Illustrative Mathematics

**HS.F.IF.A.1 Finding the Domain of a Given Function**

**Alignment to Content Standards:** HSF.IF.A.1

**Task:**

Given the function,

$$f(x)=\frac{3}{x-5}$$

1. Find solutions for $f\left(9\right)$ and $f(5)$, and show your work writing out every step.
2. Explain your steps from solving the function for each of the above *x*-values and list the operations used. Explain any restrictions that resulted from solving $f\left(9\right)$ and $f(5)$.
3. Give a possible domain for *f*$(x)$.

**Commentary**

This task is meaningful to students in that it is broken up into different steps that appear to be separate problems, yet they build upon each other to help the student determine the domain of the given function. This scaffolding assessment strategy still allows the teacher to fully evaluate the student’s understanding as well as providing students with all the steps necessary for them to be successful. As students complete the first part of the problem they will have the opportunity to make observations about the function’s domain and which values may or may not be included. When they solve for $f\left(5\right)$, students will find a solution that should help them determine that $x=5$ will not be in the domain of the function. If students can correctly complete part 1. and then successfully explain their steps in part 2., then they will be ready to make conclusions that will help them determine the function’s domain in part 3.

**Solution**

1. Find solutions for $f(9)$ and $f\left(5\right)$ and show your work writing out every step.

$$f\left(9\right)=\frac{3}{9-5}$$

$$f\left(9\right)=\frac{3}{4}$$

$$f\left(5\right)=\frac{3}{5-5}$$

$$f\left(5\right)=\frac{3}{0}=undifined $$

When the input is 9, the output is 0.75. This means that $x=9$ will be in the domain of the given function $f\left(x\right)$, and further 0.75 will be in the range of the function. When the input is 5, the output is $^{3}/\_{0}$ which is an undefined number. Therefore, since the output is undefined, we can conclude that $x=5$ is not included in the domain of the function.

1. To solve the function for any given *x*-value, first replace *x* with the corresponding *x-*value, then subtract 5 from the value of *x.* Next, divide the numerator, 3, by the value found from subtracting 5 from *x.* Both $f(9)$ and $f\left(5\right)$ can be simplified through the subtraction of 5 from the value of *x*. However, at this point we find that the last operation of division is only value when $x-5\ne 0. $Therefore, we can conclude that the domain of the function $f(x)=\frac{3}{x-5}$ does not include $x=5$.
2. One possible answer for the domain of$ f(x)=\frac{3}{x-5}$ is all real numbers except when $x=5$. Domain $f(x)=\frac{3}{x-5}$: All real numbers where, $x\ne 5$.

Also, any subset of this domain is possible and an acceptable answer.