

MATH 1710 - Written Homework 12

Due 4/23/15

Directions: Write legibly and show all your work. Please staple your pages together. The grader will not be required to grade assignments that are sloppy and/or unstapled.

1. Show that $\int_{-\pi}^{\pi} \frac{x^2 \sin x}{\sqrt{1+x^2}} dx = 0$. Do not try to find the antiderivative; instead use symmetry.

2. Compute the average value \bar{f} of the function on the indicated interval.

(a) $f(x) = 2x^2 - 3x$; $[-1, 2]$

(b) $f(x) = \frac{x}{\sqrt{x^2 + 1}}$; $[0, 3]$ (*Hint:* Substitution)

3. **Substitution Practice:** Evaluate the following integrals using an appropriate substitution.

(a) $\int x^{-1/3} \sqrt{x^{2/3} - 1} dx$

(b) $\int \frac{\sin(t^{-1})}{t^2} dt$

(c) $\int_0^1 \frac{12y^2 - 2y + 4}{(4y^3 - y^2 + 4y + 1)^2} dy$

(d) $\int \sec^2 \theta \tan^4 \theta d\theta$

(e) $\int_0^2 x \sqrt{5 - \sqrt{4 - x^2}} dx$ (*Hint:* 2 substitutions)

4. The heat capacity $C(T)$ of a substance is the amount of energy (in joules) required to raise the temperature of 1 gram by 1°C when the substance is at temperature T .

(a) Explain why the energy required to raise the temperature from T_1 to T_2 corresponds to the area under the graph of $C(T)$ over the interval $[T_1, T_2]$.

(b) How much energy is required to raise the temperature from 50° to 100° if $C(T) = 6 + 0.2\sqrt{T}$?