1. (7 points)Write out the form of the partial fraction decomposition of the expression

$$\frac{x^2}{(x-\sqrt{3})(x-3)^3(x^2+4)(x^2+x+2)^2}$$

DO NOT evaluate the numerical values of the coefficients.

2. (7+7 points) Evaluate the following integrals:

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

(b) $\displaystyle\int_0^{\sqrt[4]{\pi/4}} t^3 \sec^4(t^4)\tan^4(t^4)dt$

3. (8+8 points)Using the method of cylindrical shells, Set up, but DO NOT EVALUATE, an integral for the volume of the solid obtained by rotating

   (a) The region in the first quadrant bounded by the curves $y = e^x$ and $y = ex^2$ about the line $x = 3$.[Sketch the region and a typical rectangle]

   (b) The region bounded by the curves$y = e^x, y = 4$, and $x = 0$ about the x-axis.[Sketch the region and a typical rectangle]

4. (7 points) Let $f(x) = 3x^2 - 2ax + b$, where $a \neq 1$. Find the value of b if the average value of f over the interval $[1, a]$ is 4.

5. (10 points) Evaluate $\int (x \ln x)^2 dx$

6. (10 points) Evaluate $\dfrac{x^2}{(4-x^2)^{3/2}} dx$

7. (8 points) Evaluate $\int 8\cos^4 t\, dt$

8. (10 points) Evaluate $\dfrac{15}{(x-2)(x^2+1)}dx$

9. (10 points) Using the substitution $t = \tan(x/2)$, $-\pi < x < \pi$, to evaluate the integral $\displaystyle\int \frac{\sqrt{3}}{4 - 2\cos x} dx$

10. (8 points) Evaluate $\displaystyle\int \sqrt{\frac{1}{x} + \frac{1}{\sqrt{x}}} dx$