

## MATH 118 WINTER 2015 HOMEWORK 3

### DUE THURSDAY JAN. 29 3PM IN ASSIGNMENT BOX

QUESTION 1. (15 PTS) Calculate the following indefinite integrals through partial fractions. Please provide enough details.

a) (2 PTS)  $\int \frac{2x}{x^2 + 2x + 2} dx;$

b) (2 PTS)  $\int \frac{x^2 + 2}{(x + 1)^3(x - 2)} dx;$

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

d) (3 PTS)  $\int \frac{x^4 + 4x^3 + 11x^2 + 12x + 8}{(x^2 + 2x + 2)^2(x + 1)} dx.$

e) (3 PTS)  $\int \frac{x^4}{x^4 + x^3 - x^2 + x - 2} dx.$

f) (3 PTS)  $\int \frac{dx}{x^6 - 1}.$

QUESTION 2. (5 PTS) Let  $P, Q$  be polynomials with  $\deg(P) < \deg(Q)$ . Further assume that  $Q(x) = (x - a_1) \cdots (x - a_n)$  for some  $a_1, \dots, a_n \in \mathbb{R}$  with  $\forall i \neq j, a_i \neq a_j$ . Prove

$$\int \frac{P(x)}{Q(x)} dx = \sum_{k=1}^n A_k \ln|x - a_k| + C \quad (1)$$

where  $A_k = \frac{P(a_k)}{Q'(a_k)}$ .