

## ENTRY

As you have learned in spatial modelling lesson, spatial objects can be described as point, line and polygon (areal) features. Moreover, the spatial objects can be represented in object mode and/or image (raster) mode. In this unit, you will learn how to describe the geometric properties of spatial objects in image mode and object mode.

At the end of the unit, you should be able to describe geometric properties of point features, line features and polygon features in image mode or object mode especially for your spatial analysis projects.

## CLARIFICATION

### Description of spatial properties

Refer to the PDF version of animation presentation.

### Point Features

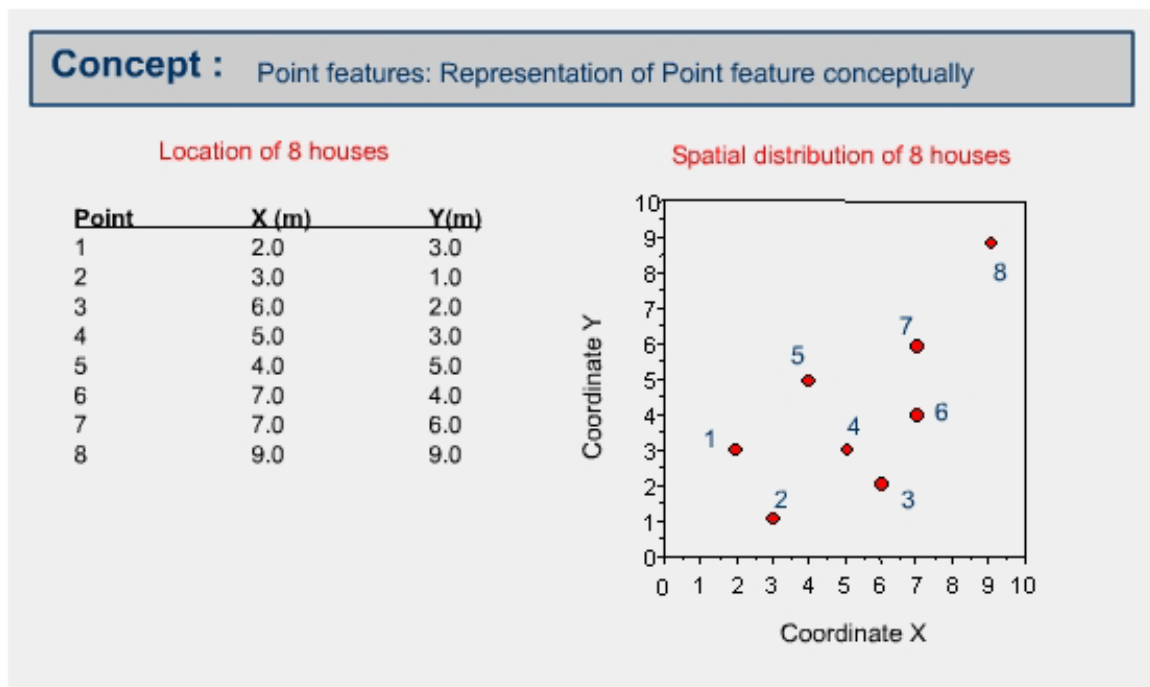
Point features can be described as single x, y value in object mode or single column, row value in image mode.

Refer to the PDF version of animation presentation.

## LOOK

### Look the example of representation of point features

The following graphic illustrates representation of point features in object mode.



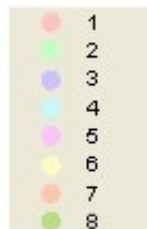
## Concept : Point features: Representation of Point feature in object mode in GIS

File structure of point features in GIS

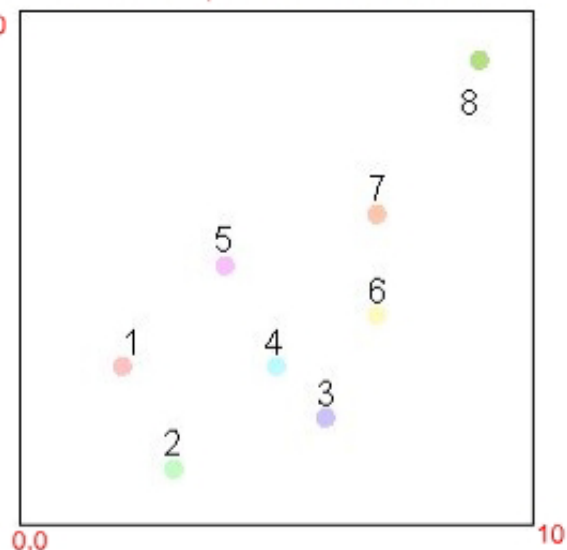
```
1 0.2000000E+01 0.3000000E+01
2 0.3000000E+01 0.1000000E+01
3 0.6000000E+01 0.2000000E+01
4 0.5000000E+01 0.3000000E+01
5 0.4000000E+01 0.5000000E+01
6 0.7000000E+01 0.4000000E+01
7 0.7000000E+01 0.6000000E+01
8 0.9000000E+01 0.9000000E+01
```

END

Map unit is meter.



Presentation of spatial distribution of 8 houses



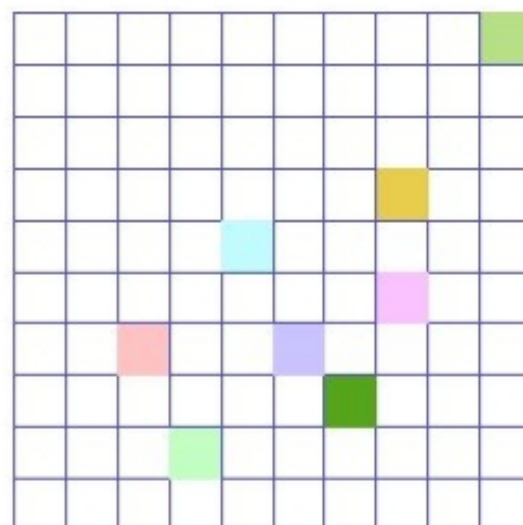
## Concept : Point features: Representation of Point feature in image mode in GIS

Ascii raster file representation of point features

```
ncols      10
nrows      10
xllcorner  0.0
yllcorner  0.0
cellsize   1.0 m
NODATA_value -9999
```

Then values of each cell are listed from left to right line by line.

Unit is in meter.



## ACT

### Create point features in point mode and image mode

1. Create a point feature file based on the following table using available GIS system at your lab.

Point-ID	X (m)	Y(m)
1	2	3
2	3	1
3	6	2

2. Create a raster representation of point feature based on the point feature vector data that you have created above using available GIS system at your lab.
3. Create an ASCII raster file based on the raster representation of point feature.

## CLARIFICATION

### Line features

Line spatial features such as road, railway and footpath can be represented as the series of single x, y values as a chain in object mode or a series of grid cells with respect to row and columns in image (raster) mode. The length, sinuosity and direction are some geometric properties of line features.

Refer to the PDF version of animation presentation.

### LOOK

Look an example of line feature in object mode.

**Concept :** Line features: Example of creating line file in object mode

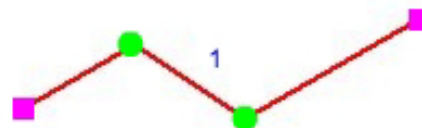
File structure of line feature in Ascii format

```

1
0.2470000E+03 0.1335000E+03
0.2515000E+03 0.1360000E+03
0.2560000E+03 0.1330000E+03
0.2630000E+03 0.1370000E+03
END
END

```

Line feature created in GIS



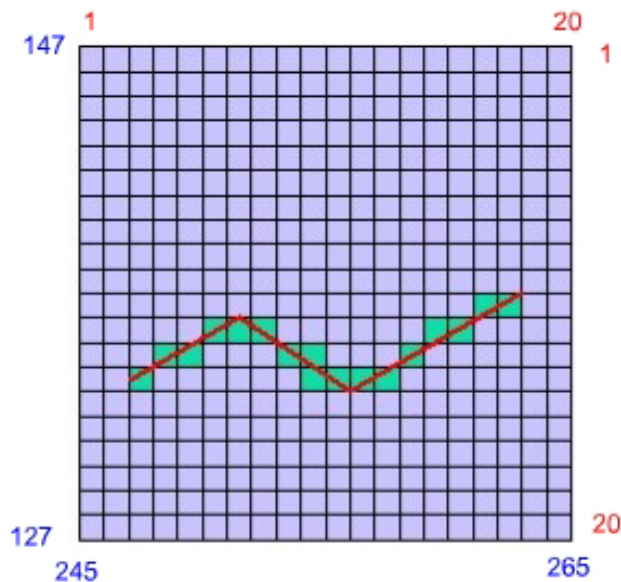
The length is 18.618 m.

See the detail calculation in previous slides

Representation of line feature in image mode is similar to the structure of representation of point feature in image mode.

## Look an example of calculating length in image mode

### Concept : Step - 1 : Rasterisation



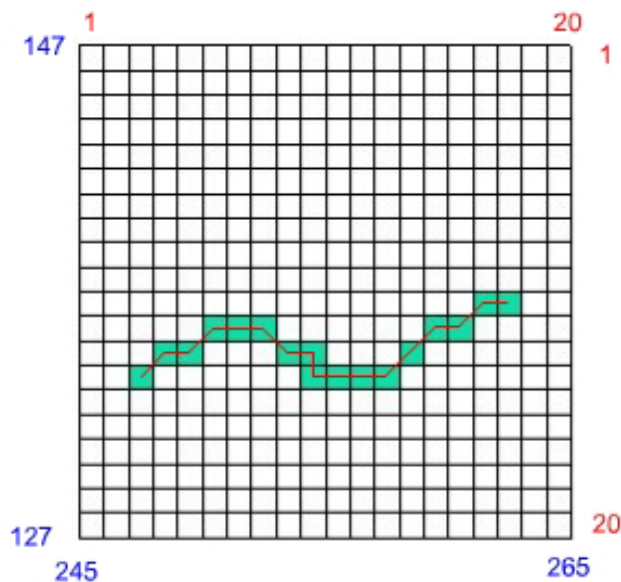
The image is created based on 1 m grid cell resolution.

The grid cells that passed through line feature are important to calculate the length in image mode.

The green cells are the cells the line feature pass through.

Some of the cells are manually remove due to the proportion of line passing through the cell is insignificant.

### Concept : Step - 2 : Calculation of length in image mode



Then connect the cell centers to calculate the length.

Then calculate the distance of from each center cell to another center cell along the connected line of cell centers

Length =  $1.4 + 1 + 1.4 + 1 + 1 + 1.4 + 1 + 1 + 1 + 1 + 1 + 1 + 1.4 + 1.4 + 1 + 1.4 + 1 = 18.4 \text{ m}$

## ACT

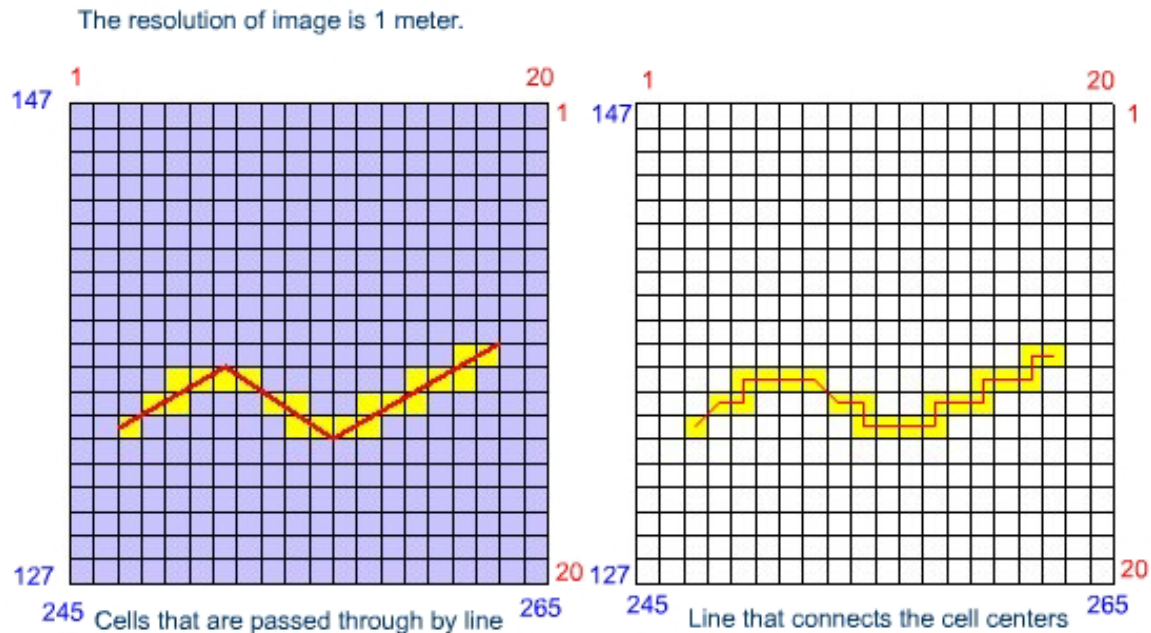
### Calculate the length in object mode

1. Create the line feature using available GIS system from your lab based on the following table. Then find out the length of the line feature.

Point	X (m)	Y(m)
1	247	133.5
2	251.5	136
3	256	133
4	263	137

### Calculate the length in image mode

Calculate the length of linear feature in image mode based on the following presentation. In this presentation, all the cells that are passed through by the line significantly and insignificantly are considered for calculation of length in image mode.



## Areal Features

Area features such as forest land, agricultural land, park and land parcels etc. can be represented as the series of single x, y values as a closed chain in object

mode or a set of contiguous cells with respect to row and columns in image (raster) mode.

The location (position), size (area, perimeter) and shape (compactness) are the geometric properties of area (polygon) features.

## CLARIFICATION

Refer to the PDF version of animation presentation.

## LOOK

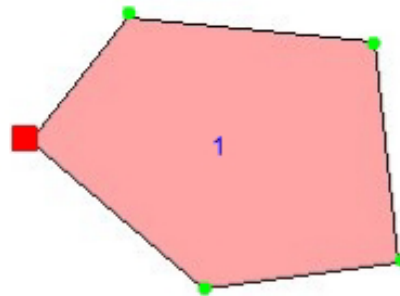
Look the example of creating areal feature in object mode

**Concept :** Areal features: Example of creating areal feature in object mode

File structure of area feature in Ascii format

```
1 0.2552839E+03 0.1381790E+03
   0.2550000E+03 0.1320000E+03
   0.2480000E+03 0.1380000E+03
   0.2520000E+03 0.1430000E+03
   0.2620000E+03 0.1420000E+03
   0.2630000E+03 0.1330000E+03
   0.2550000E+03 0.1320000E+03
END
END
```

Areal feature created in GIS



Area = 119.5 m<sup>2</sup> and Perimeter = 42.79 m

## Look the example of creating an areal feature in image mode

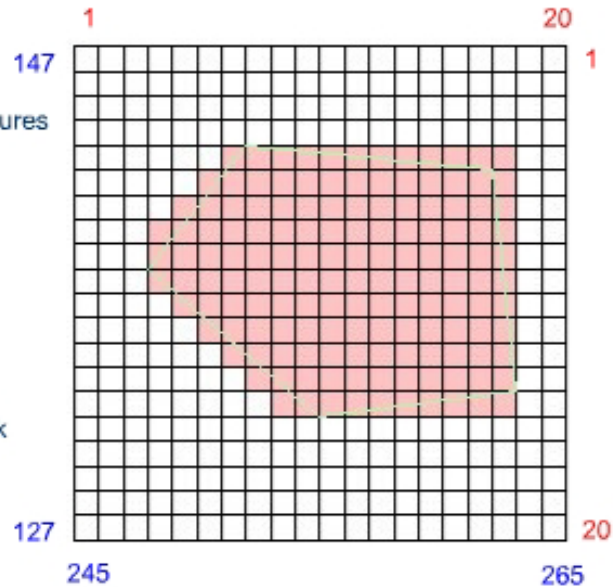
**Concept :** Areal features: Representation of areal features in image mode

The resolution of image is 0.5 meter.

Ascii raster file representation of areal features

```
ncols      40
nrows      54
xllcorner   0.0
yllcorner   0.0
cellsize    0.5 m
NODATA_value -9999
```

Light green polygon is presented as pink raster cells.



## Look the example of calculating area and perimeter in image mode

**Concept :** Calculation of area and perimeter of areal feature in image mode

The resolution of image is 0.5 meter.

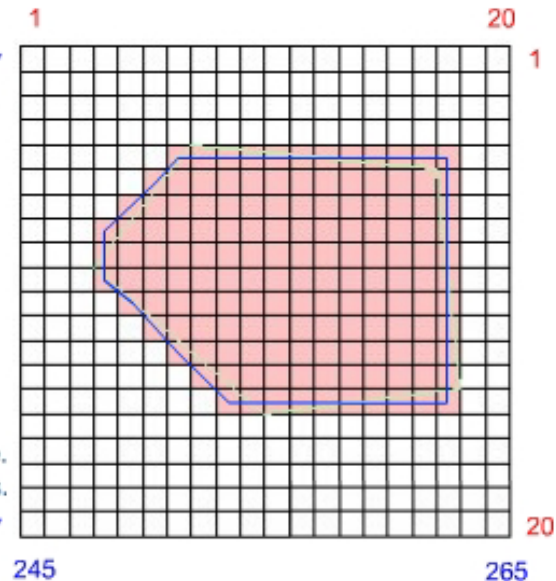
Area = Total number of cell \* area of each cell  
 $= 144 * (0.5 * 0.5)$   
 $= 36 \text{ m}^2$

Linear Perimeter =  $((8 * 1.4) + (31 * 1)) * 0.5$   
 $= 21.1 \text{ m}$

Perimeter of the envelope =  $52 * 0.5 \text{ m}$   
 $= 26 \text{ m}$

Green polygon is polygon feature in object mode.  
 Blue line is the line that connects the cell centers.

Linear perimeter is calculated based on the distance between cell centers. Envelope perimeter is calculated based on the length of cell edges bounded the area.





## ACT

### Calculate the area and perimeter in object mode

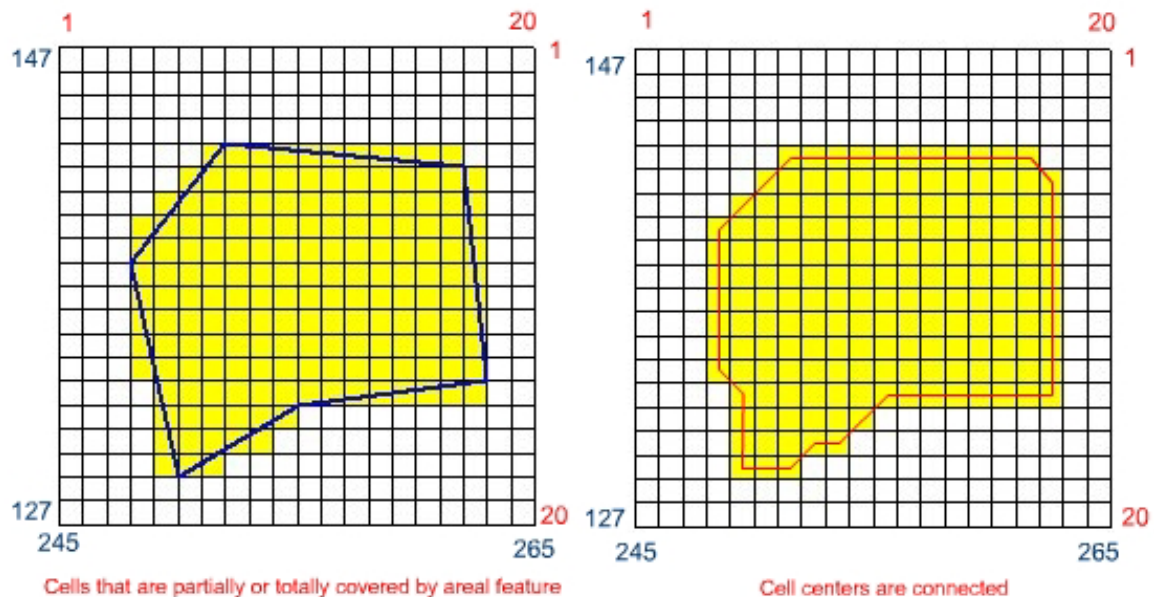
1. Create polygon feature in object mode based on the following table using available GIS system at your lab. Find out the area and perimeter values calculated by the GIS system.

Point	X (m)	Y(m)
1	248	138
2	252	143
3	262	142
4	263	133
5	255	132
6	250	129

2. Calculate the area and perimeter of created polygon using GIS.
3. Calculate the perimeter and area manually based on the created polygon feature.

### Calculate the area and perimeter in image mode

1. Calculate the area, perimeter of the envelope and linear perimeter in image mode at 1meter grid cell resolution based on the following presentation.





## **SELF-ASSESSMENT**

### **Questions**

1. Describe the geometric properties of point feature.
2. Describe the geometric properties of line feature.
3. Describe the geometric properties of areal or polygon features.

## **SHARE**

### **Share your result**

1. Share your answers to the class email list.
2. Submit your practical works of following sections as the attachment to the instructor by email.
  - Create point features in point mode and image mode
  - Create line feature in GIS
  - Calculate the length in image mode
  - Create area feature in GIS