MAT137 - Week 12 Lecture 2

- **Reminder:** The make up lecture is taking place on Thursday December 5 at 5:00 - 7:00 in MP203.
- Please fill out the feedback form by Friday December 13. Your responses are anonymous. The link is available in the announcement titled "Mid-year course feedback".
- Today's lecture will assume you have watched videos 6.11, 6.12.

For Thursday's lecture, watch videos 6.13, 6.14, 6.15

Proving something is an indeterminate form

1. Prove that $\forall c \in \mathbb{R}$, $\exists a \in \mathbb{R}$ and functions f and g s.t.

$$\lim_{x \to a} f(x) = 0, \quad \lim_{x \to a} g(x) = 0, \quad \lim_{x \to a} \frac{f(x)}{g(x)} = c$$

   This is how you show that $\frac{0}{0}$ is an indeterminate form.
2. Prove the same way that $\frac{\infty}{\infty}$, $0 \cdot \infty$, and $\infty - \infty$ are also indeterminate forms.
3. Prove that 1^∞, 0^0, and ∞^0 are indeterminate forms. (You will only get $c \geq 0$ this time)

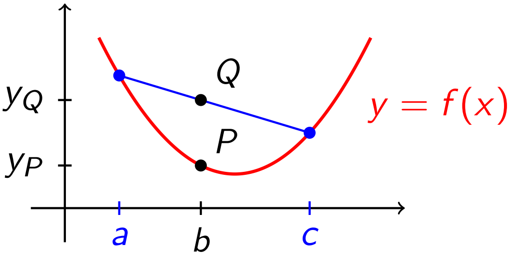
Indeterminate?

Which of the following are indeterminate forms for limits? If any of them isn't, then what is the value of such limit?

1. $\frac{0}{0}$
2. $\frac{0}{\infty}$
3. $\frac{0}{1}$
4. $\frac{\infty}{0}$
5. $\frac{\infty}{\infty}$
6. $\frac{1}{\infty}$
7. $0 \cdot \infty$
8. $\infty \cdot \infty$
9. $\sqrt{\infty}$
10. $\infty - \infty$
11. 1^{∞}
12. $1^{-\infty}$
13. 0^0
14. 0^{∞}
15. $0^{-\infty}$
16. ∞^0
17. ∞^{∞}
18. $\infty^{-\infty}$

“Secant segments are above the graph”

Let f be a function defined on an interval I.
In Video 6.11 you learned that an alternative way to define “f is concave up on I” is to say that “the secant segments stay above the graph”.



Rewrite this as a precise mathematical statement of the form

$$\text{“}\forall a, b, c \in I, \quad a < b < c \implies \boxed{\text{an inequality involving } f,\ a,\ b,\ c}\text{”}$$

Prove the forward direction!: If f is concave up on I, then it satisfies the above statement.