

Show appropriate work for all problems. If you use a substitution, show the substitution you use.

1. Evaluate the following integrals.

(a) $\int_1^2 \frac{2x-x^2}{x^3} dx$

(b) $\int (\sinh x - \sec x \tan x) dx$

(c) $\int \frac{1+x}{1+x^2} dx$

2. Suppose

$$\int_1^2 f(x) dx = 3, \int_2^4 f(x) dx = 7, \text{ and } \int_4^8 f(x) dx = -2$$

Find

$$\int_1^4 \frac{f(\sqrt{x})}{\sqrt{x}} dx$$

3. Suppose we are growing a population of yeast, and that

$f(t)$ = The rate at which the population is growing (in grams/min) at time t (in minutes)

(a) What does the following mean? Give a complete sentence, and include appropriate units.

$$\int_0^{20} f(t) dt = 17$$

(b) Suppose the statement in (a) is true, and that after 20 minutes the population of yeast is 50 grams. What was the original population at $t = 0$ minutes?