Problem 1 – The Extrema of $y = 2x^3 - 3x^2 - 12x$

1. Graph the function $y = 2x^3 - 3x^2 - 12x$. Use [–5, 5] for the *x* dimensions and [–30, 30] for the *y* dimensions.

a. How many local maximums do you see? Local minimums?

b. What is the point of inflection?

2. Find the first derivative of the function $y = 2x^3 - 3x^2 - 12x$. Set this function equal to zero and solve.

a. What are your solutions?

b. What is the name given to these solutions?

3. Find the second derivative of the original function (or the derivative of the first derivative). Evaluate each of the critical numbers in the second derivative.

a. What are these values?

b. What would the value be called if the value is positive? Negative?

c. What is the point of inflection?

d. According to your graph, does the function change concavity there?

4. Use the **trace** command to approach $x = -1$. Look at the *y*-values on both sides of $x = -1$. Do the same for $x = 2$.

a. Discuss what happens to the *y*-values on each side of x = –1.

b. Discuss what happens to the *y*-values on each side of x = 2.

c. What does this discussion tell you about the extrema of the function?

Use the **fMin** and **fMax** commands to verify that $x = -1$ yields the maximum and that $x = 2$ yields the minimum.

To obtain the **fMin** and **fMax** commands, use the [math] key and you will see **6:fMin(** and **7:fMax(**. The syntax for these commands is fMin/Max (function, variable, lower bound, upper bound).
Example: **fMax(Y_1, *x*, –2, 3)** would find the maximum value of **Y_1** between $x = -2$ and $x = 3$.

5. Does the use of the **fMin** and **fMax** command yield a similar result?

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Problem 2 – Determining the Extrema of $y = x^3$

Graph the function $f(x) = x^3$ using the same window as in Problem 1.

6. Are there any extrema? If so, at what x-values?

7. When does the function change concavity?

8. What are the critical points?

9. What is the point of inflection? Why?

10. If there is no extrema, what interval will **fMin** and **fMax** depend on?

Problem 3 – Extrema for Other Functions

11. Graph the following functions. You will need to adjust the window. Find the critical points. Use **trace** to verify the extrema. Then use **fMin** and **fMax** to make a second verification.

Function	$g(x)=(x+1)^5-5x-2$	$h(x)=\sin(3x)$	$j(x)=e^{4x}$	$k(x)=\frac{1}{x^2-9}$
1st Derivative				
2nd Derivative				
Critical Points				
Minimum/ Maximum				
Point of Inflection				