# MAT137 - Calculus with proofs

- Course website: http://uoft.me/MAT137

- TODAY: Sets, notation, and quantifiers

- **Before next class:**
  - **Watch videos 1.4, 1.5, 1.6**
  - Download next class slides.
    No need to look at them.

# Warm-up

What are the following sets?

1. $[2, 4] \cup (2, 5)$
2. $[2, 4] \cap (2, 5)$
3. $[\pi, e]$
4. $[0, 0]$
5. $(0, 0)$

# Fire

Which of the following statements are equivalent to the statement,

*"No two students in this class are not on fire."*

Which are equivalent to its negation?

1. "All student in this class, except at most one, are on fire."
2. "Two students in this class are on fire."
3. "For any pair of students in this class, one of them is on fire."
4. "At least two students in this class are not on fire."
5. "If I choose two students in this class and one of them is not on fire, then the other one is on fire."

# Similar sets

What are the following sets?

1. $A = \{x \in \mathbb{Z} : x^2 < 6\}$
2. $B = \{x \in \mathbb{N} : x^2 < 6\}$
3. $C = \{x \in \mathbb{R} : x^2 < 6\}$

# Sets and quantifiers

What are the following sets?

1. $A = \{x \in \mathbb{R} : \forall y \in [0,1],\ x < y\}$
2. $B = \{x \in \mathbb{R} : \exists y \in [0,1] \text{ s.t. } x < y\}$
3. $C = \{x \in [0,1] : \forall y \in [0,1], x < y\}$
4. $D = \{x \in [0,1] : \exists y \in [0,1] \text{ s.t. } x < y\}$
5. $E = \{x \in [0,1] : \exists y \in \mathbb{R} \text{ s.t. } x < y\}$
6. $F = \{x \in [0,1] : y \in \mathbb{R},\ x < y\}$

# Describing a new set

An irrational number is a number that is real but not rational.

$B$ is the set of positive, rational numbers and negative, irrational numbers.

Write a definition for $B$ using only mathematical notation.

You may use the words "and", "or", and "such that".
You may define $B$ with set-builder notation in one piece, or you may use unions and/or intersections, or something else.