Recitation #10: Trig Substitution and Partial Fractions

Group work:

Problem 1 *Without determining the coefficients, write the partial fraction decomposition of the following rational function:*

$$\frac{5x^{13} - 6x^{12} + 7x^3 - 5x - 18}{(2x - 3)(5x + 9)^3(x^2 + 9x + 19)(x^2 + 9x + 21)^2}$$

Problem 2 *Evaluate:*

$$\int \frac{7x^3 + 18x + 9}{x^4 + 9x^2} \, dx$$

Hint: If $f(x) = 7x^3 + 18x + 9$, then $f(2) = 101$, $f(1) = 34$, and $f(-1) = -16$.

Problem 3 *Evaluate the following integrals*

(a)
$$\int \frac{x^2}{\sqrt{4x - x^2}} \, dx.$$

(b)
$$\int \frac{e^x}{\sqrt{e^{2x} + 9}} \, dx.$$

(c)
$$\int \frac{dx}{x^{\frac{1}{2}} - 9x^{\frac{3}{2}}}.$$