2.6 Notes: Graphs of Basic Functions

**Definition (Sort of):** A function is continuous if its graph is connected at all points on the graph. In other words, you could make the graph without picking up your pencil. This is not the complete mathematical definition, but it will do for our purposes.

$f(x)$ is continuous on an interval $I$ if it is continuous at every $x\in I$.

Several types of functions will appear frequently, so it is worth studying what those graphs look like. We will transform these functions in a later lesson. For each of the following, state the domain and range, and the largest open intervals of the domain for which the functions are increasing decreasing, and constant.

**Identity Function:** $f\left(x\right)=x$

**Squaring Function:** $f\left(x\right)=x^{2}$

**Cubing Function:** $f\left(x\right)=x^{3}$

**Square Root Function:** $f\left(x\right)=\sqrt{x}$

**Cube Root Function:** $f\left(x\right)=\sqrt[3]{x}$

**Absolute Value Function:** $f\left(x\right)=|x|$

**Greatest Integer Function:** $f\left(x\right)=\left⟦x\right⟧$. This function is defined to be the greatest integer that is less than or equal to $x$. Let’s practice using this function. Determine:

* $\left⟦3\right⟧=$
* $\left⟦5.23\right⟧=$
* $\left⟦π\right⟧=$
* $\left⟦\sqrt{2}\right⟧=$
* $\left⟦-5\right⟧=$
* $\left⟦-2.66\right⟧=$

What are some real life uses of this type of function?

**Piecewise Defined Functions:** Sometimes it makes sense to define a function differently on different intervals of the domain. Let’s look at a couple of examples.

Let $f\left(x\right)=\left\{\begin{array}{c}-2 if x\geq 1\\x-3 if x<1\end{array}\right.$

Graph this function, state its range, the largest open intervals of the domain that the function is increasing, decreasing, and constant and whether or not it is continuous.

Start by evaluating the function at a variety of points. Determine:

* $f\left(1\right)$
* $f\left(2\right)$
* $f\left(4\right)$
* $f\left(0\right)$
* $f\left(-1\right)$
* $f(-2)$

Let $f\left(x\right)=\left\{\begin{array}{c}-2x-3 if x>-2\\-x^{2}+5 if x\leq -2\end{array}\right.$

Graph this function, state its range, the largest open intervals of the domain that the function is increasing, decreasing, and constant and whether or not it is continuous.

Let $f\left(x\right)=\left\{\begin{array}{c}\sqrt{x-3} if x\geq 3\\\left|x\right|+2 if x<3\end{array}\right.$

Graph this function, state its range, the largest open intervals of the domain that the function is increasing, decreasing, and constant and whether or not it is continuous.