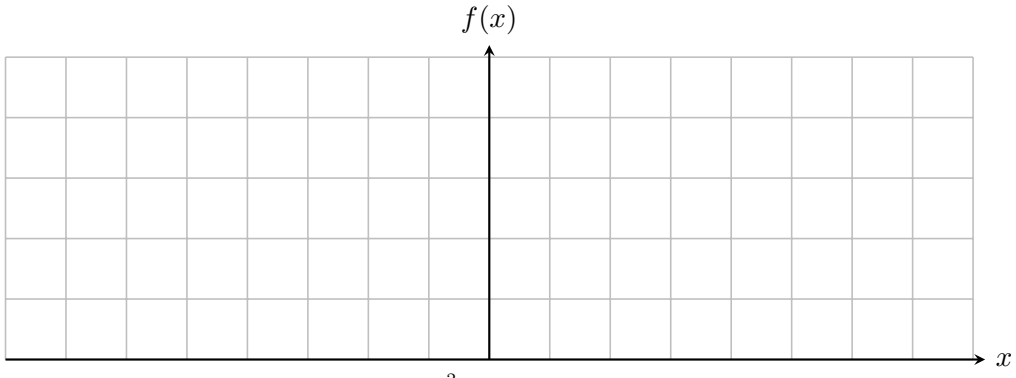
MATH 1450 **Name:**_____

## Activity 10

When modeling a situation, it is often convenient to not only think about a single function, but rather consider a family of functions. In this activity, we'll explore several common families of functions and their properties.

**1.** In statistics, we often consider different Gaussians, i.e. functions of the form $f(x) = e^{-\frac{(x-a)^2}{2b}}$ where $a, b$ are constants with $b > 0$.

**(a)** In desmos (desmos.com/calculator), enter the function $f(x) = e^{-\frac{(x-a)^2}{2b}}$. You should be prompted to "add slider"; click the box which says "all". Move the sliders for $a$ and $b$ to see how they affect the graph of $f$. Sketch the graphs of $f$ for several different values of $a$ and $b$ on the axes below.

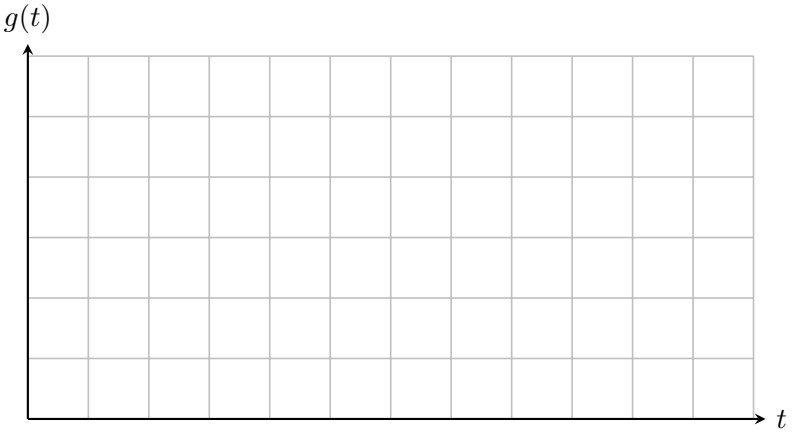



**(b)** Find the critical point(s) of $f(x) = e^{-\frac{(x-a)^2}{2b}}$. How does changing the value of $a$ and/or $b$ affect the critical point(s)?

**(c)** Find the inflection point(s) of $f(x) = e^{-\frac{(x-a)^2}{2b}}$. How does changing the value of $a$ and/or $b$ affect the inflection point(s)?

**2.** When a drug is introduced into the bloodstream of a patient, the concentration of the drug over time can often be modeled by the function $g(t) = ate^{-bt}$ where $a, b > 0$.

**(a)** In desmos, enter the function $g(t) = ate^{-bt}$ and add sliders for both $a$ and $b$. Move the sliders for $a$ and $b$ to see how they affect the graph of $g$. Sketch the graphs of $g$ for several different values of $a$ and $b$ on the axes below.




**(b)** Find the critical point(s) of $g(t) = ate^{-bt}$. How does changing the value of $a$ and/or $b$ affect the critical point(s)? What does this mean in terms of the drug's concentration in the bloodstream?

**(c)** Find the inflection point(s) of $g(t) = ate^{-bt}$. How does changing the value of $a$ and/or $b$ affect the inflection point(s)? What does this mean in terms of the drug's concentration in the bloodstream?