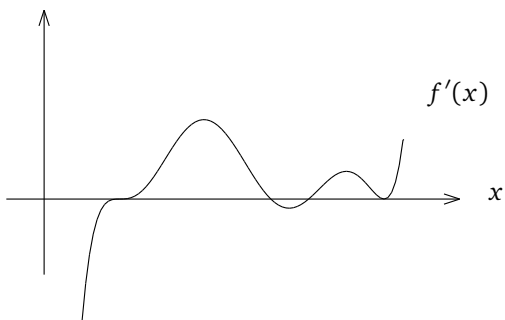


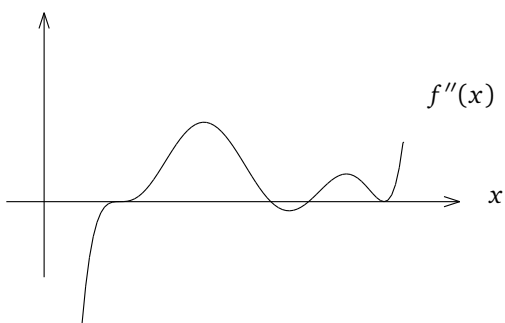
MATH 1241 - Fall 2009 - Practice Midterm - 10/21

- The quantity of a drug (in mg) in the body t minutes after it has been administered is given by $Q(t)$ for some function. Suppose we know that at 30 minutes after the drug has been administered, there are 85 mg of the drug in the body. Also from the 30 minutes to the 31 minutes after the drug has been administered, the quantity of the drug in the body decrease by roughly 0.02 mg. Use the information to estimate $Q(30.05)$.
- Find the equation of the line that passes through $f(x) = x^3 - 4x + 8$ at $x = 2$ and is perpendicular to the tangent line of $f(x)$ at $x = 2$.
- Find the derivatives of the following functions.
 - $y = ((x^2 + \sin x)^3 + 2x)^8$
 - $y = 3^{2x} \ln(2x + 1)$
 - $y = \frac{e^x + \cos x}{\sqrt{2x^3 + 7x}}$
 - $y = (7x^{11} - 12x + 13x^{-3} + e^{38})(\sin(2x^3))$
 - $y = \frac{4x^3 + 12x^2 + 8x + 7}{e^{2x}}$
 - $y = \ln(3x^2 + 5^x)$
 - $y = e^{x^2} x^2 + 3^{\ln(x^2)}$
- Consider the function $f(x) = 3x^4 + 8x^3 - 48x^2 - 300$.
 - Find the critical points (give the x , and y coordinates) of the function. Identify each critical point as a local maximum, a local minimum, or neither.
 - Find the inflection points (give the x , and y coordinates) of the function.
- A rectangular pen with three adjacent compartments is to have a total area of 2400 ft^2 . The exterior fence cost 2 dollars per ft, but the two interior lengths of fence that separate the compartments cost 1 dollars per ft. What dimensions will minimize the total cost?
- Using the definition of derivative (the "limit") to find $f'(2)$ for $f(x) = 2x^2 + 3$.
- Sketch the graph of a function whose first derivative is always positive and whose second derivative is always is always negative. $f(x)$.
- An open-top cardboard box is to be constructed so that its height is twice its width and its volume is 50 ft^3 . What dimensions minimize the cardboard used?
- It is 8 AM in the morning. Car B is 30 miles directly east of Car A and begins moving west at 90 mph. At the same moment car A begins moving north at 60 mph. What will be the minimum distance between the cars and at what time does the minimum distance occur?
- Consider all triangles formed by lines with negative slope passing through the point $(2, 3)$ and both x - and y -axes. Find the dimensions of the triangle with the smallest area.
- The owner of a consumer electronics store has found that the number of MP3 players she sells (each month) is modelled by the function: $D(x) = x^2 - 14x + 178$ where x is the selling price of a MP3 player in dollars. If we know the cost function is $C(x) = 10x^2 - 2x$ dollars, where x is the selling price of a MP3 player in dollars. What selling price of a MP3 player she should make to maximize the **Profit**. Show work and use the calculator only for basic arithmetic.

12. The following graph is a graph of a derivative function f' . Indicate the critical points of the function f . Identify each critical point as a local maximum, a local minimum, or neither. Also indicate the inflection points of the function f itself.



13. The following graph is a graph of f'' . Indicate the inflection points of the function f itself.



14. Find all the inflection points of the function $f(x) = 2x^6 + 3x^5 - 30x^4$.
15. Find all the inflection points of the function $f(x) = x^6 - 3.8x^3 + 13x^2 - e^{3x}$.
16. Sketch the graph of $f(x) = 3x^5 - 5x^3$ by using the information about its first and second derivative.