

# Week 1 Module 3: Points

## Exercises

Let's clear the global computing environment:

```
rm( list = ls() )
```

## Exercises for Week 1 Module 3: Points

### Exercise 2.1: Graphing a single point

First, create an empty plotting region with no data, where the  $x$ -values range from 0 to 10, and the  $y$ -values range from 0 to 8.

Then use the `points()` function to draw a single point located at  $x = 7$  and  $y = 3$ .

**Solution**

### Exercise 2.2: Annotating with text

Draw a graph with a single point located at  $x = 7$  and  $y = 3$ .

Set the  $x$ -values for the plotting region to range from 0 to 10, and the  $y$ -values to range from 0 to 8.

Then annotate this point with its coordinates using the `text()` function.

**Solution**

### Exercise 2.3: Adjusting the size of a point

Create a graph of the single point at  $x = 7$  and  $y = 12$ , and use a character expansion factor of 3.5.

Let the  $x$ -axis range from 0 to 10, and let the  $y$ -axis range from 0 to 20.

Remember to include a main title and to properly label the axes.

**Solution**

### Exercise 2.4: Adjusting the color of a point

Create a graph of the single point at  $x = 7$  and  $y = 12$ , using a character expansion factor of 3.5 and a color of "hotpink3".

Let the  $x$ -axis range from 0 to 10, and let the  $y$ -axis range from 0 to 20.

Remember to include a main title and to properly label the axes.

**Solution**

*# Type your answer in here*

### Exercise 2.5: Adjusting the shape of a point

Create a graph of the single point with a solid square shape at  $x = 7$  and  $y = 12$ , using a character expansion factor of 3.5 and the color “darkorchid3”.

Let the  $x$ -axis range from 0 to 10, and let the  $y$ -axis range from 0 to 20.

Remember to include a main title and to properly label the axes.

**Solution**

*# Type your solution in here*

### Exercise 2.6: Adjusting the shape of a point

Create a graph of a single circular point at  $x = 7$  and  $y = 12$ , and use a character expansion factor of 3.5, an outline color of “darkred”, an outline width of 2, and a fill color of “salmon1”.

Use a `pch` value of 21 to obtain a circular point with a color fill.

Let the  $x$ -axis range from 0 to 10, and let the  $y$ -axis range from 0 to 20.

Remember to include a main title and to properly label the axes.

**Solution**

*# Type your answer in here*

### Exercise 2.7: Plotting multiple points

Using one call to the `plot()` function, plot these points:

$X$	$Y$
3	25
6	22
8	21
10	17
13	15

**Solution**

*# Type your answer in here*

### Exercise 2.8: Modern Art

Express the poetic yearnings of your soul by creating modern art:

- Create a completely blank plot, with  $x$  ranging from 0 to 10, and  $y$  ranging from 0 to 10 as well. Make the plot square.

- In the upper left quadrant, draw an upright triangle colored red. Make it big!
- In the upper right quadrant, draw an inverted triangle with a black border, and a yellow fill. Make it the same size as the first triangle.
- In the lower left quadrant, draw a circle with a black border and a green fill. Make it the same size as the other objects.
- Finally, in the lower right quadrant draw a solid square colored blue.

### Solution

*# Type your answer in here*

## Solutions to the Exercises

### Exercise 2.1: Graphing a single point

First, create an empty plotting region with no data, where the  $x$ -values range from 0 to 10, and the  $y$ -values range from 0 to 8\$.

Then use the `points()` function to draw a single point located at  $x = 7$  and  $y = 3$ .

### Solution

```
plot(
  x = NULL,
  xlim = c(0, 10),
  ylim = c(0, 8),
  main = "Plot of a single point",
  xlab = "x",
  ylab = "y",
  las = 1
)

points(
  x = 7,
  y = 3.5
)
```

### Exercise 2.2: Annotating with text

Draw a graph with a single point located at  $x = 7$  and  $y = 3$ .

Set the  $x$ -values for the plotting region to range from 0 to 10, and the  $y$ -values to range from 0 to 8\$.

Then annotate this point with its coordinates using the `text()` function.

### Solution

```
plot(
  x = 7,
  y = 3,
  xlim = c(0, 10),
```

```

ylim = c(0, 8),
main = "Plot of a single point",
xlab = "x",
ylab = "y",
las = 1
)

text(
  x = 7,
  y = 3.5,
  labels = "(7, 3)"
)

```

### Exercise 2.3: Adjusting the size of a point

Create a graph of the single point at  $x = 7$  and  $y = 12$ , and use a character expansion factor of 3.5.

Let the  $x$ -axis range from 0 to 10, and let the  $y$ -axis range from 0 to 20.

Remember to include a main title and to properly label the axes.

#### Solution

Here's one approach:

```

plot(
  x = 7,
  y = 12,
  xlim = c(0, 10),
  ylim = c(0, 20),
  main = "Graph of scaled single point",
  xlab = "x",
  ylab = "y",
  cex = 3.5,
  las = 1
)

```

Here's another approach:

```

# First, create an empty plot with no data:

plot(
  x = NULL,
  xlim = c(0, 10),
  ylim = c(0, 20),
  main = "Graph of scaled single point",
  xlab = "x",
  ylab = "y",
  las = 1
)

# Then plot the point:

points(

```

```
x = 7,  
y = 12,  
cex = 3.5  
)
```

### Exercise 2.4: Adjusting the color of a point

Create a graph of the single point at  $x = 7$  and  $y = 12$ , using a character expansion factor of 3.5 and a color of “hotpink3”.

Let the  $x$ -axis range from 0 to 10, and let the  $y$ -axis range from 0 to 20.

Remember to include a main title and to properly label the axes.

#### Solution

Here’s my solution:

```
plot(  
  x = 7,  
  y = 12,  
  xlim = c(0, 10),  
  ylim = c(0, 20),  
  main = "Graph of hotpink single point",  
  xlab = "x",  
  ylab = "y",  
  cex = 3.5,  
  col = "hotpink3",  
  las = 1  
)
```

### Exercise 2.5: Adjusting the shape of a point

Create a graph of the single point with a solid square shape at  $x = 7$  and  $y = 12$ , using a character expansion factor of 3.5 and the color “darkorchid3”.

Let the  $x$ -axis range from 0 to 10, and let the  $y$ -axis range from 0 to 20.

Remember to include a main title and to properly label the axes.

#### Solution

Here’s my solution:

```
plot(  
  x = 7,  
  y = 12,  
  xlim = c(0, 10),  
  ylim = c(0, 20),  
  main = "Graph of scaled single point",  
  xlab = "x",  
  ylab = "y",  
  cex = 3.5,  
  col = "darkorchid3",  
  pch = 15,  
)
```

```
    las = 1
)
```

### Exercise 2.6: Adjusting the shape of a point

Create a graph of a single circular point at  $x = 7$  and  $y = 12$ , and use a character expansion factor of 3.5, an outline color of “darkred”, an outline width of 2, and a fill color of “salmon1”.

Let the  $x$ -axis range from 0 to 10, and let the  $y$ -axis range from 0 to 20.

Remember to include a main title and to properly label the axes.

#### Solution

```
plot(
  x = 7,
  y = 12,
  xlim = c(0, 10),
  ylim = c(0, 20),
  main = "Graph of scaled single point",
  xlab = "x",
  ylab = "y",
  cex = 3.5,
  lwd = 2,
  col = "darkred",
  bg = "salmon1",
  pch = 21,
  las = 1
)
```

### Exercise 2.7: Plotting multiple points

Using one call to the `plot()` function, plot these points:

$X$	$Y$
3	25
6	22
8	21
10	17
13	15

#### Solution

First, let's create the  $X$  and  $Y$  vectors:

```
x.vector <- c(3, 6, 8, 10, 13)
y.vector <- c(25, 22, 21, 17, 15)
```

Now we can plot all these values in just one call to the `plot()` function:

```

plot(
  x.vector,
  y.vector,
  main = "Plotting multiple points at once",
  xlim = c(0, 15),
  ylim = c(0, 30),
  xlab = "x",
  ylab = "y",
  pch = 19,
  cex = 2,
  col = "darkslategray3",
  las = 1
)

```

## Exercise 2.8: Modern Art

Express the poetic yearnings of your soul by creating modern art:

- Create a completely blank plot, with  $x$  ranging from 0 to 10, and  $y$  ranging from 0 to 10 as well. Make the plot square.
- In the upper left quadrant, draw an upright triangle colored red. Make it big!
- In the upper right quadrant, draw an inverted triangle with a black border, and a yellow fill. Make it the same size as the same triangle.
- In the lower left quadrant, draw a circle with a black border and a green fill. Make it the same size as the other objects.
- Finally, in the lower right quadrant draw a solid square colored blue.

### Solution

```

# First, to make the image a square,
# we set the graphical parameter `pty`
# by assigning the value "s" to it:

par( pty = "s" )

# Next, create a completely blank plot

plot( x = NULL,
      xlim = c(0, 10),
      ylim = c(0, 10),
      axes = FALSE,
      xlab = "",
      ylab = ""
)

# Finally, draw the shapes:

```

```
points( 3, 7, pch = 17, cex = 10, col = "red" )  
points( 7, 8, pch = 25, cex = 10, bg = "yellow", lwd = 2 )  
points( 3, 3, pch = 21, cex = 10, bg = "green", lwd = 2 )  
points( 7, 3, pch = 15, cex = 10, col = "blue" )
```