Mechanics Based Problems

1. Express the following limits as a definite integral on the given interval, then evaluate them using Mathematica:

(a) $\lim_{n\to\infty} \sum_{i=1}^{n} x_i \sin x_i \Delta x$, $[0, \pi]$

$$\int_0^{\pi} x \sin x \, dx = \underline{\underline{3.14159}}$$

(b) $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{e^{x_i}}{1+x_i} \Delta x$, $[1, 5]$

$$\int_1^{5} \frac{e^x}{1+x} \, dx = \underline{\underline{29.8113}}$$

(c) $\lim_{n\to\infty} \sum_{i=1}^{n} [2(x_i^*)^2 - 5x_i^*] \Delta x$, $[0, 1]$

$$\int_0^{1} (2x^2 - 5x) \, dx = \underline{\underline{-\frac{11}{6}}}$$

(d) $\lim_{n\to\infty} \sum_{i=1}^{n} \sqrt{x_i^*} \Delta x$, $[1, 4]$

$$\int_1^{4} \sqrt{x} \, dx = \underline{\underline{\frac{14}{3}}}$$

2. The graph of f is shown below. Evaluate each integral by interpreting it in terms of areas.

(a) $\int_0^2 f(x)dx$

4

(b) $\int_0^5 f(x)dx$

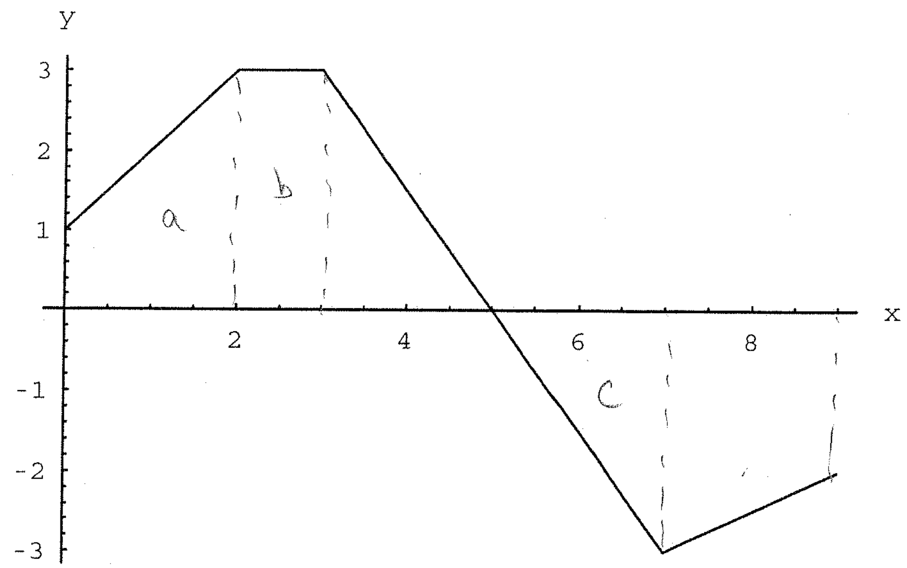
10

(c) $\int_5^7 f(x)dx$

-3

(d) $\int_0^9 f(x)dx$

2



3. Using the properties of the definite integral write the sum or difference as a single integral in the form $\int_a^b f(x)dx$.

(a) $\int_1^3 f(x)dx + \int_3^6 f(x)dx + \int_6^{12} f(x)dx$

$$= \int_1^{12} f(x)\,dx$$

(b) $\int_2^{10} f(x)dx - \int_2^7 f(x)dx$

$$= \int_7^{10} f(x)\,dx$$

4. Use the properties of the definite integral to find $\int_2^5 f(x)dx$ if $\int_2^8 f(x)dx = 1.7$ and $\int_5^8 f(x)dx = 2.5$

$-.8$

Problem Solving Problems

1. In example 2 in section 5.1 we showed that $\int_0^1 x^2 dx = \frac{1}{3}$. Use this fact and the properties of integrals to evaluate $\int_0^1 (5 - 6x^2)dx$.

3

2. Use the properties of integrals and the result of Example 3 section 5.2 to evaluate $\int_1^3 (2e^x - 1)dx$

$= 2(e^3 - e) - 2$

3. If $\int_0^2 f(x)dx = 3$ then determine the value of $\int_0^2 2(f(x) - 5)dx$

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