Pre-Calc Unit: Piecewise Functions

1.Graph $f(x) = \begin{cases} 2x & \text{if } x < 3 \\ 5 & \text{if } x \geq 3 \end{cases}$

Use x/y chart for each piece and choose the x-values based on the inequality. (Note: If x < 3, you should also use 3 and make it an open circle on the graph. Make a note on your x/y chart that the circle will be open like an asterisk or by circling it.)

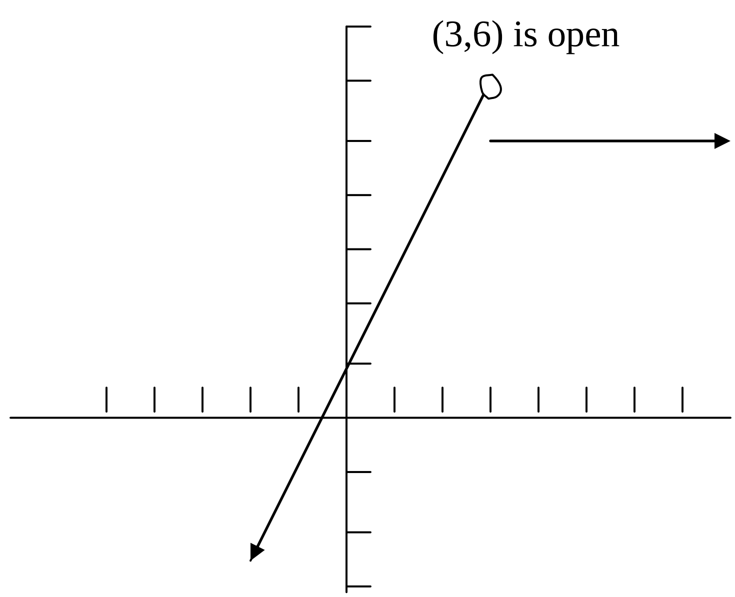
Note: There is not a need to choose more than a couple of points, since you should recognize both of these graphs as lines.

y = 2x

| x | y |
|---|---|
| 1 | 2 |
| 2 | 4 |
| **3** | **6*** |

y = 5

| x | y |
|---|---|
| 3 | 5 |
| 4 | 5 |
| 5 | 5 |




It is important to understand “boundary points”. Note that the graph of y = 2x is for x < 3 and so the graph gets up to x = 3 and stops. (In this case, it stops with an open circle at x = 3 because x

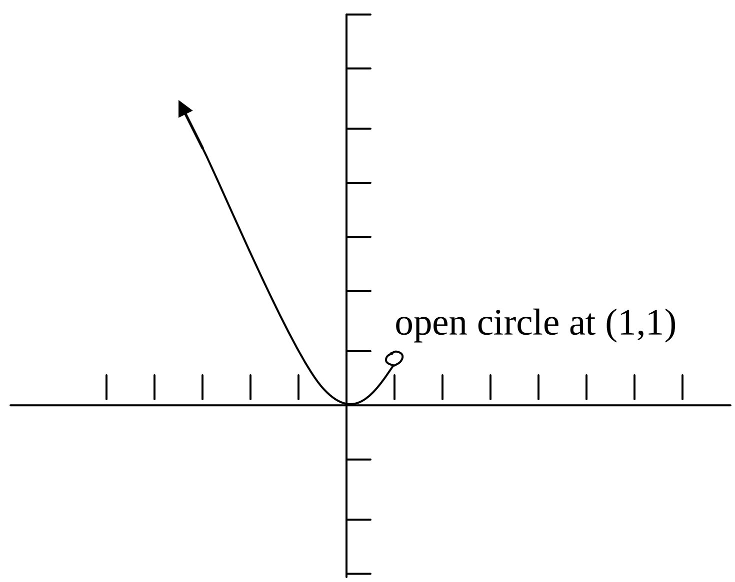
= 3 is not included in its domain.)  Make sure your graph makes it to x = 3 and does not stop at x = 2, since x = 2.5, x = 2.9, etc. all should have y-values since they are less than 3.  At x = 3, we say that this graph has jump discontinuity.

2.Graph $f(x) = \begin{cases} x^2 & \text{if } x < 1 \\ x & \text{if } x \geq 1 \end{cases}$

Since the top piece is the parabola $y = x^2$ and this is a u-shape centered at the origin, you must pick enough numbers on the x/y chart to show the proper shape.
Let's first look at the graph of $y = x^2$, $x < 1$:

$y = x^2$

| x | y |
|---|---|
| **1** | **1*** |
| 0 | 0 |
| -1 | 1 |
| -2 | 4 |

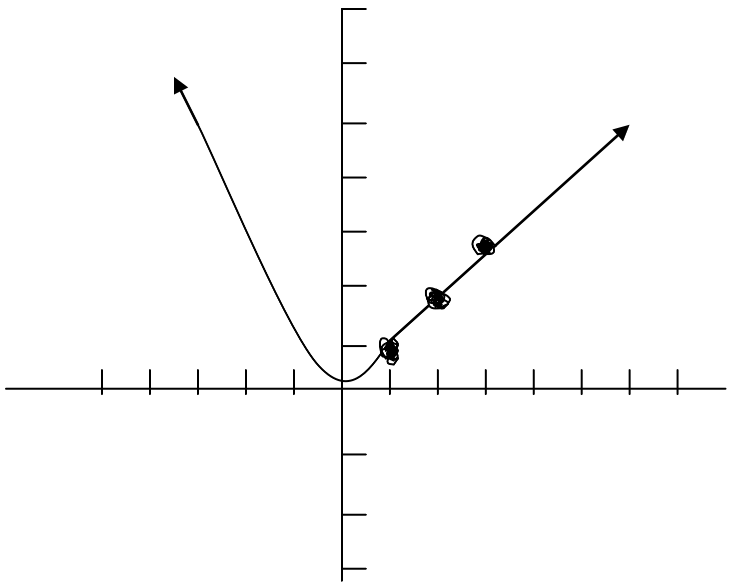



When this graph is put together with the line, the "hole" will be filled in since the line has a closed circle at (1,1)

$y = x^2$ $y = x$

| x | y |
|---|---|
| **1** | **1***|
| 0 | 0 |
| -1 | 1 |
| -2 | 4 |

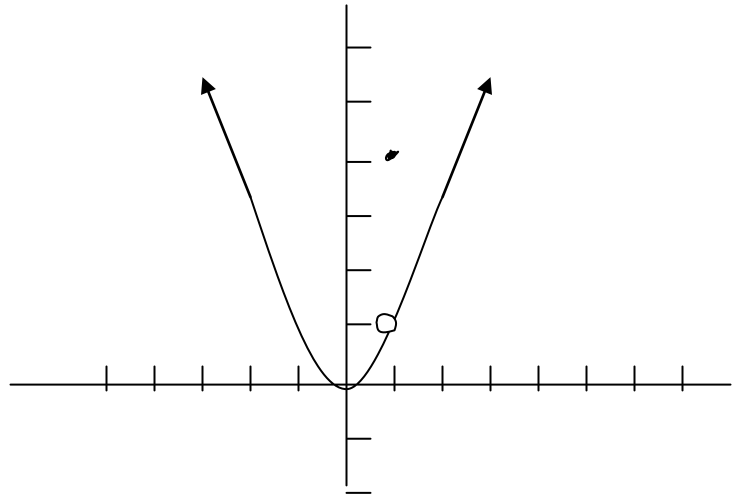
| x | y |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |



The line clearly fills in the open circle that was at (1,1) and if the circles are removed, you can see what the graph really looks like. We say that this graph is continuous at x = 1, since there is no break in the function.

3.Graph $f(x) = \begin{cases} x^2 & \text{if } x \neq 1 \\ 4 & \text{if } x = 1 \end{cases}$

This graph does not need an x/y chart to graph as long as you know what the graph of $y = x^2$ looks like. Since x cannot be one, we put an open circle on the graph of the parabola at x = 1. We also use the function $y = x^2$ to realize that the open circle should be at (1,1)



Since the second part of the function stated that if x = 1, then y = 4 we put a separate dot at the point (1,4). Note that this second part is only a dot since the constraints did not contain an inequality, but rather just the statement x = 1. This is an example of removable or point discontinuity.

4. Graph $f(x) = \begin{cases} 2 & \text{if } x < 0 \\ x + 1 & \text{if } 0 \leq x < 2 \\ 3 & \text{if } x > 2 \end{cases}$

Even though this one has 3 pieces, it is done exactly the same. Make three separate x/y charts and note any open circles and boundary points.

y = 2

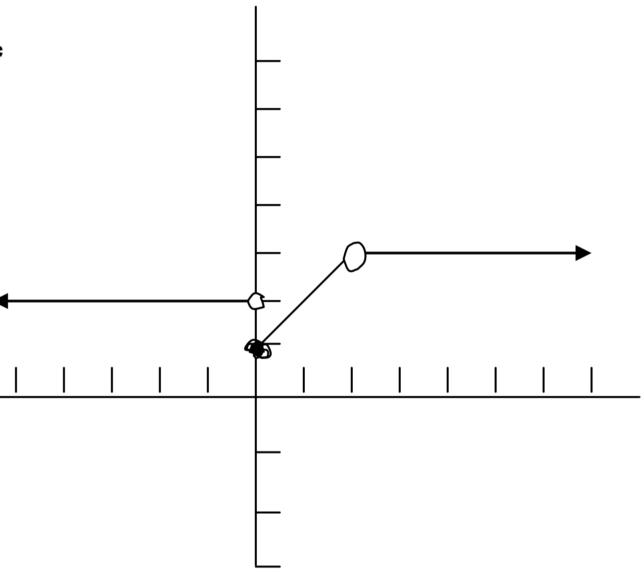
| x | y |
|---|---|
| **0** | **2***|
| -1 | 2 |
| -2 | 2 |

y = x + 1

| x | y |
|---|---|
| 0 | 1 |
| 1 | 2 |
| **2** | **3*** |

y = 3

| x | y |
|---|---|
| **2** | **3*** |
| 3 | 3 |
| 4 | 3 |



You should notice that the middle function has two constraints and does not go past x = 0 or x = 2. It does have an open circle at x = 2, because the inequality did not include that point. What types of discontinuity are there at x = 0 and x = 1?

Homework:

Ditto: Graphing Piecewise Functions