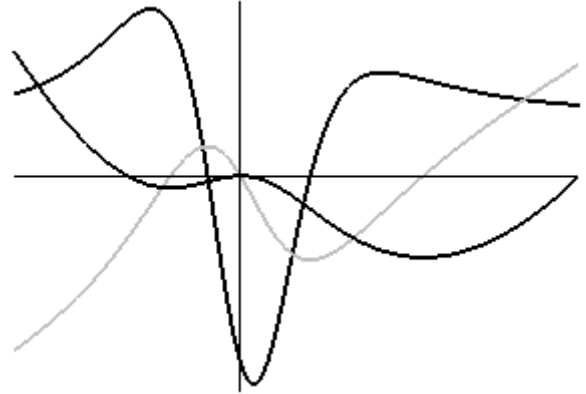


This fun fifty-minute test covers sections 3.3 through 3.10 of *Calculus* (4ed) by James Stewart. Clearly indicate your answers. Unless otherwise indicated, all parts of problems are four points each.

1. The figure shows the graphs of  $f$ ,  $f'$ , and  $f''$ . Identify each curve.



(a) = \_\_, (b) = \_\_, (c) = \_\_

2. Find the (first) derivative of the following

a)  $x^3 + 5x^2 - 4x$

b)  $x^2(x^3 - 1)$

c)  $\sqrt[3]{t}(t + 2)$

d)  $\frac{1 - \sin 2x}{1 + \sin 2x}$

e)  $\sqrt[5]{x \tan x}$

f)  $(x + 2)^8(x - 3)^8$

3. Find the (first) derivative of the following functions.

a)  $(2x^2 - 3)^{200}$

b)  $x \csc x$

c)  $\sqrt{1+\sqrt{x}}$

d)  $\cot^2 x - \csc^2 x$

4. Find the second derivative of the following functions.

a)  $\sec x$

b)  $\frac{x^2}{x-1}$

5. Find the equation of the tangent line to  $y = \frac{1}{\sin x + \cos x}$  when  $x = 0$ .

6. The gas law for an ideal gas at absolute temperature  $T$  (in kelvins), pressure  $P$  (in atmospheres), and volume  $V$  (in liters) is  $PV = nRT$ , where  $n$  is the number of moles and  $R = 0.0821$  is the gas constant. Suppose, at a certain instant,  $P = 12$  atm and is increasing at a rate of 2 atm/hour and  $V = 1000$  L and is decreasing at a rate of 2.5 L/hour. Find the rate of change of  $T$  with respect to time at that instant if  $n = 10$  moles. (6 points)

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

a)  $x^2y^2 = x^2 - y^2$

b)  $x^8 + y^8 = 81$

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

9. Find  $\frac{d^{801}}{dx^{801}} f(x)$  for  $f(x) = 3\sin(x) - x^5$ .

10. The area of a square is increasing at the rate of  $40 \text{ ft}^2/\text{sec}$ . How fast is the side of the square increasing when the length of the side is 5 feet? (6 points)

11. A 35-foot ladder is leaning against a wall when Mean Mitch begins to pull its base away from the wall. When the base is 21 feet from the wall, the base is moving at a rate of 0.5 feet per second. How fast is the top sliding down at that time? (8 points)