Assignment 2: Graphing Functions (0.2) **Name**______________________
Please provide a handwritten response.

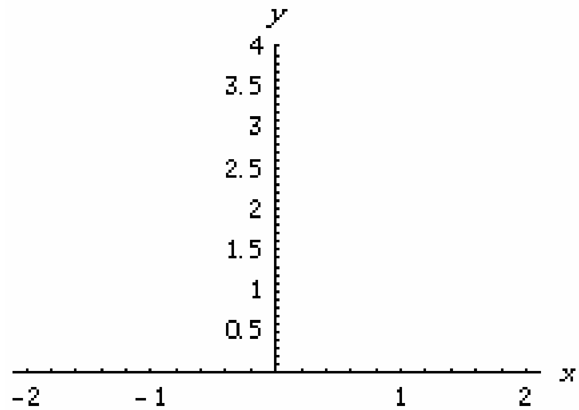
1a. In *Mathematica*, functions $y = f(x)$ are graphed using the **`Plot`** command. For example, execute the command

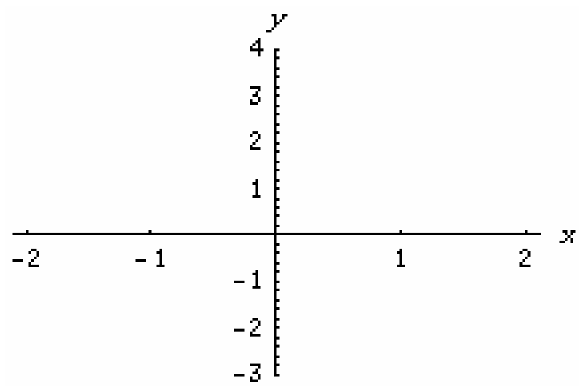
```
f[x_] = x^2
```

to define the familiar function $f(x) = x^2$ and then graph this function over the domain $-2 \le x \le 2$ by executing the command

```
Plot[f[x], {x, -2, 2}]
```

Sketch the result on the axes at right. Also execute **`?Plot`** and record below *Mathematica*'s description of **`Plot`** .





1b. *Mathematica* automatically chose an appropriate *y*–range for the graph in Question **1**. However, we can specify a different *y*–range by applying an "option" called **`PlotRange`** to the **`Plot`** command. Execute the command

```
Plot[f[x], {x, -2, 2},
                    PlotRange->{-3, 4}]
```

to graph *f* over the same domain as in part **a** but with *y*–range $-3 \le y \le 4$, and sketch the result on the axes at right.

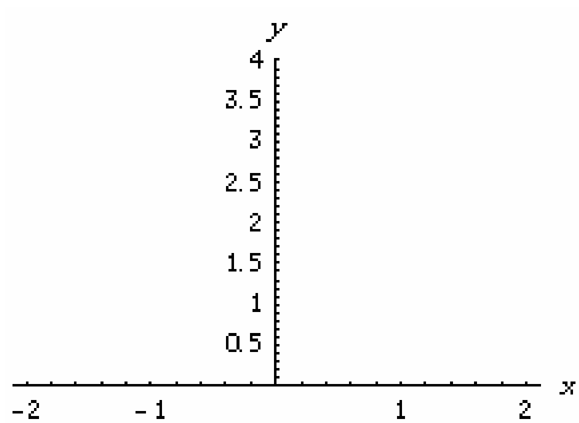
1c. The **`Plot`** command can also be used to graph two or more functions together. Execute the command

```
g[x_] = 4 - x^2
```

to define the function $g(x) = 4 - x^2$, and then graph *f* and *g* over the domain $-2 \le x \le 2$ on the same axes by executing the command

```
Plot[{f[x], g[x]}, {x, -2, 2}]
```

Sketch the result on the axes at right.



2a. We can also use the **Plot** command to "zoom" in on details of graphs like the one in Example 2.2 of your text. Execute the commands **Clear[f]** and

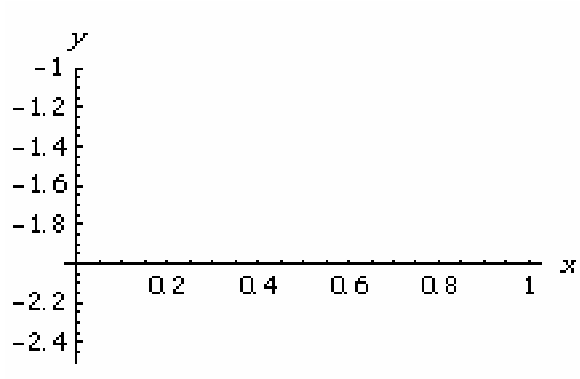
```
f[x_] = x^3 + 4x^2 - 5x - 1
```

to define the function $f(x) = x^3 + 4x^2 - 5x - 1$ in *Mathematica*, and then execute the command **Plot[f[x], {x, -4, 4}]** . The result should look roughly like Figure 0.27a.

2b. As the text indicates, the graph seems to have a local minimum between $x = 0$ and $x = 1$; we can use zooming to locate this minimum as accurately as we wish. Start by executing the command

```
Plot[f[x], {x, 0, 1}]
```

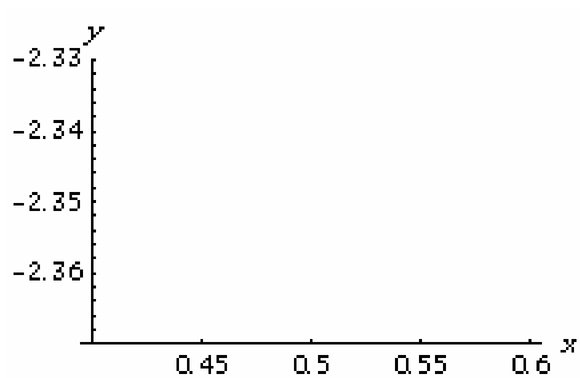
to get a closer look, and sketch the result on the axes at right.



2c. We can see now that the minimum actually lies between $x = 0.4$ and $x = 0.6$; zoom in still further by executing the command

```
Plot[f[x], {x, 0.4, 0.6}]
```

and sketch the result on the axes at right. What can we now say about the location of the minimum?



3. Once again execute the command **Clear[f]** , followed by the command

```
f[x_] = (x - 1)/(x^2 - 5x + 6)
```

to define the function $f(x) = \dfrac{x-1}{x^2 - 5x + 6}$ studied in Example 2.5. Now use the **Plot** command with the **PlotRange** option as you did above to graph *f* over the domain $1 \le x \le 4$ with *y*–range $-10 \le y \le 8$, and sketch the result on the axes at right. Do the cöordinate axes cross at the origin? Why does the graph include two vertical lines?