

Math 1500 Distance Assignment 3 Due June 19.

This HW covers Sections 2.3 to 2.9. It is important that you only upload your assignment ONCE.

1. Find $\lim_{x \rightarrow 0}$ of the following:

$$f(x) = \frac{\sin x}{x + \tan x}, \quad g(x) = (1 + 2x)^{3/x}.$$

2. Given the graph of $y = f(x)$ in Assignment 1, question 10. Graph $y = f'(x)$.
3. Find the derivative of the following functions. Do not simplify your answers.

(a) $3x^2 + 4x^{2.5} + 7x^{-8} + 5\pi^6$

(b) $(e^{2x} + 3x)(\sin 4x + 5^6)$

(c) $\frac{\tan 2x}{1 + \cos 3x}$

(d) $(1 + \sin 2x)^3$

(e) $\sqrt{\frac{1+x^2}{1+\csc x}}$

(f) $\frac{\tan(x^2)}{x^2}$

(g) $\sin(x^2 + \cos x^3)$

(h) $2^{x+\cot x}$

(i) $\log_2(1 + (2 + 3x)^{1/3})$

(j) $(\cos 2x)^{3x}$

(k) $\tan^{-1}(1 + x^2)$

(l) $|1 + x|$

(m) $f(x) = \begin{cases} -x^2, & x \leq 0; \\ x^4, & x > 0. \end{cases}$

(n) $g(x) = \begin{cases} -x^2, & x < 0; \\ 1, & x = 0; \\ x^4, & x > 0. \end{cases}$

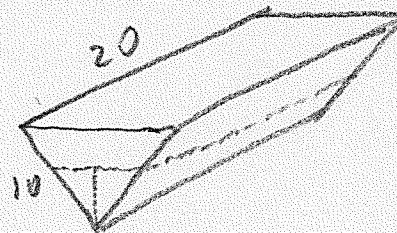
4. Find y' if $e^{xy} + x + \cos y = 0$.

5. Prove that $(\sin 2x)' = 2 \cos 2x$. You may assume the following facts:

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1, \quad \lim_{x \rightarrow 0} \frac{\cos x - 1}{x} = 0.$$

6. The height of a projectile at time t (in seconds) is given by $h(t) = 10 + 30t - 40t^2$ in meters. Determine the initial (at $t = 0$) height and velocity. Determine the time when the projectile reaches its maximum height and what is the maximum height. Determine the time and the velocity when the projectile falls back down to earth at zero height.

7. Given a water trough whose cross-section is an equilateral triangle whose side has length 10m and whose length is 20m. Water is poured into the trough at a rate of $10m^3$ per second. Find the rate at which the height of the water is increasing when the height of the water is $\sqrt{3}$ m.



8. Using implicit differentiation, show that $\frac{d}{dx} \sec^{-1}(x^2) = \frac{2}{x\sqrt{x^4-1}}$, $x \in (1, \infty)$