Calculus I review problems:

(A) Evaluate the limits:

(1) $\lim_{x\to 2} \frac{x^2-x-2}{x^2-4}$ (2) $\lim_{x\to 0} \frac{\sin x^2}{x^2}$ (3) $\lim_{x\to 0} x^2 \sin \frac{1}{x^2}$ (4) $\lim_{x\to \infty} e^{-x^2}$

(5) $\lim_{x\to 0} \frac{\tan^{-1} x}{\sin^{-1} x}$ (6) $\lim_{x\to 1} \frac{x^3-1}{x^2-1}$ (7) $\lim_{x\to \infty} x^2 e^{-3x}$ (8) $\lim_{x\to 0} \sqrt{x}\, \ln(x^2)$

(B) Determine all horizontal and vertical asymptotes

(9) $f(x) = \frac{x+1}{x^2-3x+2}$ (10) $f(x) = 3\ln(x-2)$ (11) $f(x) = \frac{3}{e^x-2}$ (12) $f(x) = \frac{x^2}{x^2-1}$

(C) Use the limit definition to find the indicated derivative

(13) $f'(1)$ for $f(x) = \sqrt{x}$ (14) $f'(x)$ for $f(x) = x^3 + x$ (15) $f'(x)$ for $f(x) = 2 + 3/x$

(D) Find an equation of the tangent line

(16) $y = 3e^{2x}$ at $x = 0$ (17) $y = \sqrt{x^2+1}$ at $x = 0$

(18) $y^2 + xe^y = 4 - x$ at $(2,0)$

(E) Find the derivative

(19) $\tan^{-1}(\cos 2x^3)$ (20) $e^{\sqrt{3x}} + \cos^2(x^{-2}) \sin\sqrt{x}$

(21) second derivative of $\tan 2x$ (22) $y'(x)$ in $\sin(xy) + x^2 = x - y$

(F) Prove that:

(23) $x^3 + 7x - 1 = 0$ has exactly one solution

(24) $x^4 + 2x^2 - 3 = 0$ has exactly two solutions

(G) Find a value of "c" as guaranteed by the Mean Value Theorem

(25) for $f(x) = x^3 - x$ on $[0,2]$

(H) Do the following by hand: find all x-intercepts, find all critical numbers, identify all intervals of increase / decrease, find all local extrema, determine all intervals of concavity, find all inflection points of

(26) $f(x) = x^3 - 3x^2 - 24x$

(I) Find the absolute extrema

(27) $f(x) = x^2 e^{-x}$ on $[-1,4]$

(J) Find the linear approximation ~~to estimate~~ of

(28) $\sqrt{x^2+3}$ at $x_0 = 1$

(K) Use the linear approximation to estimate

(29) $\sqrt{25.25}$

(L) Do 2 steps of Newton's Method to find an approximate solution

(30) $x^3 + 5x - 1 = 0$

(M) Evaluate the indefinite integrals

(31) $\int 4x \sec x^2 \tan x^2 \, dx$ (32) $\int \tan x \, dx$ (33) $\int \sqrt{3x+1} \, dx$

(34) $\int \frac{e^{1/x^2}}{x^3} dx$ (35) $\int \frac{x^3+7}{x^2} dx$ (36) $\int \frac{x^2}{x^3+7} dx$ (37) $\int x^2(x^3+7) \, dx$

(N) Find a function $f(x)$ satisfying:

(38) $f'(x) = e^{-2x}$ & $f(0) = 3$

(O) Evaluate the following using Riemann sums:

(39) $\int_1^3 x^2 dx$

(P) Find the average valu of function on the given interval

(40) $f(x) = 4x - x^2$ on $[0,4]$

(Q) Evaluate the definite integrals

(41) $\int_0^1 t e^{-t^2} dt$ (42) $\int_0^{\pi/2} \sin 2x \, dx$

(R) Evaluate the area enclosed between

(43) $y = x^2 - 15$ and $y = 3 - x^2$ (44) $y = x^2$, $y = 0$, $y = 2 - x$

(S) Evaluate volume of the solid ~~by~~ obtained by ~~rotating~~ revolving the region bounded by $x = 4 - y^2$ and $x = y^2 - 4$ about

(45) x-axis (46) y-axis (47) $x = 4$ (48) $y = 4$

Calculus I quiz:

(1) An absolute extremum of a function on a closed interval must occur at either a critical number or an endpoint?

(2) To evaluate a definite integral, you can use any antiderivative?

(3) The area between f and g is given by $\int_a^b (f(x) - g(x))\,dx$?

(4) For any polynomial $p(x)$, $\lim_{x \to \infty} p(x) = \infty$?

(5) Given the graph of $f'(x)$, you can construct the graph of $f(x)$?

(6) If $f'(x) > 0$ for $x < a$ and $f'(x) < 0$ for $x > a$, then $f(a)$ is a local maximum?

(7) If a function is continuous at $x=a$, then it has a tangent line at $x=a$?

(8) If $f(x) = \frac{p(x)}{q(x)}$ for polynomials p and q with $q(a) = 0$, then f has a vertical asymptote at $x=a$?

(9) L'Hôpital's Rule states that the limit of the derivative equals the limit of the function?

(10) $\lim_{x \to a} \frac{f(x)}{g(x)} = \frac{\lim_{x \to a} f(x)}{\lim_{x \to a} g(x)}$?

(11) All piecewise continuous functions are integrable?

(12) If $f''(a) = 0$, then $y = f(x)$ has an inflection point at $x=a$?