Practice Problems for Exam 2

Calculus I, MATH 1141
Fall 2020

Read each question carefully and practice showing all work to earn full credit.

1. Find the derivatives of the following functions. You may use any derivative rules we have learned, but show work for partial credit!

a) $f(x) = x^3 - 5x^2 - 3x + 19$

b) $g(t) = \dfrac{3}{t^2} - 8\sqrt{t}$

c) $G(y) = \sin(y)\tan(y)$

d) $F(x) = \dfrac{x^2 - 1}{x + 2}$

e) $f(x) = e^{x^3 - 2}$

f) $f(x) = \ln(\cos(x^2))$

g) $g(t) = t\ln(t) - t$

h) $f(x) = \ln\left(\dfrac{\sqrt{2x-1}}{x^4}\right)$

i) $F(x) = x^2 e^{1/x}$

j) $g(t) = \sin^2(\pi t)$

k) $f(x) = 3 \cdot 5^x + 4\log_2(x)$

2. Consider the following relation: $x^3 - y^2 + 1 = 4xy$.
a) Find dy/dx using implicit differentiation.
b) Find the equation of the tangent line to the curve at the point $P = (2, 1)$.

3. When air expands adiabatically (without gaining or losing heat), its pressure and volume are related by the equation $PV^{1.4} = C$, where C is a constant. Suppose the volume is 400 cm^3, the pressure is 80 kPa and the pressure is decreasing at a rate of 10 kPa/min. At what rate is the volume increasing at this moment? What are the units of the rate of change of the volume?

4. Use linear approximation to approximate $\sqrt{398}$. Choose an appropriate function and base point for your approximation.

5. A television camera is positioned 4,000 ft from the base of a rocket launching pad. Suppose the rocket rises vertically and its speed is 600 ft/sec when it has risen 3,000 ft.

a) How fast is the distance from the television camera to the rocket changing at that moment?

b) If the television camera is always kept aimed at the rocket, how fast is the camera's angle of elevation changing at that same moment?