Exercise 1. Write out the form of the partial fraction decomposition of the function. Do *not* determine the numerical values of the coefficients.

(a) $\dfrac{x^4 + 1}{x^5 + 4x^3}$

(b) $\dfrac{1}{(x^2 - 9)^2}$

(c) $\dfrac{2x + 1}{(x + 1)^3(x^2 + 4)^2}$

(d) $\dfrac{x^4}{(x^3 + x)(x^2 - x + 3)}$

(e) $\dfrac{1}{x^6 - x^3}$

(f) $\dfrac{x^2}{x^2 + x + 2}$

2-4 Evaluate the integral.

Exercise 2. $\displaystyle\int \frac{x^2 - 2x - 1}{(x - 1)^2(x^2 + 1)}\, dx$

Exercise 3. $\displaystyle\int \frac{x^3 + x^2 + 2x + 1}{(x^2 + 1)(x^2 + 2)}\, dx$

Exercise 4. $\displaystyle\int \frac{dx}{x(x^2 + 4)^2}$

Exercise 5. Make a substitution to express the integrand as a rational function and then evaluate the integral.

$$\int_{1/3}^{3} \frac{\sqrt{x}}{x^2 + x}\, dx$$

Exercise 6. Use integration by parts to show that

$$\int \frac{dx}{(x^2 + 1)^n} = \frac{x}{(x^2 + 1)^n} + 2n \int \frac{x^2}{(x^2 + 1)^{n+1}}\, dx.$$