

Name.....SSN.....Score.....

Show all work

- Find the limits (16)
 - $\lim_{x \rightarrow \infty} \frac{4x^2 - 3}{x^2 + x - 6}$;
 - $\lim_{x \rightarrow \infty} \left(\frac{2x+2}{2x+1} \right)^x$;
 - $\lim_{x \rightarrow 1} \left(\frac{1}{\ln x} - \frac{1}{x-1} \right)$;
 - $\lim_{x \rightarrow -2} \frac{\sin(x+2)}{2x+4}$.
- Find the derivatives of $y = f(x)$ with respect to x (16)
 - $f(x) = (\cos(3x + 1))^2$;
 - $f(x) = \frac{x}{\sqrt{1+x^2}}$;
 - $f(x) = x \tan \sqrt{x}$;
 - $x^2 - x \sin y + y^2 = 4$.
- Find the integrals (20)
 - $\int \frac{e^x}{(e^x - 2) \ln(e^x - 2)} dx$;
 - $\int \cos^4 x \sin^2 x dx$;
 - $\int_0^1 (x^2 - 2x + 1) dx$;
 - $\int_0^2 (x - |x - 1|) dx$.
- Use a linear approximation to estimate the following values (10)
 - $\sqrt{17}$;
 - $\sin 58^\circ$.
- If $g(x) = \sqrt{x - 2}$, and $(h \circ g)(x) = x + 1$, find $h(x)$.(5)
- If a ball is thrown vertically upward with a velocity of 30 ft/s, then its height in feet after t seconds is $s = 30t - 6t^2$. What is the velocity of the ball when it is 24 ft above the ground on its way up? On its way down? (5)
- A box with a squares base and open up must have a volume of $8 m^3$. Find the dimensions of the box that minimize the amount of material used.(10)
- Sketch the graph of $y = 2 \sin x + \cos^2 x$. Find the x- and y- intercepts; plot the stationary points and the inflection points; determine the intervals where y is increasing and decreasing, where the graph is concave up and concave down.(10)
- Use the second part of fundamental theorem of calculus:(8)
 - Find the derivative $\frac{d}{dx} \int_{3x}^{e^x} \cot t^2 dt$;
 - Prove that the function $F(x) = \int_x^{2x} \frac{-1}{t} dt$ is a constant on the interval $(-\infty, 0)$.