## Annotation for the $9^{th}$ week

I need to show you two more examples, it should take circa 30 minutes:

$$\lim_{x\to -1} \sin\frac{\pi x}{2}\cdot\frac{e^2-e^{2x^2}}{x^3-4x^2-5x} \quad\text{and}\quad \lim_{x\to 0}\frac{\sqrt{2+\sin x}-\sqrt{2+\tan x}}{\log(1-x^3)}\,.$$

You can try to solve them at home; or at least think about them little bit. And we will make a short break. Then, you will have about 80 minutes to practice these kinds of problems. Examples to practise:

(Very Easy) 5b; 6b, e; 7b.

(Easy) 5e, f; 6i; 7c, d.

(Medium) 5h; 6g, k, l; 7f.

(Exam) 7g, h, j, m, o, p, q, r.

We will ignore the following examples: 7e, i, k, n, t, u, v.

In the last 50 minutes I will demonstrate how to deal the last type of examples. E.g.

$$\lim_{x\to +\infty}\left(\frac{x^2+2x-1}{2x^2-3x-2}\right)^{\frac{1}{x}} \quad\text{and}\quad \lim_{x\to 0}\,(2e^x-1)^{\frac{\tan^2 x}{x^3}}\,.$$

It uses definition of general exponentiation, which is $a^b = e^{b\log a}$ for $a>0$ and $b\in\mathbb{R}$. So, thanks to the continuity of $e^x$, we will be able to solve these in the same way as previous examples. Finally, I will have some concluding remarks about the existence of a limit. In particular, why and how to show that the following limits do not exist:

$$\lim_{x\to +\infty}\sin\pi x \quad\text{and}\quad \lim_{x\to 0_+}\frac{1}{x}\cos\frac{1}{x}\,.$$