

Instructor: Harry S. Mills

Show all work. Do your own work. Submit problems in the proper order. Spread your work out! If you get stuck, start a fresh piece of paper. You can always *insert* more pages if you do it this way. Only your *name* should be on this cover sheet. Test is 50 minutes. Start a 12:10. End at 1:00.

1. (20 pts) Evaluate $\int_1^4 (x^2 - 2) dx$, by the limit definition of the definite integral.
2. Fundamental Theorem of Calculus time!
 - a. (10 pts) Evaluate $\int_0^{\frac{\pi}{4}} (\sec^2(x) - 2) dx$ using the Fundamental Theorem of Calculus.
 - b. (10 pts) Evaluate $\frac{d}{dx} \int_0^{\sin(x)} \left(\frac{\sec^2(t) + 12t}{t^2 - 7} \right) dt$ by the Fundamental Theorem.
3. The velocity of a particle, in meters per second, is given by $f(t) = t^2 - 5t + 6$, where $t =$ time, in seconds. Give *exact* answers to the following.
 - a. (10 pts) Find the net displacement of the particle, from time $t = 0$ to time $t = 3$.
 - b. (10 pts) Find the total distance travelled, from time $t = 0$ to time $t = 3$.
4. Substitution! Evaluate the following definite and indefinite integrals.
 - a. (10 pts) $\int \left(\frac{dx}{(\sqrt{x} + 1)^3} \right)$
 - b. (10 pts) $\int_0^{\frac{\pi}{6}} \sec^2(2x) dx$. I want an *exact* answer.

Bonus Answer any two of the following, for up to 10 bonus points.

5. (5 pts) Evaluate $\lim_{x \rightarrow -\infty} \left(\sqrt{49x^2 + 3x + 7x} \right)$.



6. (5 pts) Find all vertical and horizontal asymptote of $f(x) = \frac{x-3}{x+2}$, and use them, together with intervals of increase and decrease, and concavity to sketch the graph of f . (Show work!)

7. (5 pts) Find the equation of the oblique asymptote for $f(x) = \frac{2x^3 - 5x + 6}{x^2 - 2x}$