

7. [13 points] Household electricity in the United States is supplied in the form of an alternating current that varies sinusoidally with a frequency of 60 cycles per second (Hz). The voltage is given by the equation

$$E(t) = 170 \sin(120\pi t),$$

where t is given in seconds and E is in volts.

- a. [7 points] Using integration by parts, find $\int \sin^2 \theta d\theta$. Show all work to receive full credit. (Hint: $\sin^2 \theta + \cos^2 \theta = 1$.)

- b. [6 points] Voltmeters read the root-mean-square (RMS) voltage, which is defined to be the square root of the average value of $[E(t)]^2$ over one cycle. Find the exact RMS voltage of household current.