

Honors Calculus, Math 1450: 17957- Assignment 1

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Due in class on 9/1/2017 9/8/2017

1. Find the first and the second derivatives of the following functions

(a) $w = re^{-r}$

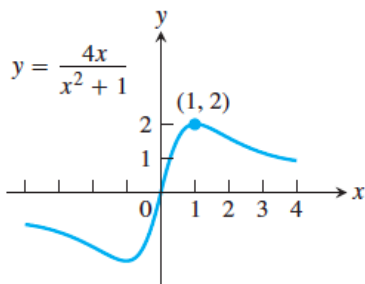
(b) $s = 3z^2e^{2z}$

(c) $y = -2x^{-1} + \frac{4}{x^2}$

(d) $u = d^{9/4} + e^{-2d}$

2. Does any tangent to the curve $y = \sqrt{x}$ cross the x -axis at $x = -1$? If so, find an equation for the line and the point of tangency. If not, why not?

3. Find the equation of the tangent line to *Newton's serpentine* (graphed below) at the origin and the point $(1, 2)$.



4. Find all points of the curve $y = \cot x$, for $0 < x < \pi$, where the tangent line is parallel to the line $y = -x$. Sketch the curve and the tangent(s) together, labeling each with its equation.

5. Is there a value of b that will make

$$f(x) = \begin{cases} x + b, & \text{if } x < 0 \\ \cos x, & \text{if } x \geq 0 \end{cases}$$

continuous at $x = 0$? Differentiable at $x = 0$? Give reasons for your answers.

6. Find

$$\frac{d^{2017}}{dx^{2017}}(\cos x).$$

7. Assume that a particle's position on the x -axis is given by

$$x = 3 \cos t + 4 \sin t,$$

where x is measured in feet and t is measured in seconds.

(a) Find the particle's position when $t = 0$, $t = \pi/2$, $t = \pi$.

(b) Find the particle's velocity when $t = 0$, $t = \pi/2$, $t = \pi$.

8. Find the derivatives of the following functions

(a) $r = (\csc \theta + \cot \theta)^{-1}$

(b) $y = \frac{1}{x} \sin^{-5}(3x) - \frac{x}{2} \cos^3 x$

(c) $h = y \tan(2\sqrt{y}) + 7$

(d) $u = \sin(x^2 e^x)$

(e) $w = \sqrt{3r + \sqrt{2 + \sqrt{1 - r}}}$

9. In some heavy machinery a piston is moving straight up and down, and its position at time t sec is

$$s = A \cos(2\pi nt)$$

with A and n positive numbers. The value of A is the amplitude of the motion, and n is the frequency (number of times the piston moves up and down each second). What effect does doubling the frequency have on the piston's velocity and acceleration?

10. Suppose that $f(x) = x^2$ and $g(x) = |x|$.

(a) Write down what the composite functions $f \circ g$ and $g \circ f$ are.

(b) Are these functions differentiable?

(c) Does your answer contradict the Chain Rule? Explain.