MAT137 - Calculus with proofs

- Assignment 1 is due on October 1.
- TODAY: Quantifiers
- NEXT CLASS: Conditionals
  - **Required videos: 1.7, 1.8**
  - Supplementary video: 1.9

Mother

Let

$$H = \{ \text{ humans } \}$$

True or False?

1. $\forall x \in H$, $\exists y \in H$ such that y gave birth to x
2. $\exists y \in H$ such that $\forall x \in H$, y gave birth to x

Even numbers

Which of these is a correct description of the set E of even integers?

1. $E = \{n \in \mathbb{Z} \ : \ \forall a \in \mathbb{Z},\ n = 2a\}$
2. $E = \{n \in \mathbb{Z} \ : \ \exists a \in \mathbb{Z} \text{ s.t. } n = 2a\}$

Negation 1

Write the negation of these statements as simply as possible:

1. My favourite integer number is greater than 7.
2. I know at least five students at U of T who have a cellphone.
3. There is a country in the European Union with fewer than 1000 inhabitants.
4. All of my friends like apples.
5. I like apples and oranges.

Negation of $\boxed{\cdots}$ $=$ $\boxed{\cdots}$ is false.

Functions and quantifiers

Let f be a function with domain $\mathbb{R}$.
Rewrite the following statements using $\forall$ or $\exists$:

1. The graph of f intercepts the x-axis.
2. f is the zero function.
3. f is not the zero function.
4. f never vanishes.
5. The equation $f(x) = 0$ has a solution.
6. The equation $f(x) = 0$ has no solutions.
7. f takes both positive and negative values.
8. f is never negative.