<u>Annotation for the 8^{th} week</u>

We will start with the midterm, which takes 60 minutes. Then, we learn how to deal with a new type of problems. For example, the simple limit like

$$\lim_{x\to 0} \frac{1-\cos\frac{1}{4}x^2}{x^4}\,,$$

or a little bit harder one

$$\lim_{x\to -\infty} \frac{\log(1+e^x)}{\sin\frac{1}{x}}$$

and the exam-like question would be

$$\lim_{x\to -1} \frac{e^{x^3-x}-\cos(\log x^2)}{\arcsin(x^2-1)}\,.$$

To solve these problems we will use two ingredients. First, there are the following well-known limits:

$$\lim_{x\to 0}\frac{\sin x}{x}=1,\qquad \lim_{x\to 0}\frac{e^x-1}{x}=1,\qquad \lim_{x\to 1}\frac{\log x}{x-1}=1,$$

$$\lim_{x\to 0}\frac{\tan x}{x}=1,\qquad \lim_{x\to 0}\frac{\arcsin x}{x}=1,\qquad \lim_{x\to 0}\frac{\arctan x}{x}=1,\qquad \lim_{x\to 0}\frac{1-\cos x}{x^2}=\frac{1}{2}\,.$$

Second, we transform more complicated limits as above to the basic ones using the theorem about limit of a compostition with (I) variant.