Workshop 2 August 30, 2011

1. Just some algebra here. Rewrite

$$\frac{1}{2x+3}+\frac{x}{x^2+2x+2}+\frac{1}{x^2+4x+5}$$

as a single fraction. You should expand and simplify the numerator, but can leave the denominator factored.

2. If $f(0)=f(1)=g(0)=g(1)=0$, show that $\int_0^1 f''(x)g(x)\,dx=\int_0^1 f(x)g''(x)\,dx$.

3. Household electricity is supplied in the form of alternating current that varies from +170V (volts) to -170V with a frequency of 60Hz (Hertz, or cycles per second). If you understand this, you can check that the following formula is correct for the voltage

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

where t is time in seconds. A voltmeter reads the RMS (root mean square) voltage, i.e. the square root of the average value of $[E(t)]^2$ over one cycle.

   (a) Use this description to calculate the RMS.

   (b) Some appliances require 240V RMS voltage. Find the corresponding amplitude to make this value. (I.e., instead of ±170V, what value should the peak voltage be?)

4. Compute $\int \sqrt{1-x^2}\,dx$.

5. Compute $\int x\sqrt{1-x^2}\,dx$.

6. Compute $\int \sqrt{3+x^2}\,dx$.

7. Using 1, evaluate

$$\int \frac{3x^4+19x^3+44x^2+43x+16}{(2x+3)(x^2+2x+2)(x^2+4x+5)}\,dx.$$