Problem 1: Integrate the following:

(a) $\displaystyle\int \frac{x^3}{\sqrt{1-x^2}}\,dx$

(b) $\displaystyle\int \frac{-x+5}{(x+1)(x-2)}\,dx$

(c) $\displaystyle\int_0^\infty \frac{x}{(x^2+1)^2}\,dx$

(d) $\displaystyle\int \frac{dx}{x^2\sqrt{x^2-9}}$

(e) $\displaystyle\int_2^6 \frac{dx}{6(x-2)^{3/2}}$

(f) $\displaystyle\int \frac{x}{\sqrt{x^2+36}}\,dx$

(g) $\displaystyle\int \frac{3x^2+4x+3}{(x+1)(x^2+1)}\,dx$

(h) $\displaystyle\int_{-2}^0 \frac{2}{(x+2)^{1/4}}\,dx$

(i) $\displaystyle\int \frac{x+4}{x(x-2)^2}\,dx$

(j) $\displaystyle\int \frac{x^3}{\sqrt{x^2+25}}\,dx$

(k) $\displaystyle\int_3^5 \frac{dx}{(x-3)^2}$

(l) $\displaystyle\int \frac{3}{x^2\sqrt{x^2+9}}\,dx$

(m) $\displaystyle\int \frac{x+4}{x^2-4}\,dx$

(n) $\displaystyle\int \frac{3x}{(x+1)(x-2)}\,dx$

(o) $\displaystyle\int_{-1}^1 \frac{dx}{x+1}$

(p) $\displaystyle\int \frac{dx}{\sqrt{16-x^2}}$

(q) $\displaystyle\int_0^1 x\ln x\,dx$

Problem 2: Integrate the following:

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

(b) $\displaystyle\int \frac{-4x-16}{x^3+16x}\,dx$

(c) $\displaystyle\int_1^3 \frac{dx}{\sqrt{3-x}}$

(d) $\displaystyle\int_0^\infty \frac{3}{(x+1)^2}\,dx$

(e) $\displaystyle\int \frac{x^3}{\sqrt{4-x^2}}\,dx$

(f) $\displaystyle\int \frac{3x}{x^2+3x-4}\,dx$

(g) $\displaystyle\int \frac{x}{x^2+2x+5}\,dx$

(h) $\displaystyle\int_1^4 \frac{dx}{\sqrt{x-1}}$

(i) $\displaystyle\int_{-\infty}^\infty \frac{e^x}{1+e^{2x}}\,dx$

(j) $\displaystyle\int_{-\infty}^{-1} xe^{-x^2}\,dx$

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

(l) $\displaystyle\int_0^\infty \frac{dx}{(x+1)^3}$

(m) $\displaystyle\int_0^\infty \frac{2x}{x^4+1}\,dx$

(n) $\displaystyle\int \frac{x^2+4x+2}{x^2+1}\,dx$

(o) $\displaystyle\int_1^\infty \tan^{-1}x\,dx$

(p) $\displaystyle\int_0^4 \frac{x^3-1}{2\sqrt{x}}\,dx$

Problem 3: Complete the following:

(a) Set up but do not evaluate the integral that gives the area of the surface revolving the curve $y = \sqrt{2x+1}$ from $x = 0$ to $x = 4$ around the x-axis.

(b) Set up but do not evaluate an integral to find the area of the surface obtained by rotating the curve $y = \ln(1 - x^2)$ for $0 \leq x \leq 1/2$ about the x-axis.

(c) Set up but do not evaluate the area of the surface obtained by rotating the curve $y = \sqrt{1+4x}$ for $5 \leq x \leq 11$ about the x-axis.

(d) Set up but do not evaluate an integral for computing the area of the surface obtained by rotating the arc of the parabola $y = x^2$ between $x = 1$ and $x = 3$ around the y-axis.

(e) The curve $y = x^3$ for $1 \leq x \leq 2$ is rotated about the x-axis. Find the area of the resulting surface.

(f) Set up but do not evaluate an integral to compute the surface area resulting from rotating the curve $y = \sqrt[3]{x}$, $1 \leq x \leq 8$, about the y-axis.

(g) Find the area of the surface of revolution generated by revolving the curve $x^3 = 3y$, $0 \leq y \leq 9$ about the x-axis.

Problem 4: Write out the form of the partial fraction decomposition of

$$f(x) = \frac{x^4 + 3}{x^3(x+5)^2(x^2+2x+3)^2}$$

You do not need to find the numerical value of the coefficients. You need only specify the form of the decomposition.