

### MATH 201 FALL 2019 GRADED HOMEWORK #3

*Write clearly, on separate paper. All questions carry equal weight.*

- (1) Determine the limit of the sequence

$$\left\{ \frac{2n^3 + 7n^2 - 3n}{5n^3 - n + 1} \right\}_{n \in \mathbb{N}},$$

justifying your answer.

- (2) Give a proof, by induction, of the following

**Proposition.** For each positive integer  $n$ , the function  $(1+x)^n$  is continuous.

- (3) Let  $\{x_n\}_{n \in U}$  be a sequence such that

$$\forall m, n \in U, |x_m - x_n| < \frac{1}{m} + \frac{1}{n}.$$

Give a careful, direct proof that  $\{x_n\}_{n \in U}$  is a Cauchy sequence.