

Name: _____

Complete the following problems to the best of your ability. Clearly number each question, and write your name on each sheet of paper you turn in. Algebraic support must be shown to receive full credit (i.e. show work!). Answers should be exact unless otherwise specified.

- (1) (10 pts.) Find the absolute extreme values of $f(t) = t\sqrt{4-t^2}$ on the interval $[-1, 2]$.
- (2) (10 pts.) Evaluate the following limits: (a) $\lim_{t \rightarrow 0} \frac{e^t - 1}{t^3}$, (b) $\lim_{x \rightarrow 0^+} (\tan x)^x$.
- (3) (10 pts.) A cylindrical can is made to hold 8 in^3 of water. Find the dimensions of the can that will minimize the amount of metal needed to build it.
- (4) (10 pts.) A car is traveling at 70 ft/s when the brakes are fully applied, producing a constant deceleration of 22 ft/s^2 . What is the distance traveled by the car before it comes to a stop?
- (5) (10 pts.) Consider the function $f(x) = x \cos x$.
- (a) Estimate the area under the curve of f between $x = 0$ and $x = \pi$ using four approximating rectangles and left endpoints (it's fine to leave your answer in correctly-rounded decimal form).
- (b) Sketch the graph of f and the four approximating rectangles on the interval $[0, \pi]$, and determine whether your estimate from part (a) an underestimate or an overestimate.
- (6) (10 pts.)
- (a) Evaluate the definite integral $\int_7^7 x^{2x e^{\sqrt{\ln x}}} dx$.
- (b) If $\int_1^{12} f(x) dx = -5$ and $\int_3^{12} f(x) dx = 2$, what is $\int_3^1 f(x) dx$.
- (7) (15 pts.)
- (a) If $f(x) = \int_0^{\tan x} \sqrt{t - \sqrt{t}} dt$, find $f'(x)$.
- (b) On what interval is the curve $f(x) = \int_0^x \frac{t^2}{t^2 + t + 2} dx$ concave downward?
- (c) Evaluate $\int_1^2 \frac{(x-1)^3}{x^2} dx$ (Hint: multiply out the numerator and divide term-by-term).
- (8) (10 pts.) Consider a particle moving along a straight line with acceleration function (in m/s^2) given by $a(t) = 2t + 3$ and initial velocity $v(0) = -4$.
- (a) Find the velocity of the particle at time t .
- (b) Find the total distance traveled by the particle between $t = 0$ and $t = 3 \text{ s}$.
- (9) (15 pts.) Evaluate the following integrals: (a) $\int \tan^2 \theta \sec^2 \theta d\theta$, (b) $\int_0^1 \frac{e^z + 1}{e^z + z} dz$.