

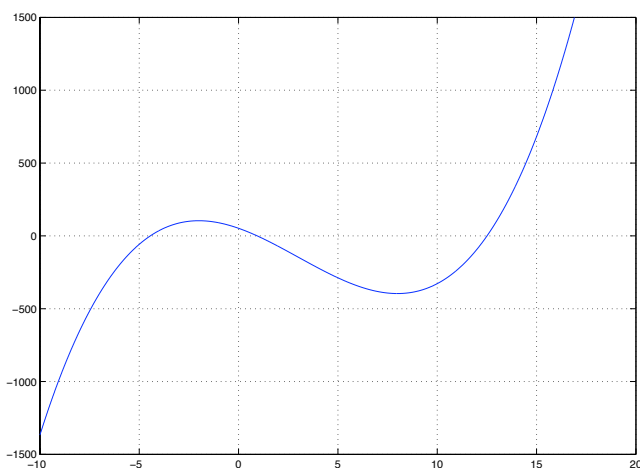
Calculus 1 -Using First and Second Derivatives

Professor:

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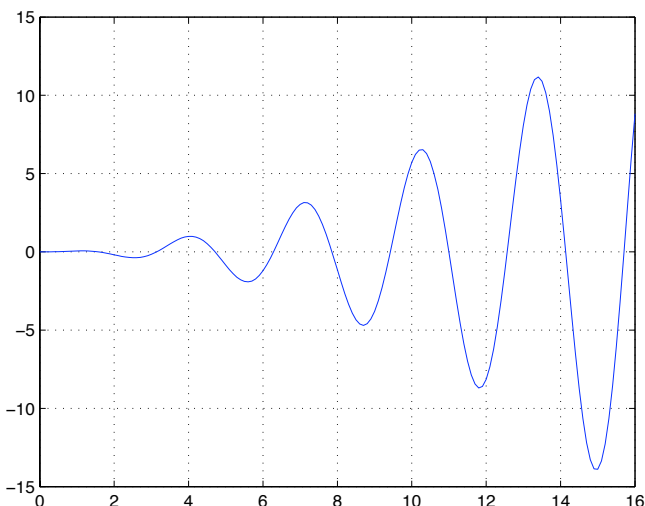
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PROBLEM 1: Below is the graph of $f(t)$, where f is the amount of money in your bank account and t is the number of months since moving into your new apartment. Start by describing in words what is happening to your finances according to this function.



1. Draw on the graph all the points where the function reaches a local maximum or minimum, meaning top or bottom of a hill within the graph window.
2. What do you notice about the slope of the tangent line at these points?
3. Based on your answer to part 2, how could you solve for the exact (t, y) value of these points?
4. Which point is a maximum?
5. Is the slope positive or negative just to the right of the maximum? Just to the left of the maximum? Does this make sense? (Think about walking up over the TOP of a hill.)
6. Is the function concave up or down at the maximum?
7. Which point is the minimum?
8. Is the slope positive or negative just to the right of the minimum? Just to the left of the minimum? Does this make sense? (Think about walking down across the BOTTOM of a valley.)
9. Is the function concave up or down at the minimum?
10. Thinking about the meaning of the function, finances, why might you care about the maximum or minimum? Are they the maximum and minimum for all time? How do you know this?

PROBLEM 2: Graph of $m(t)$, where m is your mood during a road trip and t is the hours since starting your drive for the day. What is the approximate value of $m(10)$? What does this mean in terms of the function?



1. Draw on the graph all the points where the function reaches a local maximum or minimum, meaning top or bottom of a hill within the graph window.
2. What do you notice about the slope of the tangent line at these points?
3. What do these points mean in terms of your mood on the road trip?
4. Circle all the points that correspond to maxima.
5. Is the slope positive or negative just to the right of the maxima? Just to the left of the maxima?
6. Is the function concave up or down at the maxima?
7. Put a square around all the points that correspond to minima.
8. Is the slope positive or negative just to the right of the minima? Just to the left of the minima?
9. Is the function concave up or down at the minima?
10. Do you notice a pattern here? What is the pattern for the maxima and minima? (Say in words what you notice.)
11. Propose a method for finding points where maxima and minima occur without looking at a graph of the function.
12. Propose a first derivative method for testing whether a given point is a maximum or minimum.
13. Propose a second derivative method for testing whether a given point is a maximum or minimum.

PROBLEM 3: Points where a function reaches a maximum or minimum are called **Critical Points**. Using your logic from numbers 11-13 above, find the critical point for the function $f(x) = x^2 + 2x + 1$ and decide if it is a maximum or minimum.