

## 1 PART I: FINDING PARTIAL FRACTIONS

Write a partial fraction form of the following. Do NOT solve for the constants!

1.  $\frac{1 + 3x + 4x^2}{x^3 + 4x^2 + 3x}$
2.  $\frac{1}{x^4 + 9x^2}$
3.  $\frac{3x^3 - 7x}{(x^2 + 5)(x^2 - 4)}$
4.  $\frac{5x^3 + 2x^2}{(x - 4)(x^2 + 8x + 90)(x - 3)^2}$
5.  $\frac{x^7 - 6x^5 + 1}{(x - 1)(2x - 3)^3(4x^2 + 1)(x^2 + 36)^2}$
6.  $\frac{3x^2 + 1}{x^4 - 16}$
7.  $\frac{6x + 7}{(x^2 - 2x + 1)(x^2 + 5x + 9)}$
8.  $\frac{1 - 8x}{(x^2)(x + 2)(x^2 + 3)^2}$
9.  $\frac{x^2 + x}{x^3 + 3x^2 + 2x}$
10.  $\frac{2x^2 + 1}{x^5 - 4x^4 + 4x^3}$

## 2 PART II: FINDING ANTIDERIVATES

1.  $\int \frac{x^2 + 2x + 9}{x^3 + 9x} dx$
2.  $\int \frac{x^4 - x^2 + 3x + 1}{(x - 1)(x^2 + 1)^2} dx$
3.  $\int \frac{1}{x^2 - 16} dx$
4.  $\int \frac{1}{\sqrt{x^2 - 16}} dx$
5.  $\int \frac{x}{\sqrt{x^2 - 16}} dx$

6.  $\int \frac{3x^2}{x^2 - 4} dx$
7.  $\int \frac{7x^2 + 3}{25x^4 + x^2} dx$
8.  $\int \frac{2x^4 + x^3 + 4x^2 - 3x + 2}{x(x^2 + 1)^2} dx$
9.  $\int \frac{6x^2 + 21x + 20}{(x + 1)(x + 2)^2} dx$
10.  $\int \frac{12x^2 + 2x + 27}{6x(4x^2 + 9)} dx$

### 3 PART III: IMPROPER INTEGRALS

State whether the following converge or diverge. If an integral converges, state the value it converges to.

1.  $\int_4^{\infty} \frac{4}{x^2 - 4} dx$
2.  $\int_{10}^{\infty} \frac{3x}{x^2 - 9} dx$
3.  $\int_2^3 \frac{5x}{\sqrt{x^2 - 4}} dx$
4.  $\int_{-1}^1 \frac{5x + 1}{4\sqrt[3]{x}} dx$
5.  $\int_1^{\infty} \frac{4x^2 + 18}{x^3 + 9x} dx$
6.  $\int_1^{\infty} \frac{60x^2 - 4x + 100}{(x^2 + 1)(16x^2 + 25)} dx$