to obtain sample space for tossing a fair coin or tossing a fair die activities. The graphing calculator may also be used to simulate these activities. Discuss event that produce (a) P(A) = 1. Tossing a fair coin. P(Head) + P(Tail) = 1. (b) P(A) = 0 Climbing up the twin tower. Drilling exercise.</td>
<td>Contextual Learning</td>
<td>Making inference</td>
<td>Determination Cooperation Rational</td>
<td>Limit to sample space with equally likely outcomes.</td>
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<td></td>
<td></td>
<td>7.1 Understand and use the concept of probability of an event.</td>
<td>i) Determine the sample space of an experiment with equally likely outcomes</td>
<td></td>
<td>Mastery Learning</td>
<td>Working out mentally</td>
<td></td>
<td><strong>Equally likely</strong></td>
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<td>ii) Determine the probability of an event with equiprobable sample space.</td>
<td></td>
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<td>Finding all possible solutions.</td>
<td></td>
<td>A sample space in which each outcome is equally likely is called equiprobable sample space.</td>
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<td></td>
<td>iii) Solve problems involving probability of an event.</td>
<td></td>
<td></td>
<td>Finding all possible solutions.</td>
<td></td>
<td>The probability of an outcome A, with equiprobable sample space</td>
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<td></td>
<td>Include everyday problems and making predictions.</td>
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<td>WEEKS</td>
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</table>
| 7.2   |               | Understand and use the concept of probability of the complement of an event. | (i) State the complement of an event in:  
   a) words  
   b) set notation  
(ii) Find the probability of the complement of an event | Discuss equiprobable sample space through activities such as finding the consonants and vowels from the word given.  
Include events in real life situations such as winning or losing a game and passing or failing an exam. | Constructivism  
Contextual Learning | Identifying relations  
Finding all possible solutions  
Making inferences  
Drawing diagrams | Cooperation  
Equity  
Rationale  
Precise | The complement of an event A is the set of all outcomes in the sample space that are not included in the outcomes of event A. |
| 7.3   |               | Understand and use the concept of probability of combined event | i) List the outcomes for events:  
   a) A or B as elements of set A ∪ B  
ii) Find the probability by listing the outcomes of the combined event:  
   a) A or B | Example i:  
A coin is tossed twice consecutively. List the probability for each combined event  
a) Q = An event to get the numbers at the first go or both times showing the pictures  
Q = {NP, NN, PP}  
b) R = An event to get the picture at the second toss or both times showing the number.  
R= {NP, PP , NN }  
Example ii:  
Find the probability by listing the outcomes of the combined event  
a) S = {NP, NN, PN, PP}  
n(S) = 4  
Q = {NP, NN, PP}  
n(Q) = 3. | Mastery Learning  
Enquiry  
Discovery | Estimating  
Identifying Patterns  
Identifying Relations  
Finding all possible solutions | Tolerance  
Determination  
Consistent | Event  
Combined event  
Consecutively  
Toss |
<table>
<thead>
<tr>
<th>WEEKS</th>
<th>LEARNING AREA</th>
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<th>LEARNING OUTCOMES</th>
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<th>GENERICS</th>
<th>CCTS</th>
<th>MORAL VALUES</th>
<th>POINTS TO NOTE / VOCABULARY</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(i) list the outcomes for events $A$ and $B$ as elements of set $A \cap B$</td>
<td>$P(Q) = \frac{n(Q)}{n(S)} = \frac{3}{4}$</td>
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<td>1. Ask one student to toss 2 coins at the same time.</td>
<td>Contextual Learning</td>
<td></td>
<td></td>
<td>Cooperation</td>
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<td>2. Fill in the outcomes.</td>
<td>Identifying relations</td>
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<td>Systematic</td>
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<td>3. List the outcomes for different event</td>
<td>Finding all possible solution</td>
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<td></td>
<td>Rational</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>$A$ and $A = {A,A}$</td>
<td>Drawing diagram</td>
<td></td>
<td></td>
<td>Combined event</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$A$ and $G = {A,G}, (G,A)}$</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$G$ and $G = {G,G}$</td>
<td></td>
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<td>4. State the relationship between $A$ and $\cap$.</td>
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<td></td>
<td></td>
<td></td>
<td>$A$ and $A = A \cap A$</td>
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<td></td>
<td></td>
<td></td>
<td>$A$ and $G = A \cap G$</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$G$ and $G = G \cap G$</td>
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<td>5. The total number of the event $n(A \cap A) = 1$</td>
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<td></td>
<td></td>
<td>$n(A \cap G) = 2$</td>
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<td></td>
<td></td>
<td></td>
<td>$n(G \cap G) = 1$</td>
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</tbody>
</table>
(ii) Find the probability by listing the outcomes of the combined event A and B

1. Split the class into the group
2. Each group will be given one coin and one dice.
3. List out all the possible combination when toss the coin and dice at the same time
   \{(A,1), (A,2), (A,3), (A,4), (A,5), (A,6), (G,1), (G,2), (G,3), (G,4), (G,5), (G,6)\}
4. Find the probability of getting ‘1’ when rolling a coin is ‘A’.
   \[P(A \cap 1) = \frac{1}{12}\]
5. Introduce a tree diagram
6. Based on tree diagram, find the probability of :-
   (a) getting ‘A’
   (b) getting ‘1’
   \[P(A) = \frac{1}{2}\]
   \[P(1) = \frac{1}{6}\]
7. The probability to getting ‘A’ and ‘1’ can be written as
   \[P(A \cap 1) = P(A) \times P(1)\]
   \[= \frac{1}{2} \times \frac{1}{6}\]
   \[= \frac{1}{12}\]
### LEARNING OUTCOMES

(iii) Solve problems involving probability of combined event.

Use two-way classification tables of events from newspaper articles or statistical data to find probability of combined events. Ask students to create tree diagrams from these tables. Example of a two-way classification table:

<table>
<thead>
<tr>
<th>MEANS OF GOING TO WORK</th>
<th>Office</th>
<th>Car</th>
<th>Bus</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>56</td>
<td>25</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>50</td>
<td>42</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

Discuss:

- situations where decision have to made based on probability, for example in business, such as determining the value for specific insurance policy and time the slot for TV advertisements
- the statement “probability is the underlying language of statistics”.

### POINTS TO NOTE / VOCABULARY

- ICT Mastery Learning
- Self-access Learning
- Emphasis that:
  - knowledge about probability making decisions
  - predictions as based on probability is not definite or absolute.
## WEEKS | LEARNING AREA | LEARNING OBJECTIVES | LEARNING OUTCOMES | SUGGESTED TEACHING & LEARNING ACTIVITIES | GENERICS | CCTS | MORAL VALUES | POINTS TO NOTE / VOCABULARY
---|---|---|---|---|---|---|---|---
8 BEARING | Students will be taught to: 8.1 Understand and use the concept of bearing | Students will be able to: (i) Draw and label the eight main compass directions: (a) north, south, east, west (b) north-east, north-west, south-east, south-west  (ii) State the compass angle of any compass direction  (iii) Draw a diagram of a point which shows the direction of B relative to another point A given the bearing of B from A | Carry out activities or games involving finding directions using a compass, such as treasure hunt or scavenger hunt. It can also be about locating several points on a map | Constructivism Cooperative Multiple intelligence | Making connections Visualize mentally | Cooperation Accuracy Neatness Carefulness | Compass angle bearing  Compass angle and bearing are written in three-digit form, 000° to 360°. They are measured in a clockwise direction from north. Due north is considered as bearing 000°. For cases involving degrees and minutes, state in degrees up to one decimal point.  North–east South–east North-west South-west
<table>
<thead>
<tr>
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<td></td>
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<td>(iv) State the bearing of point A from point B based on given information</td>
<td></td>
<td>Mastery learning Contextual Constructivism Self-access learning (Mathematical-logical Verbal-linguistic)</td>
<td>lov], Constructivism Self-access learning (Mathematical-logical Verbal-linguistic)</td>
<td>Making connections Visualize mentally</td>
<td>Rational Accuracy Systematic Carefulness</td>
<td>Begin with the case where bearing of point B from point A is given</td>
</tr>
<tr>
<td></td>
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<td>(v) Solve problems involving bearing</td>
<td></td>
<td>Contextual Constructivism Self-access learning (Mathematical-logical Verbal-linguistic) Communication</td>
<td>Interpret Draw diagrams Recognizing relationship Problem solving</td>
<td>Accuracy Rational Responsibility Appreciation</td>
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</table>

Discuss the use of bearing in real life situations. For example, in map reading and navigation.
### WEEKS  | LEARNING AREA       | LEARNING OBJECTIVES                                      | LEARNING OUTCOMES                      | SUGGESTED TEACHING & LEARNING ACTIVITIES                                                                 | GENERICS          | CCTS              | MORAL VALUES | POINTS TO NOTE / VOCABULARY |
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<tbody>
<tr>
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<td>EARTH AS A SPHERE</td>
<td>Students will be taught to:</td>
<td>Students will be able to:</td>
<td>Models such as globes should be used. Introduce the meridian through Greenwich in England as the Greenwich Meridian with longitude 0° Discuss that: (a) all points on a meridian have the same longitude. (b) there are two meridians on a great circle through both poles. (c) Meridians with longitudes x°E (or W) and (180° - x°)W (or E) form a great circle through both poles.</td>
<td>Contextual learning</td>
<td>Identifying patterns</td>
<td>Constructivism</td>
<td>Great circle</td>
</tr>
<tr>
<td></td>
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<td>9.1 Understand and use the concept of longitude.</td>
<td>(i) Sketch a great circle through the north and south poles. (ii) State the longitude of a given point. (iii) Sketch and label a meridian with the longitude given. (iv) Find the difference between two longitudes.</td>
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<td>Meridian</td>
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<td>Longitude</td>
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<td>9.2 Understand and use the concept of latitude</td>
<td>(i) Sketch a circle parallel to the equator. (ii) State the latitude of a given point.</td>
<td>Using any computer software to sketch a circle parallel to the equator. Constructivism Self-access learning</td>
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<td>Drawing diagrams</td>
<td>Rational</td>
<td>Equator</td>
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<td>Latitude Emphasize that * the latitude of the equator is 0° * latitude ranges from 0° to 90°N(or S)</td>
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<td>WEEKS</td>
<td>LEARNING AREA</td>
<td>LEARNING OBJECTIVES</td>
<td>LEARNING OUTCOMES</td>
<td>SUGGESTED TEACHING &amp; LEARNING ACTIVITIES</td>
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<td>(iii) Sketch and label a parallel of latitude.</td>
<td>Discuss that all points on a parallel of latitude have the same latitude</td>
<td>Cooperative learning Enquiry-discovery Communication method of learning</td>
<td>Finding all possible solutions Logical reasoning Recognizing &amp; interpreting data</td>
<td>Cooperation Sharing Systematic Tolerance</td>
<td>Parallel of latitude</td>
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<td>(iv) Find the difference between two latitudes.</td>
<td>Carry out group activity such as station game. Each station will have different diagram and the student will be ask to find the difference between two latitudes for each diagram.</td>
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<td></td>
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<td>Involve actual places on the earth</td>
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<tr>
<td>9.3</td>
<td></td>
<td>9.3 Understand the concept of location of a place.</td>
<td>(i) State the latitude and longitude of a given place. (ii) Mark the location of a place. (iii) Sketch and label the latitude and longitude of a given place.</td>
<td>Use a globe or a map to find locations of cities around the world. Use a globe or a map to name a place given its location.</td>
<td>Contextual Learning, Constructivism, Communication Method of Learning.</td>
<td>Logical Reasoning, Identifying Relation, Recognizing and Representing.</td>
<td>Express the difference between two latitudes with an angle in the range of $0^\circ \leq x \leq 180^\circ$.</td>
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<td>9.4</td>
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<td>9.4 Understand and use the concept of distance on the surface of the earth to solve problems</td>
<td>(i) Find the length of an arc of a great circle in nautical mile, given the subtended angle at the centre of the earth and vice versa</td>
<td>Identifying relations</td>
<td></td>
<td>Systematic Rational</td>
<td>A place on the surface of the earth is represented by a point. The location of a place A at latitude $x^\circ N$ and longitude $y^\circ E$ is written as $A(x^\circ N, y^\circ E)$.</td>
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<tr>
<td>WEEKS</td>
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<td>LEARNING OUTCOMES</td>
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<td>(ii) find the distance between two points measured along a meridian, given the latitudes of both points. (iii) find the latitude of a point given the latitude of another point and the distance between the two points along the same meridian. (iv) find the distance between two points measured along the equator, given the longitudes of both points. (v) find the longitudes of a point given the longitude of another point and the distance between the two points along the equator. (vi) state the relations between the radius of the earth and the radius of a parallel of latitude. (vii) state the relation between the length of an arc on the equator between two meridians and the length of the corresponding arc on a parallel of latitude.</td>
<td>Use the globe to find the distance between two cities or town on the same meridian. Sketch the angle at centre of the earth that is subtended by the arc between two given points along the equator. Discuss how to find the value of this angle Use models such as the globe, to find relationships between the radius of the earth and radii parallel of latitudes</td>
<td>Contextual Learning</td>
<td>Representing and interpreting data Drawing diagrams</td>
<td>Cooperative learning Enquiry discovery</td>
<td>Identifying relations Neatness Systematic Rational</td>
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<td>Enquiry discovery Constructivism</td>
<td>Identifying relations Cooperative learning Enquiry discovery Constructivism Communication Method of Learning</td>
<td>Identifying relations</td>
<td>Method of Learning</td>
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<td>WEEKS</td>
<td>LEARNING AREA</td>
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<td>(viii) find the distance between two points measured along a parallel of a latitude.</td>
<td>Find the distance between two cities or towns on the same parallel of latitudes as a group project.</td>
<td>• Mastery Learning</td>
<td></td>
<td></td>
<td></td>
<td>Cooperation Tolerance Sharing</td>
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<tr>
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<td>(ix) find the latitude of a point given the longitude of another point and the distance between the points along a parallel of latitude.</td>
<td>Use the globe and a few pieces of string to show how to determine the shortest distance between two points on the surface of the earth.</td>
<td>• Cooperator Learning • Multiple Learning • Contextual Learning • Enquiry discovery • Self access Learning</td>
<td></td>
<td></td>
<td></td>
<td>Cooperation</td>
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<td>(x) Find the shortest distance between two points on the surface of the earth.</td>
<td></td>
<td>• Cooperative Learning • Multiple Learning • Contextual Learning • Enquiry discovery • Self access Learning</td>
<td></td>
<td></td>
<td></td>
<td>Sharing</td>
</tr>
</tbody>
</table>
|       |               | (xi) Solve problems involving: - (a) distance between two points  
(b) traveling on a surface of the earth. | | • Cooperative Learning • Self access Learning • Mastery Learning • Thinking skills | | | | Tolerance|
|       |               | | | Drawing diagrams  
Comparing & differentiating 
Making inferences | | | | Sharing Rational |
<table>
<thead>
<tr>
<th>WEEKS</th>
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<th>LEARNING OUTCOMES</th>
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<th>CCTS</th>
<th>MORAL VALUES</th>
<th>POINTS TO NOTE / VOCABULARY</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>Plans and Elevations</td>
<td>Students will be taught to:</td>
<td>Students will be able to</td>
<td>Use models, blocks or plan and elevation kit</td>
<td>Contextual learning</td>
<td>Comparing and Differentiating</td>
<td>Accuracy</td>
<td>Emphasize the different uses of dashed lines and solid lines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.1 Understand and use the concept of orthogonal projection</td>
<td>10.1.1 Identify orthogonal projection</td>
<td></td>
<td>Mastery Learning</td>
<td>Visualization</td>
<td>Creative thinking</td>
<td>Begin with simple solid objects such as cubic, cuboids, cylinder, cone, prism and right pyramid</td>
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<td>10.1.2 Draw orthogonal projection, given an object and a plane</td>
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<td>Identifyin g relationship</td>
<td>Systematic</td>
<td>Vocab Orthogonal projection</td>
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<td>10.1.3 Determine the difference between an object and</td>
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<td>10.2 Understand and use the Concept of plan and elevation</td>
<td>10.2.1 Draw the plan of a solid Object</td>
<td>Carry out activities in groups where students combine two or more different shapes of simple solid objects into interesting models and draw plans and elevations for these models</td>
<td>Mastery Learning</td>
<td>Analyzing</td>
<td>Accuracy</td>
<td>Limit to full scale drawings only</td>
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<td>10.2.2 a) Draw the front elevation</td>
<td></td>
<td>Self access learning</td>
<td>Synthesizing</td>
<td>Creative thinking</td>
<td>Include drawing plan and elevation in one diagram showing projections lines</td>
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<td>b) Side elevation of a solid object</td>
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<td>LEARNING OUTCOMES</td>
<td>SUGGESTED TEACHING &amp; LEARNING ACTIVITIES</td>
<td>GENERICS</td>
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<td>10.2.3 Draw</td>
<td>Use models to show that it is important to have a plan and at least two side elevations to construct a solid object. Carry out group project: Draw plan and elevation of buildings or structures, for example students or teachers dream home and construct a scale model based on the drawings. Involve real life situations such as in building prototypes and using actual home plans</td>
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