(1) If f(x) = IxI then find $f''(x)$.   (2)   Show details, find $\lim\limits_{x \to 0} \dfrac{\sin 3x}{x}$

(3) List three ways we can tell by looking at the graph of f(x) at x=a that f'(a) doesn't exist.

(4) If the graph of f(x) has a horizontal tangent at x=a then the graph of $f'(x)$ has what at x=a?

(5) True or False: There are functions which are continuous but not differentiable.

(6) If g(x) = cot x then $g'(x)$ =_____   (7) $\dfrac{d}{dt}\left[\dfrac{2}{t^5}\right]$ = _____

(8) If f(x) = sin²x + cos²x then $f'(x)$ = _____

(9) True or False: for every function f, $\lim\limits_{z \to x} \dfrac{f(z) - f(x)}{z - x} = f'(x)$

(10) Using the **definition of derivative**, find $f'(x)$ if f(x) = $\dfrac{1}{3 - x}$

(11) Prove: If f and g are differentiable functions then $\dfrac{d}{dx}$(f(x) - g(x)) = f'(x) - g'(x).

In problems 12- 17 , find $\dfrac{dy}{dx}$. Work carefully, very <u>limited</u> partial credit will be given. Simplify your answers. Do not leave any negative exponents or complex fractions. Combine fractions.

(12)) y = $\dfrac{\sqrt{x}}{1 + x^3}$ (13)   y = x³ tanx + x $\sqrt[3]{x}$

(14) y = sin²(3x)   (15) y = $\sqrt{1 + \sin(4x)}$

(16) y = $\dfrac{x^3}{\sqrt{1 - x^2}}$ (17)   y = $\dfrac{x - 4x^5}{x^3}$

(18) Find the point(s) on the curve y = 2sec x - tan x, 0 < x < 2π at which the tangent is
       horizontal.

(19) Find an equation of the tangent line to the curve x²+y²=25 at the point (4,3).

(20) There are two tangent lines to the parabola y=(x+2)² that pass through the origin. Find the
       points where these tangent lines intersect the parabola.

(21) Given the equation motion of a given particle s = t⁴ - 4t³ + 2, where s is in meters and t is in
       seconds, find the time(s) at which the acceleration is 0.

(22) Show that the curves whose equations are y ^{2}= x^3 and 2x^2 + 3y^2 = 5 intersect at the point (1,1)
       and that their tangent lines are perpendicular there. (EXPLAIN)

(23) Find the D^{13}(cos 2x)

(24)) Use differentials or linear approximation to approximate $\sqrt{24.8}$.   .

(25) A boat is pulled into a dock by means of a rope in a winch 12 feet above the deck of the boat.
       a) The winch pulls the rope at a rate of 4 feet per second. Determine the speed of the boat when
              there is 13 feet of rope out.
       b) At what rate is the angle θ changing at this instant?