

Name: Key  
September 23, 2014  
MAC 2312.5828  
Cyr

Quiz 3

You must show all work to receive full credit!!

**Problem 1.** (1.5 pts) Evaluate  $\lim_{u \rightarrow \infty} \frac{3u^4 + 2}{(u^2 - 4)(3u^2 - 1)}$  (be sure to justify your answer).

$$\lim_{u \rightarrow \infty} \frac{3u^4 + 2}{3u^4 - 13u^2 + 4} = \lim_{u \rightarrow \infty} \frac{3u^4}{3u^4} = \textcircled{1}$$

Since  $\deg(\text{numerator}) = \deg(\text{denominator})$ , we can just find the limit of the ratio of the leading coefficients.

**Problem 2.** (3.5 pts) Evaluate  $\int \frac{x^2 + x + 7}{(x^2 + 7)^2} dx$ .

$$\begin{aligned} \frac{x^2 + x + 7}{(x^2 + 7)^2} &= \frac{Ax + B}{x^2 + 7} + \frac{Cx + D}{(x^2 + 7)^2} \Rightarrow x^2 + x + 7 = (Ax + B)(x^2 + 7) + Cx + D \\ x^2 + x + 7 &= Ax^3 + Bx^2 + (7A + C)x + 7B + D \\ A &= 0 \quad B = 1 \quad C = 1 \quad D = 0 \end{aligned}$$

$$\int \frac{dx}{x^2 + 7} + \int \frac{x dx}{(x^2 + 7)^2} \quad \begin{array}{l} u = x^2 + 7 \\ du = 2x dx \end{array}$$

$$\frac{1}{\sqrt{7}} \tan^{-1}\left(\frac{x}{\sqrt{7}}\right) + \frac{1}{2} \int \frac{du}{u^2} = \boxed{\frac{1}{\sqrt{7}} \tan^{-1}\left(\frac{x}{\sqrt{7}}\right) - \frac{1}{2(x^2 + 7)} + C}$$