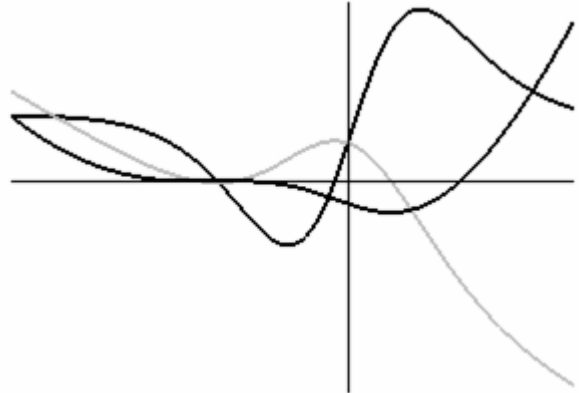


This taxing but fun fifty-minute test covers sections 3.5 through 3.11 of *Calculus* (5ed) by James Stewart. Clearly indicate your answers. Unless otherwise indicated, all parts of problems are four points each.

1. The figure shows the graphs of f , f' , and f'' . Identify each curve. (2 points each)

(a) = __, (b) = __, (c) = __



2. Find the (first) derivative of the following

a) $\sinh \ln x$

b) $x \ln x - x$

c) $\tanh^{-1} \sqrt{x}$

d) $\ln \sqrt[5]{x}$

e) $\log_3(5x)$

f) $\ln \sinh x$

3. Find the (first) derivative of the $y = x^x$. (Hint: Logarithmic differentiation?) (6 points)

4. Find the first and second derivative of the following functions. (6 points each)

a) $x \cosh x$

b) e^{x^2}

5. Find the linearization of the function $y = \cosh(x)$ at $a = 0$.

6. **Using differentials** (or a linearization) approximate $(3.00001)^4$. Show your work!
(6 points)

7. Use implicit differentiation to find $\frac{dy}{dx}$.

a) $x^4 + y^4 = a^4$

b) $x^2 + xy + y^2 = 3$

8. For either part a) or part b) of the previous problem, find $\frac{d^2y}{dx^2}$. (6 points)

9. Find $\frac{d^{103}}{dx^{103}} f(x)$ for $f(x) = \cos(2x)$ (6 points)

10. If $y = x^3 + 2x$ and $dx/dt = 5$, find dy/dt when $x = 2$. (6 points)

11. An ice cube (literally a cube) is melting (losing volume) at a rate of $24 \text{ mm}^3/\text{sec}$. How fast is the length of a side decreasing when the side is 3 mm ? (8 points)