

1. The people of Fredonia are of two races X and Y. Initially, the population consists of 30 million X people. Then each year one million Y people and no X people migrate in. However, 1 million of the residents, both X and Y people, also migrate out. Assume that Fredonia is a melting pot with X and Y people thoroughly mixed. Set up a differential equation to predict the number of X people after t years. (Note that t is a continuous variable; it can assume any real value ≥ 0 .)

2. Partial fractions

Decompose the following rational functions into partial fractions.

(a) $\frac{1}{(s+1)(s-1)(s-2)}$

(b) $\frac{1}{(s-1)^2(s-2)}$

3. Integration by parts

(a) Compute $\int t \sin t \, dt$.

(b) Compute $\int t e^t \, dt$.

(c) Compute $\int t^2 e^t \, dt$.