

Work each problem on a separate page please (front & back is ok); SHOW YOUR WORK ☺

① (40 pts.) Differentiate the functions below with respect to  $x$ ,  $a, b, c$  are constants.

a.)  $f(x) = ax^2 + bx + c$

b.)  $g(x) = \cos^2(x)$

c.)  $h(x) = \frac{x+2}{x^4 + \sqrt{x}}$

d.)  $i(x) = (ax^2 + bx + c)e^{2x}$

e.)  $j(x) = \tan^{-1}(ax)$

f.)  $k(x) = \sqrt{x + \cos(x)}$

g.)  $l(x) = \sin(ax^2 + bx + c)$

h.)  $m(x) = 8^{x+c}$

i.)  $y(x) = \frac{3x - (\cos(x) + x)}{\tan(x)}$

j.)  $y(x) = (\sin(x))^{\cos(x)}$

CHOOSE  
ANY 8  
of  
THESE

② (5 pts.) Determine the limit below, show your work;  $f$  is a function of  $x$ ,

$$\lim_{x \rightarrow 0} \left( \frac{\sin(f(x))}{f(x)} \right) \text{ where } \lim_{x \rightarrow 0} f(x) = 0 \text{ & } f \text{ is differentiable at zero.}$$

③ (5 pts.) Consider the function:

$$f(x) = \begin{cases} (x+5)^2 & -\infty < x < -4 \\ |x| - 3 & -4 < x < \infty \end{cases}$$

Find where  $f$  is decreasing or increasing. Also find the critical numbers of  $f$  and any local minima or maxima. Does  $f$  have any global extrema? (Please use calculus & graph to check)

④ (20 pts.) Calculate the definite integrals below.

a.)  $\int_0^1 (x^6 + 3x^3 + 2x - 1) dx$

c.)  $\int_{\ln(3)}^{\ln(4)} e^x dx$

b.)  $\int_0^{\pi} \sin(x) dx$

d.)  $\int_{-B}^B |x| dx$  where  $B$  is an arbitrary fixed #.

CHOOSE  
ANY 3  
of THESE

⑤ (10 pts.) Let  $f(x) = \frac{h}{b}x$  where  $h$  and  $b$  are constants. Calculate the definite integral of  $f(x)$  from zero to  $b$ . Make a graph and explain, what does the integral tell you?

⑥ (5 pts.) Calculate the derivative of the integral using the FTC

$$\frac{d}{dx} \int_{\cos(x)}^{\sin(x)} \ln(t+9) dt$$

⑦ (15 pts.) Determine the following indefinite integrals:

a.)  $\int e^{3x} dx$

c.)  $\int x \cos(x^2) dx$

b.)  $\int \sin(ax) dx$

d.)  $\int \frac{\sin \sqrt{x}}{\sqrt{x}} dx$

CHOOSE  
ANY 3  
of THESE

Extra Credit (5 pts.) work any 2 of the 4 skipped problems.

Survey Over ↗