1. (1 pt) mathbioLibrary/setABiocLabs/Lab121_K1_poly_exp.pg

Because of the accuracy of WebWork, you should use 5 or 6 significant figures on all problems.

Consider the function

$$g(x) = (9 - x^2)e^{-0.84x^2}.$$

a. Find all x- and y-intercepts. List the x-intercepts in numerical order.

The x-intercepts are _____ and _____

The y-intercepts is _____

Find the derivative of the function $g(x)$.

$g'(x) =$ _____

Find the critical points of the function $g(x)$. List the critical points, $x_{c1} < x_{c2} < x_{c3}$, and determine the function value at each of the critical points.

$x_{c1} =$ _____

$g(x_{c1}) =$ _____

This is a relative MAXIMUM or MINIMUM. _____

$x_{c2} =$ _____

$g(x_{c2}) =$ _____

This is a relative MAXIMUM or MINIMUM. _____

$x_{c3} =$ _____

$g(x_{c3}) =$ _____

This is a relative MAXIMUM or MINIMUM. _____

The absolute MAXIMUM for all x satisfies

$x_{max} =$ _____ and $g(x_{max}) =$ _____

(If there are more than one absolute maxima, then give the one with the smallest x-value.

The absolute MINIMUM for all x satisfies

$x_{min} =$ _____ and $g(x_{min}) =$ _____

(If there are more than one absolute minima, then give the one with the smallest x-value.

Find the second derivative of the function $g(x)$.

$g''(x) =$ _____

Find the points of inflection for $g(x)$. List the points of inflection, $x_{p1} < x_{p2} < x_{p3} < x_{p4}$, and determine the function value at each of the points of inflection.

$x_{p1} =$ _____

$g(x_{p1}) =$ _____

$x_{p2} =$ _____

$g(x_{p2}) =$ _____

$x_{p3} =$ _____

$g(x_{p3}) =$ _____

$x_{p4} =$ _____

$g(x_{p4}) =$ _____

List any **vertical asymptotes**. (If NONE exist, then enter "None" for your answer.)

Vertical asymptote at $x =$ _____

List any **horizontal asymptotes**. (If NONE exist, then enter "None" for your answer.)

Horizontal asymptote at $y =$ _____

Is this function ODD, EVEN, or NEITHER? _____

b. In your Lab Report, graph $g(x)$ for $x \in [-5,5]$. Create a second graph showing this function for $x \in [2.9,3.9]$ to observe behavior near one of the x-intercepts. Describe the difference in scales between your graphs and why you need the different scales to observe the relevant behavior for this function. Also, create two graphs of the derivative function, $g'(x)$, using the same intervals as you did for the original function, $g(x)$. Discuss what the x-intercepts of $g'(x)$ correspond to on the graphs of $g(x)$. Also, find where the graph of the derivative has its maxima and minima, and discuss what significant points correspond to these features.

We have a theorem that states that any continuously differentiable function on a closed interval must achieve its absolute minimum and maximum in the interval and these absolute extrema occur at either a relative maximum or minimum or at one of the endpoints. Does this theorem extend to a continuously differentiable function for the entire interval, $x \in (-\infty,\infty)$?