Last name _____

First name _____

LARSON—MATH 550—CLASSROOM WORKSHEET 15
Ceiling, floor & more (notation).

Concepts & Notation

- Sec. 2.6. Δ operator. Rising and falling factorials.
- Sec. 3.1. floor and ceiling notation.
- Sec. 3.2. interval notation.
- Sec. 3.4. mod notation.
- Sec. 4.4. Analyzing the size of $n!$
- Sec. 5.1. Binomial coefficients!

Homework

1. Define $x^{\underline{m}}$. Find $5^{\underline{3}}$.

2. Define $x^{\overline{m}}$. Find $5^{\overline{3}}$.

3. What are $\lceil x \rceil$ and $\lfloor x \rfloor$?

4. Claim: $\lceil x \rceil = x \Leftrightarrow x$ is an integer $\Leftrightarrow \lfloor x \rfloor = x$

5. Claim: $\lceil x \rceil - \lfloor x \rfloor = [x$ is not an integer $]$

6. Claim: $x - 1 < \lfloor x \rfloor \leq x \leq \lceil x \rceil < x + 1$.

7. Claim: $\lfloor x \rfloor = n \Leftrightarrow n \leq x < n + 1$.

8. Claim: $\lfloor x + n \rfloor = \lfloor x \rfloor + n$ (for $n \in \mathbb{Z}, x \in \mathbb{R}$) .

9. Does $\lfloor nx \rfloor = nx$?

10. What are $[\alpha..\beta], [\alpha..\beta)$ (for $\alpha, \beta \in \mathbb{R}$)?

11. How many integers are in $[\alpha..\beta)$ (for $\alpha, \beta \in \mathbb{R}$)?

The *quotient* of positive integers n and m is $\lfloor n/m \rfloor$ and the *modulus* is the remainder of dividing n by m, denoted $n \mod m$.

12. Find $\lfloor 32/5 \rfloor$ and $32 \mod 5$ and check that $32 = \lfloor 32/5 \rfloor \cdot 5 + (32 \mod 5)$.

13. State a general law for positive integers n and m.