

1	Create a map of your own residential area 1. Add 4 Area (id, name) 2. Add 4 Garden (id, name) 3. Add 2 Highways (id, name) 4. Add 2 railway track (id, name, line) 5. Add 5 Railway stations(id, name, line) 6. Add 5 Restaurants (id, name) [At least 2 should be inside any garden] 7. Add 5 Hospitals 8. Add 10 Building / residential compound / Business Park.	25
2	Perform the following queries on above layers 1. Add a new column Garden_area and calculate the area of each garden 2. Show the largest garden. 3. Show all the railway tracks that intersect with Highways. 4. Find all the restaurants inside a garden. 5. Find all the railway tracks that do not intersects with highway	15
3	Viva	5
4	Journal	5

QGIS Practical – Residential Area Mapping Project

◇ Step-by-Step Guide – Map Creation in QGIS

☒ Step 1: Create a New QGIS Project

- Open QGIS
- Save the project as ResidentialArea.qgz

☒ Step 2: Create ‘Area’ Layer

- Go to: **Layer → Create Layer → New Shapefile Layer**
 - **Geometry Type:** Polygon
 - **File Name:** area.shp
 - **Fields:**
 - id – Whole number (Integer)
 - name – Text (String)

☒ Step 3: Add 4 Areas

- Click on the layer → Toggle **Edit Mode**
- Use **Add Polygon Feature** to draw:
 - id: 1, name: Vashi
 - id: 2, name: Nerul
 - id: 3, name: Sanpada
 - id: 4, name: Thane
- Save edits and exit Edit Mode

☒ Step 4: Create ‘Garden’ Layer

- Geometry Type: **Polygon**
- File Name: `garden.shp`
- Fields:
 - `id, name`

☒ Step 5: Add 4 Gardens

- Example gardens:
 - `id: 1, name: Central Park`
 - `id: 2, name: Eco Garden`
 - `id: 3, name: Lotus Garden`
 - `id: 4, name: Riverside Park`

☒ Step 6: Create ‘Highway’ Layer

- Geometry Type: **Line**
- File Name: `highway.shp`
- Fields:
 - `id, name`

☒ Step 7: Add 2 Highways

- Example:
 - `id: 1, name: Mumbai-Pune Expressway`
 - `id: 2, name: Palm Beach Road`

☒ Step 8: Create ‘Railway Track’ Layer

- Geometry Type: **Line**
- File Name: `railway_track.shp`
- Fields:
 - `id, name, line` (e.g., Central/Western)

☒ Step 9: Add 2 Railway Tracks

- Example:
 - `id: 1, name: Harbour Line, line: Central`
 - `id: 2, name: Thane Line, line: Central`
-

☒ Step 10: Create 'Railway Station' Layer

- Geometry Type: **Point**
- File Name: `station.shp`
- Fields:
 - `id, name, line`

☒ Step 11: Add 5 Railway Stations

- Example:
 - `id: 1, name: Vashi`
 - `id: 2, name: Sanpada`
 - `id: 3, name: Nerul`
 - `id: 4, name: Thane`
 - `id: 5, name: Belapur`
-

☒ Step 12: Create 'Restaurant' Layer

- Geometry Type: **Point**
- File Name: `restaurant.shp`
- Fields:
 - `id, name`

☒ Step 13: Add 5 Restaurants

- Example:
 - `id: 1, name: Pizza Paradise` (*inside garden*)
 - `id: 2, name: Green Garden Café` (*inside garden*)
 - `id: 3, name: Burger Point`
 - `id: 4, name: Tandoori Delight`
 - `id: 5, name: Spice Hub`
-

☒ Step 14: Create 'Hospital' Layer

- Geometry Type: **Point**
- File Name: `hospital.shp`
- Fields:
 - `id, name`

☒ Step 15: Add 5 Hospitals

- Example:
 - `id: 1, name: Metro Hospital`
 - `id: 2, name: Lifeline Hospital`

- `id: 3, name: CityCare Clinic`
 - `id: 4, name: Sunshine Hospital`
 - `id: 5, name: Global Health Centre`
-

☒ Step 16: Create ‘Building / Compound / Business Park’ Layer

- Geometry Type: **Point**
- File Name: `building.shp`
- Fields:
 - `id, name`

☒ Step 17: Add 10 Buildings / Compounds / Business Parks

- Example:
 - `id: 1, name: Orchid Residency`
 - `id: 2, name: Skyline Apartments`
 - `id: 3, name: Blue Heaven Towers`
 - `id: 4, name: Techno Park`
 - `id: 5, name: Galaxy Heights`
 - `id: 6, name: Marvel Residency`
 - `id: 7, name: Emerald Greens`
 - `id: 8, name: Skyline Business Hub`
 - `id: 9, name: Sunshine Plaza`
 - `id: 10, name: Neptune Chambers`

Performing Spatial Queries on Layers in QGIS

Query 1: Add a new column `Garden_area` and calculate the area of each garden

1. Right-click on the `garden` layer → Click **Open Attribute Table**.
 2. Click on the **Toggle Editing Mode** ( pencil icon).
 3. Click the **Field Calculator** (Σ icon).
 4. Create a new field:
 - **Output field name:** `Garden_area`
 - **Output field type:** Decimal (or Float)
 - **Expression:** `area($geometry)` *(This calculates area in square meters)*
 5. Click **OK**, then **Save Edits** and **Toggle Editing Mode Off**.
-

Query 2: Show the Largest Garden

1. Right-click on the `garden` layer → Open **Attribute Table**.
 2. Click the column header `Garden_area` to **sort it descending** (largest on top).
 3. The **topmost row** is your **largest garden**.
 4. You can also **select it on the map** by clicking that row.
-

Query 3: Show all Railway Tracks that Intersect with Highways

1. Go to **Vector** → **Spatial Query** → **Spatial Query**.
 2. In the dialog box:
 - **Select features from:** `railway_track`
 - **Where the feature:** **intersects**
 - **Reference features of:** `highway`
 3. Click **Apply** or **Run**.
 4. The railway tracks intersecting with highways will be selected on the map.
 5. You can export these selections if needed:
 - Right-click `railway_track` → **Export** → **Save Selected Features As...**
-

Query 4: Find all Restaurants Inside a Garden

1. Go to **Vector** → **Spatial Query**.
 2. Select:
 - **Select features from:** `restaurant`
 - **Where the feature:** **within**
 - **Reference features of:** `garden`
 3. Click **Apply** or **Run**.
 4. Restaurants inside gardens will be highlighted.
-

Query 5: Find Railway Tracks that Do NOT Intersect with Highways

1. Go to **Vector** → **Spatial Query**.
2. Set:
 - **Select features from:** `railway_track`
 - **That do not intersect**
 - **Reference features of:** `highway`
3. Click **Apply**.
4. These selected tracks are **not intersecting any highways**

1	Create a map of your own residential area 1. Add 4 Area (id, name) 2. Add 4 Garden (id, name) 3. Add 2 Highways (id, name) 4. Add 2 railway track (id, name, line) 5. Add 5 Railway stations(id, name, line) 6. Add 5 Restaurants (id, name) [At least 2 should be inside any garden] 7. Add 5 Hospitals 8. Add 10 Building / residential compound / Business.	25
2	Create a Map using above layers Add the following 1. Add a North Pointer 2. Add Legend and Scale 3. Use "+" Symbol to indicate hospitals. 4. Use a symbol indicating Metro station for one of the railway station. 5. Save your map in JPEG format with 1200 dpi of resolution.	15
3	Viva	5
4	Journal	5

Create a Map Layout and Add Elements

◇ Step 1: Open Print Layout

- In QGIS top menu → Click **Project** → **New Print Layout**
 - Give layout name: ResidentialMapLayout → Click **OK**
-

◇ Step 2: Add the Map to Layout

- In the layout window → Click **Add Map** tool ( icon)
 - Drag a rectangle across the layout to place the map
 - Your active QGIS map canvas will appear
-

◇ Step 3: Add North Pointer

- Click **Add Image** tool ( icon)
- Drag to create image box
- In **Item Properties** panel:

- Click the folder icon → Choose any north arrow from C:\Program Files\QGIS <version>\apps\qgis\svg\north_arrows
 - Resize and place at top-right or top-left
-

◇ Step 4: Add Legend

- Click **Add Legend** tool ( icon)
 - Click on layout to place it
 - In **Item Properties**, you can:
 - Rename layer names if needed
 - Uncheck unwanted layers
 - Adjust spacing and font
-

◇ Step 5: Add Scale Bar

- Click **Add Scalebar** tool ( icon)
 - Click on layout to place it
 - In **Item Properties**:
 - Choose units (e.g., meters)
 - Set style and number of segments
-

◇ Step 6: Use "+" Symbol for Hospitals

- In **Layers Panel**, right-click `hospital` → **Properties** → **Symbology**
 - Choose **Marker Symbol** → Select “Cross (+)” symbol
 - Change color to Red or Blue
 - Apply and Close
-

◇ Step 7: Set Metro Icon for One Railway Station

- Right-click `station` layer → Open **Attribute Table**
- Choose a station (e.g., Vashi) → Note its ID
- In Layer Properties → **Symbology** → Choose **Categorized**
 - Column: `id`
 - Assign normal symbol to others
 - Assign **Metro icon (SVG)** to Vashi:
 - Click on symbol → SVG Marker → Choose metro icon like subway symbol
- Apply and Close

◇ Step 8: Export as JPEG (1200 dpi)

- In the **Print Layout** window:
 - Click **Layout** → **Export as Image**
 - Choose file format: **JPEG**
 - Set **Resolution (DPI): 1200**
 - Save the image (e.g., ResidentialMap.jpg)
-

1	Create a map based on following assumptions 1. Add 1 Highways (id= "375") 2. Add 6 Farms (id, own_name) (2 farms near Highway) 3. Add 4 narrow Paths between farms (id) 4. Add a main road that passes near farms and touches the highway. 5. Add 2 Farm houses in any two farms (id, frm_id). 6. Add 4 Residential areas. (at-least one near farm and one near main road) 7. Add two Primary Schools 8. Add a Bus stop and an Auto Stand near a main road. 9. Add a Grampanchayat office 10. Add 4 wells (3 in farms and 1 in residential area)	25
2	Perform the following queries on above layers 1. Show all the farms that contains well. 2. Calculate area of each farm and Show the largest farm. 3. Show all the paths that intersect with Highways.	15
3	Viva	5
4	Journal	5

QGIS Practical: Create a Farm & Village Themed Map

◇ Step 1: Start New QGIS Project

- Open **QGIS**
 - Save project as VillageMap.qgz
-

Part 1: Creating the Map

Step 1: Create a New Project

1. **Open QGIS** and create a new project by selecting `Project > New`.

Step 2: Add the Highway Layer

1. **Create the Highway Layer:**
 - `Open Layer > Create Layer > New Shapefile Layer`.
 - Choose the layer type as **Line**.
 - Add a field for the `id` (Field type: Integer).
 - Save the layer as "Highway".
 - Add the highway with `id = 375` using the **Add Line Feature** tool, drawing the highway on the map.

Step 3: Create Farms Layer

1. **Create the Farms Layer:**
 - `Open Layer > Create Layer > New Shapefile Layer`.
 - Choose the layer type as **Point**.
 - Add fields for `id` (Integer) and `own_name` (Text).
 - Save the layer as "Farms".
 - Add 6 farms using the **Add Point Feature** tool. Ensure that 2 are near the highway.

Step 4: Create Narrow Paths Layer

1. **Create the Narrow Paths Layer:**
 - `Open Layer > Create Layer > New Shapefile Layer`.
 - Choose the layer type as **Line**.
 - Add a field for `id` (Integer).
 - Save the layer as "Narrow Paths".
 - Draw 4 narrow paths connecting the farms using the **Add Line Feature** tool.

Step 5: Create the Main Road Layer

1. **Create the Main Road Layer:**
 - `Open Layer > Create Layer > New Shapefile Layer`.
 - Choose the layer type as **Line**.
 - No additional attributes needed.
 - Save the layer as "Main Road".
 - Draw the main road passing near farms and touching the highway.

Step 6: Create Farmhouses Layer

1. **Create the Farmhouses Layer:**
 - `Open Layer > Create Layer > New Shapefile Layer`.
 - Choose the layer type as **Point**.

- Add fields for `id` (Integer) and `frm_id` (Integer).
- Save the layer as "Farmhouses".
- Add 2 farmhouses, linking them to specific farms via the `frm_id`.

Step 7: Create Residential Areas Layer

1. Create the Residential Areas Layer:

- Open `Layer > Create Layer > New Shapefile Layer`.
- Choose the layer type as **Point**.
- Save the layer as "Residential Areas".
- Add 4 residential areas (one near a farm, one near the main road).

Step 8: Create Primary Schools Layer

1. Create the Primary Schools Layer:

- Open `Layer > Create Layer > New Shapefile Layer`.
- Choose the layer type as **Point**.
- Save the layer as "Primary Schools".
- Add 2 primary school locations.

Step 9: Create Bus Stop and Auto Stand Layer

1. Create the Bus Stop and Auto Stand Layer:

- Open `Layer > Create Layer > New Shapefile Layer`.
- Choose the layer type as **Point**.
- Save the layer as "Bus Stop & Auto Stand".
- Add the bus stop and auto stand near the main road.

Step 10: Create Grampanchayat Office Layer

1. Create the Grampanchayat Office Layer:

- Open `Layer > Create Layer > New Shapefile Layer`.
- Choose the layer type as **Point**.
- Save the layer as "Grampanchayat Office".
- Add the Grampanchayat office location.

Step 11: Create Wells Layer

1. Create the Wells Layer:

- Open `Layer > Create Layer > New Shapefile Layer`.
- Choose the layer type as **Point**.
- Save the layer as "Wells".
- Add 4 wells (3 on farms and 1 in a residential area).

Step 12: Style the Layers

1. For each layer, you can set the styling in the **Layer Properties**:

- Set **different symbols** for each feature (e.g., highways, farms, houses, schools).
- Use **different colors** and **labels** to differentiate them visually.

Spatial Queries – Farm Village Map

◇ Query 1: Show all the farms that contain wells

Steps:

1. Go to **Vector** → **Spatial Query**
2. In the dialog:
 - **Input Layer:** farms
 - **Predicate:** Contains
 - **Reference Layer:** well
3. Click **Run**
4. Selected farms will be highlighted (these contain wells)

 *Optional:* Use “Create Layer from Selected Features” to export selected farms.

◇ Query 2: Calculate area of each farm and show the largest farm

Steps:

1. Open **Attribute Table** of farms layer
 2. Enter **Field Calculator** (abacus icon)
 3. Create new field:
 - **Field Name:** farm_area
 - **Output Field Type:** Decimal (Float)
 - **Expression:** area(\$geometry) → Click OK
 4. Sort the farm_area column (descending)
 5. The top row will show the **largest farm**
-

◇ Query 3: Show all paths that intersect with highways

Steps:

1. Go to **Vector** → **Spatial Query**
2. Select:
 - **Input Layer:** paths

- **Predicate:** Intersects
 - **Reference Layer:** highway
3. Click **Run**
 4. Intersecting paths will be selected

 *Optional:* Export as new layer → “Export” → “Save Selected Features As...”

1	Create a map based on following assumptions 1. Add 1 Highways (id= "375") 2. Add 6 Farms (id, own_name) (2 farms near Highway) 3. Add 4 narrow Paths between farms (id) 4. Add a main road that passes near farms and touches the highway. 5. Add 2 Farm houses in any two farms (id, frm_id). 6. Add 4 Residential areas. (at-least one near farm and one near main road) 7. Add two Primary Schools 8. Add a Bus stop and an Auto Stand near a main road. 9. Add a Grampanchayat office 10. Add 4 wells (3 in farms and 1 in residential area)	25
2	Format the above layers using different styling options.	15
3	Viva	5
4	Journal	5

Step 1: Prepare Your Data Layers

You will need to create vector layers for each element (Highways, Farms, Paths, etc.). Follow the steps to create them.

1. **Create Highway Layer**
 - **Layer Type:** Vector Layer (Line)
 - **Attributes:** id (375)
 - **Style:** Set the line width to represent the highway (e.g., thick line, dark color).
 - Draw the highway feature on the map using the **Add Line** tool.
2. **Create Farms Layer**
 - **Layer Type:** Vector Layer (Point)
 - **Attributes:** id, own_name
 - **Style:** Use different symbols for each farm. For example, a farm icon or circle with farm names as labels.
 - Draw 6 farms. Place 2 near the highway for proximity.
3. **Create Narrow Paths Layer**
 - **Layer Type:** Vector Layer (Line)
 - **Attributes:** id

- **Style:** Use a thinner line style to represent narrow paths.
- Draw 4 narrow paths connecting the farms.
- 4. **Create Main Road Layer**
 - **Layer Type:** Vector Layer (Line)
 - **Attributes:** None.
 - **Style:** Set a moderate line width.
 - Draw a main road that passes near the farms and touches the highway.
- 5. **Create Farmhouses Layer**
 - **Layer Type:** Vector Layer (Point)
 - **Attributes:** `id`, `frm_id` (Farm ID)
 - **Style:** Use a unique symbol (e.g., house icon).
 - Draw 2 farmhouses, assigning them to farms based on proximity.
- 6. **Create Residential Areas Layer**
 - **Layer Type:** Vector Layer (Polygon/Point)
 - **Attributes:** None.
 - **Style:** Use a distinctive color or pattern to represent the residential areas.
 - Draw 4 residential areas, ensuring that at least one is near a farm and one near the main road.
- 7. **Create Primary Schools Layer**
 - **Layer Type:** Vector Layer (Point)
 - **Attributes:** None.
 - **Style:** Use a school icon symbol.
 - Draw 2 primary schools at appropriate locations on the map.
- 8. **Create Bus Stop and Auto Stand Layer**
 - **Layer Type:** Vector Layer (Point)
 - **Attributes:** None.
 - **Style:** Use an icon symbol for bus stops and auto stands.
 - Draw the bus stop and auto stand near the main road.
- 9. **Create Grampanchayat Office Layer**
 - **Layer Type:** Vector Layer (Point)
 - **Attributes:** None.
 - **Style:** Use a unique symbol for the Grampanchayat office (e.g., government building).
 - Draw the Grampanchayat office at a central location.
- 10. **Create Wells Layer**
 - **Layer Type:** Vector Layer (Point)
 - **Attributes:** None.
 - **Style:** Use a well icon or a simple circle.
 - Draw 4 wells, with 3 on farms and 1 in a residential area.

Step 2: Add Styles and Labels

For each layer, apply styles to differentiate the elements visually. Here's how you can style each layer:

1. **Highways**
 - Open Layer Properties -> Symbology.
 - Change the line width to 4 or 5 pixels, and set a darker color (e.g., dark gray or black).
2. **Farms**

- Open Layer Properties -> Symbology.
 - Set the symbol to a circle or farm icon.
 - Use different colors for each farm or a similar color palette for a uniform look.
3. **Narrow Paths**
 - Open Layer Properties -> Symbology.
 - Set the line width to 1 pixel and select a lighter color like gray.
 4. **Main Road**
 - Open Layer Properties -> Symbology.
 - Set the line width to 3 pixels and choose a color like brown or gray.
 5. **Farmhouses**
 - Open Layer Properties -> Symbology.
 - Set a unique symbol, like a house or dot, for each farmhouse.
 6. **Residential Areas**
 - Open Layer Properties -> Symbology.
 - Use a fill color like light yellow or green to represent residential areas.
 - Add labels for residential area names if applicable.
 7. **Primary Schools**
 - Open Layer Properties -> Symbology.
 - Use a school icon or symbol.
 8. **Bus Stop and Auto Stand**
 - Open Layer Properties -> Symbology.
 - Use bus stop and auto stand icons from the symbol library.
 9. **Grampanchayat Office**
 - Open Layer Properties -> Symbology.
 - Use a government building or office symbol.
 10. **Wells**
 - Open Layer Properties -> Symbology.
 - Use a circle or water well icon.

Step 3: Label Features

1. **Label Farms:** Enable labeling for the Farms layer. Go to Layer Properties -> Labels, and choose to label the farms by own_name.
2. **Label Residential Areas:** Enable labeling for the Residential Areas layer and add relevant names or IDs.

Step 4: Create a Map Layout

1. **Open Print Layout:** Go to Project -> New Print Layout.
2. **Add Map:** Click on Add Map and draw a rectangle to add the map to the layout.
3. **Add Legends, Scale, and North Arrow:** Use the Add Legend, Add Scale Bar, and Add North Arrow tools to complete your map.
4. **Customize:** Arrange these elements on the layout and customize their properties (font size, color, etc.).

Step 5: Save and Export

Once the map looks good, save your project and export it as a PNG, PDF, or other format via Layout -> Export as Image/PDF.

1	Create a map based on following assumptions 1. Add 1 Highways (id= "375") 2. Add 6 Farms (id, own_name) (2 farms near Highway) 3. Add 4 narrow Paths between farms (id) 4. Add a main road that passes near farms and touches the highway. 5. Add 2 Farm houses in any two farms (id, frm_id). 6. Add 4 Residential areas. (at-least one near farm and one near main road) 7. Add two Primary Schools 8. Add a Bus stop and an Auto Stand near a main road. 9. Add a Grampanchayat office 10. Add 4 wells (3 in farms and 1 in residential area)	25
2	Open "Open Street Map" Search Taj Mahal, Agra Geo-reference the aerial image of Taj Mahal (Hint: use Image from required Files)	15
3	Viva	5
4	Journal	5

Part 2: Open Street Map and Geo-Reference the Taj Mahal Image

Step 1: Open OpenStreetMap in QGIS

1. Install QuickMapServices Plugin:

- Go to Plugins > Manage and Install Plugins.
- Search for QuickMapServices, and install it.
- Once installed, go to Web > QuickMapServices > OSM to add the OpenStreetMap layer.

Step 2: Search for Taj Mahal, Agra

1. Use the Search Tool:

- In the QGIS toolbar, click on the **Find** tool (magnifying glass) and search for "Taj Mahal, Agra".
- QGIS will zoom to the location of Taj Mahal.

Step 3: Add the Aerial Image of Taj Mahal

1. Add the Image:

- Go to Raster > Add Raster Layer.

- Browse for the image file of the Taj Mahal (ensure the file is available locally or from a specific directory).
- Click `Open` to add the image as a new raster layer.

Step 4: Geo-Reference the Image

1. **Open the Geo-Referencer:**

- Go to `Raster > Georeferencer > Georeferencer`.
- The GeoReferencer window will open.

2. **Add Ground Control Points (GCP):**

- In the **Geo-Referencer** window, select the **Add Point** tool.
- Click on known locations (for example, corners of the Taj Mahal, identifiable landmarks) on the aerial image and match them to their coordinates on the map.

3. **Transform the Image:**

- Once enough GCPs are added, click **Start Georeferencing**.
- The software will transform the image and align it with the map based on the points you provided.

Step 5: Save and Export the Map

1. Once the map is ready, you can export it by going to `Project > New Print Layout` and selecting the layers to display on your final map.
 2. Add elements like **legend**, **scale bar**, and **north arrow** as needed.
 3. Export the layout as an image or PDF via the `Export as Image` option in the Print Layout.
-

1	Create a map of your own residential area 1. Add 4 Area (id, name) 2. Add 4 Garden (id, name) 3. Add 2 railway track (id, name, line) 4. Add 5 Railway stations(id, name, line) 5. Add 5 Restaurants (id, name) [At least 2 should be inside any garden]	20
2	Create a Map using above layers Perform the following tasks 1. Add a North Pointer 2. Add Legend and Scale 3. Add a suitable title with proper formatting. 4. Use a symbol indicating Metro station for one of the railway station. 5. Save your map in JPEG format with 1200 dpi of resolution.	10
3	Open "Open Street Map" Search Girgaum Chowpatty Beach Geo-reference the aerial image of Girgaum Chowpatty beach (Hint: use Image from required Files)	10
4	Viva	5
5	Journal	5

Part 1: Create the Layers

Step 1: Create the Area Layer

1. Create the Area Layer:

- Open Layer > Create Layer > New Shapefile Layer.
- Choose the layer type as **Polygon**.
- Add fields for id (Integer) and name (Text).
- Save the layer as "Areas".
- Add 4 areas using the **Add Polygon Feature** tool.

Step 2: Create the Garden Layer

1. Create the Garden Layer:

- Open Layer > Create Layer > New Shapefile Layer.
- Choose the layer type as **Polygon**.
- Add fields for id (Integer) and name (Text).
- Save the layer as "Gardens".
- Add 4 garden locations, ensuring that 2 are inside any area.

Step 3: Create the Railway Track Layer

1. Create the Railway Track Layer:

- Open Layer > Create Layer > New Shapefile Layer.
- Choose the layer type as **Line**.
- Add fields for id (Integer), name (Text), and line (Text).
- Save the layer as "Railway Tracks".
- Draw 2 railway tracks using the **Add Line Feature** tool.

Step 4: Create the Railway Station Layer

1. Create the Railway Station Layer:

- Open **Layer > Create Layer > New Shapefile Layer**.
- Choose the layer type as **Point**.
- Add fields for **id** (Integer), **name** (Text), and **line** (Text).
- Save the layer as "Railway Stations".
- Add 5 railway stations using the **Add Point Feature** tool.

Step 5: Create the Restaurant Layer

1. Create the Restaurant Layer:

- Open **Layer > Create Layer > New Shapefile Layer**.
 - Choose the layer type as **Point**.
 - Add fields for **id** (Integer) and **name** (Text).
 - Save the layer as "Restaurants".
 - Add 5 restaurants, ensuring that at least 2 are inside any garden.
-

Part 2: Creating the Map

Step 1: Style the Layers

1. Style the Layers:

- Right-click on each layer and select **Properties**.
- Set the symbology for each layer:
 - **Areas:** Choose a color fill for areas.
 - **Gardens:** Use a distinct color for gardens.
 - **Railway Tracks:** Use a line symbol to represent tracks.
 - **Railway Stations:** Use a point symbol, and for one station, choose a symbol indicating a **Metro Station**.
 - **Restaurants:** Use a different symbol for restaurants.

Step 2: Add a North Pointer

1. Add North Pointer:

- Go to the **Layout** tab > **Add Item > Add North Arrow**.
- Select a suitable north pointer and place it on the map.

Step 3: Add a Legend

1. Add Legend:

- Go to **Layout > Add Item > Add Legend**.
- The legend will automatically include the layers in the map. Adjust the placement and styling as needed.

Step 4: Add a Scale Bar

1. Add a Scale Bar:

- Go to **Layout > Add Item > Add Scale Bar**.
- Choose the scale type and adjust its position on the map.

Step 5: Add a Title

1. **Add a Title:**
 - Go to **Layout > Add Item > Add Label**.
 - Add a suitable title (e.g., "Map of My Residential Area").
 - Format the title by adjusting font size, style, and position.
-

Part 3: Save the Map

Step 1: Export the Map as JPEG

1. Once you have styled your map with all necessary layers, legends, and other items, go to:
 - `Project > New Print Layout`.
 - Name your layout and click **OK**.
 2. In the layout view, adjust the map area, ensuring everything fits nicely.
 3. Once satisfied, go to **Layout > Export as Image**.
 - Set the resolution to **1200 dpi**.
 - Choose **JPEG** as the format.
 - Save the image in the desired location.
-

Part 4: Open and Geo-reference the Aerial Image of Girgaum Chowpatty Beach

Step 1: Open OpenStreetMap in QGIS

1. **Install QuickMapServices Plugin:**
 - Go to `Plugins > Manage and Install Plugins`.
 - Search for `QuickMapServices` and install it.
 - Once installed, go to `Web > QuickMapServices > OSM` to add OpenStreetMap.

Step 2: Search for Girgaum Chowpatty Beach

1. **Search for Girgaum Chowpatty Beach:**
 - Use the **Find** tool (magnifying glass) in the toolbar to search for "Girgaum Chowpatty Beach".
 - QGIS will zoom to the location.

Step 3: Add and Geo-reference the Aerial Image

1. **Add the Aerial Image:**
 - Go to `Raster > Add Raster Layer`.

- Browse to the directory where the aerial image is stored and open it.
 - 2. **Geo-reference the Image:**
 - Go to **Raster > Georeferencer > Georeferencer**.
 - Add Ground Control Points (GCP) by clicking known locations (e.g., identifiable corners or landmarks) on the aerial image and matching them with coordinates on the map.
 - 3. **Transform the Image:**
 - Once enough GCPs are added, click **Start Georeferencing**.
 - The software will align the aerial image with the map.
-

1	Open Ind_adm0.shp file in QGIS Geo-reference the Maharashtra Map at appropriate location. (Hint: use Image from required Files)	10
2	Create a Raster Data Model by importing Population Density Grid of 1990 & Population Density Grid of 2000. Calculate the difference in population from 1990 to 2000. Distinguish the populated areas by using colours on the basis of population density change.	20
3	Import “10n060e_20101117_gmted_mea300.tif” raster data which represent surface elevations map of India. To study the elevation of hilly area of North India, extract the required Raster area by Extent. Perform Hill Shade surface analysis using the above elevation map.	10
4	Viva	5
5	Journal	5

Task 1: Geo-reference the Maharashtra Map

Step 1: Open Ind_adm0.shp in QGIS

1. Launch QGIS and go to **Layer > Add Layer > Add Vector Layer**.
2. Browse to the location of Ind_adm0.shp and open it.
 - The map of India should appear.

Step 2: Geo-reference the Maharashtra Map

1. **Add the Image of Maharashtra:**
 - Go to **Raster > Add Raster Layer**.
 - Browse to the directory where the image of Maharashtra is stored (you might need to use the image from the required files).
2. **Open the Geo-referencing Tool:**
 - Go to **Raster > Georeferencer > Georeferencer**.
 - Click on **Open Raster** in the Georeferencer window and select the Maharashtra map image.
3. **Add Ground Control Points (GCP):**

- Use the **Add Point** tool to click on well-known locations (like city corners or landmarks) on both the Maharashtra image and the base map of India.
 - Use **the View** to match each GCP's coordinates in the image to its corresponding position on the base map.
4. **Start Georeferencing:**
- Once you have enough GCPs, click on **Start Georeferencing**.
 - The Maharashtra map will align with the rest of the India map in the appropriate location.

Task 2: Create a Raster Data Model for Population Density Change

Step 1: Import the Population Density Grids for 1990 and 2000

1. **Load the Population Density Grids:**
 - Go to **Raster > Add Raster Layer**.
 - Browse and select the Population Density Grid for 1990 (population_density_1990.tif) and 2000 (population_density_2000.tif).

Step 2: Calculate the Difference in Population

1. **Open the Raster Calculator:**
 - Go to **Raster > Raster Calculator**.
 - The Raster Calculator window will open.
2. **Calculate the Difference:**
 - In the Raster Calculator, create an expression to calculate the difference between the 2000 and 1990 population density grids. Example:

```

arduino
CopyEdit
"population_density_2000" - "population_density_1990"

```

- Click **OK** to create the new raster layer.

Step 3: Distinguish Populated Areas

1. **Style the Population Density Change:**
 - Right-click on the resulting difference layer and select **Properties**.
 - Go to the **Symbology** tab.
 - Set the **Color Ramp** to display positive and negative changes in population (e.g., using a blue-to-red gradient).
 - Red can represent areas with increased population.
 - Blue can represent areas with decreased population.
2. **Adjust the Symbology:**
 - Set the **min/max values** appropriately for the color scheme to clearly highlight changes.

Task 3: Import and Analyze Elevation Data

Step 1: Import the Elevation Data

1. Load the Surface Elevation Raster:

- Go to **Raster > Add Raster Layer**.
- Browse and select the raster file `10n060e_20101117_gmted_mea300.tif` (this represents the surface elevation map of India).
- The raster map should appear with elevation data.

Step 2: Extract the Required Raster Area (North India)

1. Extract by Extent:

- Go to **Raster > Extraction > Clipper**.
- In the **Clipper** window, select **Extract by Extent**.
- Set the **Extent** to cover the hilly areas of North India (you can manually adjust the extent or use coordinates for a more precise selection).
- Click **Run** to extract the region of interest.

Step 3: Perform Hillshade Surface Analysis

1. Generate Hillshade:

- Go to **Raster > Analysis > Hillshade**.
- Select the extracted raster layer.
- Set the **Azimuth** and **Altitude** for the hillshade. Typical values:
 - **Azimuth** = 315° (for light source in the west).
 - **Altitude** = 45° (standard light angle).
- Click **OK** to generate the hillshade.

2. Style the Hillshade Layer:

- Right-click on the hillshade layer, select **Properties**.
 - In the **Symbology** tab, choose a **Black and White** color ramp for a realistic shadow effect.
 - Adjust the **Contrast Enhancement** to enhance details of the elevation.
-

1	Import “10n060e_20101117_gmted_mea300.tif” raster data which represent surface elevations map of India. To study the elevation of hilly area of North India, extract the required Raster area by Extent. Perform Terrain analysis using the above elevation map.	20
2	Import “sample.csv” file in a new QGIS project. Using attribute table perform the following tasks • Format “Tsunami” with red colour and others using black colour symbol. • Show the place with highest number of death value. • Show the places where Tsunami occurred for highest time in terms of hours. • Show all the Natural calamities that occurred in India • Show all the places where Tsunami occurred between 2000 and 2019.	20
3	Viva	5
4	Journal	5

Task 1: Terrain Analysis with Elevation Data

Step 1: Import the Elevation Data

1. **Open QGIS** and go to **Raster > Add Raster Layer**.
2. Browse and select the raster file `10n060e_20101117_gmted_mea300.tif`, which represents the surface elevation map of India.
3. The raster map will load and show elevation data.

Step 2: Extract the Required Raster Area (North India)

1. **Go to Raster > Extraction > Clipper**.
2. In the **Clipper** window, select **Extract by Extent**.
 - Set the extent manually or specify the coordinates for the northern region of India.
 - Click **Run** to extract the area of interest (the hilly area of North India).

Step 3: Perform Terrain Analysis (Slope, Aspect, Hillshade)

1. **Generate Slope:**
 - Go to **Raster > Terrain Analysis > Slope**.
 - Select the extracted elevation raster.
 - Choose the output file path and click **Run**.
 - The slope raster will show the steepness of the terrain.
2. **Generate Aspect** (direction of slope):
 - Go to **Raster > Terrain Analysis > Aspect**.
 - Select the extracted elevation raster and click **Run**.
 - This raster will show the direction of slope, which is helpful for understanding terrain orientation.
3. **Generate Hillshade:**
 - Go to **Raster > Analysis > Hillshade**.
 - Select the extracted elevation raster.
 - Set the **Azimuth** (315°) and **Altitude** (45°) for lighting parameters.
 - Click **Run** to generate a hillshade that simulates shadows based on terrain.
 - The hillshade layer will give a 3D effect to highlight the terrain's features.

4. Style the Layers:

- Right-click on each resulting raster (slope, aspect, and hillshade) and go to **Properties**.
 - In the **Symbology** tab, choose appropriate color ramps to visualize the terrain features. For example:
 - **Slope**: Use a color gradient where steep slopes are shown in darker colors.
 - **Aspect**: Use a color scheme that shows direction (e.g., greens for north-facing slopes, yellows for south-facing slopes).
 - **Hillshade**: Apply a gray scale to enhance the 3D effect.
-

Task 2: Import and Analyze `sample.csv` in QGIS

Step 1: Import the `sample.csv` File

1. **Go to Layer > Add Layer > Add Delimited Text Layer.**
2. Browse to the location of `sample.csv` and select it.
3. In the **Add Layer** window, ensure that the **X** and **Y** fields are set to the correct longitude and latitude columns in the CSV file (if geographic coordinates are provided).
4. Click **OK** to load the data points from the CSV into the map.

Step 2: Format “Tsunami” with Red Colour

1. **Open Attribute Table:**
 - Right-click on the CSV layer and select **Open Attribute Table**.
2. **Apply Style Based on “Tsunami”:**
 - Right-click on the CSV layer and choose **Properties**.
 - Go to the **Symbology** tab.
 - Choose **Categorized** styling and select the column containing the type of natural calamity (e.g., "Calamity_Type").
 - Set the **Tsunami** entries to **Red** and other calamities to **Black** by manually choosing the color.

Step 3: Show the Place with Highest Number of Deaths

1. **Find Highest Death Count:**
 - In the **Attribute Table**, sort the column for "Deaths" in descending order.
 - Note the place with the highest death count.
2. **Highlight the Location:**
 - Right-click on the layer and choose **Zoom to Feature(s)** to zoom into the location with the highest death toll.

Step 4: Show the Place with Tsunami Occurred for the Highest Time (in Hours)

1. **Sort by Time:**
 - In the **Attribute Table**, find the column for **Time** (the duration of the tsunami).

- Sort this column to identify the place where the tsunami lasted the longest in terms of hours.
- 2. **Highlight the Location:**
 - Zoom to the location with the longest tsunami duration by right-clicking the layer and selecting **Zoom to Feature(s)**.

Step 5: Show All Natural Calamities in India

1. **Filter for Natural Calamities:**
 - In the **Attribute Table**, create a **Query** using the **Select by Expression** tool.
 - Set the expression to select all rows where the "Calamity_Type" is not null or equals "Natural Calamity."
 - Highlight the locations of all the natural calamities on the map.

Step 6: Show Tsunami Occurred Between 2000 and 2019

1. **Filter Tsunami Occurrences:**
 - In the **Attribute Table**, filter the data based on the year.
 - Use the **Select by Expression** tool with an expression like:

```

bash
CopyEdit
"Year" >= 2000 AND "Year" <= 2019 AND "Calamity_Type" =
'Tsunami'

```
2. **Zoom to the Selected Features:**
 - Right-click the layer and select **Zoom to Selected** to view all the places where the tsunami occurred between 2000 and 2019.

1	Automating Map Creation with Print Composer Atlas	20
2	Demonstrate the use of Raster data sampling.	20
3	Viva	5
4	Journal	5

1. Automating Map Creation with Print Composer Atlas (20 Marks)

Objective:

To automatically generate individual maps for each feature (e.g., each ward, zone, or district) using the **Atlas** feature in QGIS Print Layout.

Steps:

1. **Open QGIS and Load Data:**
Load the polygon shapefile layer (e.g., wards, villages, etc.) which will act as the coverage layer.
2. **Go to Project → New Print Layout:**
Give your layout a name (e.g., "Atlas Maps").
3. **Add a Map Frame:**
Click the **Add Map** tool and draw the map canvas on the layout.
4. **Enable Atlas Generation:**
In the right panel, click on the **Atlas** tab → Check **“Generate an Atlas”**.
5. **Select the Coverage Layer:**
Under **“Coverage Layer”**, select the layer with features you want to make individual maps for.
6. **Set Page Name Field (Optional):**
Choose a field (like `name`, `ID`, etc.) for the map name.
7. **Map Frame Configuration:**
Select the map frame → In the Item Properties, check **“Controlled by Atlas”**.
8. **Add Labels (Optional):**
Add text labels using dynamic variables like `[ % "name" % ]` to display names on each map.
9. **Configure Output Settings (Optional):**
Under **Atlas** → **Export Atlas**, choose format (PDF/Images), file naming pattern, and output folder.
10. **Preview and Export:**
Use **Preview Atlas** to check each map, then **Export Atlas** to generate all maps automatically.

Conclusion:

Using the Atlas tool in Print Composer saves time and effort by automating map creation for multiple features.

2. Demonstrate the Use of Raster Data Sampling in QGIS

Objective:

To extract or analyze pixel values from a raster image (like elevation, temperature, NDVI, etc.) using sample points or vector layers.

Steps to Perform Raster Data Sampling in QGIS:

1. **Open QGIS and Load Data:**
 - Load a **Raster layer** (e.g., DEM, satellite image).

- Load or create a **Point or Polygon vector layer** to extract data from the raster.
- 2. **Check Coordinate Reference System (CRS):**
 - Ensure both raster and vector layers are in the same CRS.
- 3. **Install Processing Plugin (if not already):**
 - Go to **Plugins → Manage and Install Plugins → Enable Processing.**
- 4. **Open the ‘Sample Raster Values’ Tool:**
 - Go to **Processing → Toolbox.**
 - Search “**Sample raster values**”.
- 5. **Configure the Tool:**
 - **Input Layer:** Select the vector layer (points or polygons).
 - **Raster Layer(s):** Select the raster(s) you want to sample from.
 - Choose whether to **append results as fields** to the vector layer.
- 6. **Run the Tool:**
 - Click **Run** and wait for the process to finish.
- 7. **View Results:**
 - The output will be a new vector layer with raster values added as new attributes (fields).
- 8. **Export the Results (Optional):**
 - Right-click the output layer → **Export → Save Features As → Save as new shapefile or CSV** for analysis.

Conclusion:

Raster data sampling is useful for extracting pixel-based information at specific locations, aiding spatial analysis like elevation at points, NDVI values at farms, etc.

1	Demonstrate Interpolation of point data.	20
2	Demonstrate the use of Raster data sampling.	20
3	Viva	5
4	Journal	5

☒ 1. Demonstrate Interpolation of Point Data in QGIS

Objective:

To generate a continuous surface (raster) from discrete point data using interpolation techniques such as **IDW (Inverse Distance Weighting)** or **TIN (Triangulated Irregular Network)**.

Steps:

1. **Open QGIS and Load Point Data:**
 - Load a vector point layer (e.g., rainfall stations, temperature data, etc.) that has a **numeric attribute** (like rainfall value, elevation, etc.).
 2. **Check Attribute Table:**
 - Ensure that each point has a numeric value in a specific field (e.g., "rainfall").
 3. **Open Interpolation Tool:**
 - Go to **Processing → Toolbox**.
 - Search and open **"Interpolation"** under **Raster Analysis**.
 4. **Configure Interpolation Parameters:**
 - **Input layer:** Select your point layer.
 - **Interpolation attribute:** Choose the numeric field (e.g., rainfall).
 - **Interpolation method:** Select **IDW** (Inverse Distance Weighted) or **TIN**.
 - **Extent & Resolution:** Define the output raster extent and resolution.
 5. **Run the Tool:**
 - Click **Run** to create the interpolated raster.
 6. **View and Style the Output:**
 - The resulting raster layer appears in the Layers panel.
 - Use the **Symbolology tab** to apply a color ramp (e.g., greens to reds) to visualize the surface.
 7. **(Optional) Add Contours:**
 - You can generate **contour lines** from the raster using the **Contour tool** in the toolbox.
-

Conclusion:

Interpolation helps convert point-based data into a continuous surface, useful for visualizing variations in elevation, temperature, rainfall, etc.

☒ 2. Demonstrate the Use of Raster Data Sampling in QGIS

Objective:

To extract pixel values from a raster dataset (e.g., elevation, NDVI) using a vector layer (point or polygon).

Steps:

1. **Open QGIS and Load Data:**
 - Load your **Raster layer** (e.g., DEM, NDVI).
 - Load or create a **vector layer** (points or polygons) for sampling locations.
2. **Check CRS Compatibility:**
 - Make sure both raster and vector layers have the same **Coordinate Reference System (CRS)**.
3. **Open 'Sample Raster Values' Tool:**
 - Go to **Processing → Toolbox**.
 - Search and open **"Sample raster values"** under **Raster Analysis**.

4. **Set Parameters:**
 - **Input point/polygon layer:** Choose the vector layer.
 - **Raster layer(s):** Select one or more raster layers.
 - Enable **append raster values as new attributes**.
5. **Run the Tool:**
 - Click **Run** to generate a new vector layer with raster values added.
6. **View Results:**
 - Open the attribute table of the output layer to view the sampled raster values in new columns.
7. **(Optional) Export Results:**
 - Right-click the result layer → **Export** → **Save Features As** CSV or Shapefile.

Conclusion:

Raster sampling helps extract data like elevation or NDVI at specific locations, enabling deeper spatial analysis.

1	Validate Map data using Excel. Perform the following tasks • Format the data set • Remove the duplicate entries if any. • Coding of variable. • Verify the Plausibility of Data.	20
2	Validate Map data using QGIS. • Verify the coordinates of Map Data. • Prepare the data for mapping. • Map the data.	20
3	Viva	5
4	Journal	5

☒ 1. Validate Map Data Using Excel

Objective:

To clean and validate spatial data in Excel before using it for mapping in QGIS or other GIS software.

◇ Steps:

A. Format the Dataset

1. Open the Excel file containing the map data (e.g., coordinates, names, attributes).
 2. Ensure that each column has proper headings like ID, Name, Latitude, Longitude, Type, etc.
 3. Check that all values are correctly placed under respective columns.
-

B. Remove Duplicate Entries

1. Select the entire dataset (including headers).
 2. Go to the **Data** tab → Click **Remove Duplicates**.
 3. Select columns (e.g., Latitude and Longitude) to check for duplicates.
 4. Click OK – Excel will remove duplicate rows if found.
-

C. Coding of Variable

1. Convert text-based categories into numeric codes for analysis.
 - Example: "Urban" = 1, "Rural" = 2.
2. Insert a new column like **"Location Code"**, then apply codes using **IF** or **VLOOKUP**.

```
excel
CopyEdit
=IF(B2="Urban",1,2)
```

D. Verify the Plausibility of Data

1. Check if all coordinates are valid:
 - **Latitude** should be between **-90 to +90**
 - **Longitude** should be between **-180 to +180**
 2. Sort or filter columns to identify outliers or blank values.
 3. Use **Conditional Formatting** to highlight invalid or missing entries.
-

Conclusion:

Validating map data in Excel ensures clean, structured, and accurate inputs for GIS mapping.

☒ 2. Validate Map Data Using QGIS

Objective:

To check, prepare, and visualize map data using QGIS software for accurate spatial representation.

◇ Steps:**A. Verify the Coordinates of Map Data**

1. Load the CSV or Shapefile containing map data into QGIS.
 2. If using a CSV, go to **Layer** → **Add Layer** → **Add Delimited Text Layer**.
 - Select X (Longitude) and Y (Latitude) fields.
 3. Ensure the correct **Coordinate Reference System (CRS)** (e.g., WGS 84 – EPSG:4326).
-

B. Prepare the Data for Mapping

1. Inspect the attribute table for missing or incorrect entries.
 2. Remove or correct invalid data using **Field Calculator** or **Attribute Table Editor**.
 3. Use **Geometry Check Tool**:
 - Go to **Vector** → **Geometry Tools** → **Check Validity**.
 - Fix invalid geometries if required.
-

C. Map the Data

1. Once cleaned, visualize the data by:
 - Applying **Symbology** based on attributes (e.g., type, category).
 - Labeling points using field values (e.g., name or ID).
 2. You can also add **Basemaps** from **XYZ Tiles** to verify positions visually.
-

Conclusion:

QGIS allows precise validation and visualization of spatial data, ensuring readiness for mapping and analysis.