Annotation for the Bonus week

We will solve the sample written exam, i.e. we will deal with the three following exercises:

1. Find the limit of a function:
$$\lim_{x\to 0} \frac{1-e^{x^3}}{\sin x - \tan x}\,.$$
Answer: 2. Either one trivial LCI or not so nice (but doable) L'H.

2. Find the limit of a function:
$$\lim_{x\to 0_+} (1-\sqrt{\arcsin x})^{\frac{1}{\sqrt[4]{1-\cos x}}}.$$
Answer: $e^{-\sqrt[4]{2}}$. Either 3xLCC and 1xLCI (all trivial) or really ugly derivatives in L'H.

3. Sketch the graph of a function:
$$f(x) = \operatorname{arctan} \frac{x+3}{x+4}\,.$$
Answer: $\mathcal{D}_f = \mathbb{R}\setminus\{-4\}$, $\lim_{x\to\pm\infty} f(x) = \frac{\pi}{4}$, $\lim_{x\to -4_\pm} f(x) = \mp\frac{\pi}{2}$, $f'(x) = \frac{1}{2x^2+14x+25}$, f is increasing on $(-\infty,-4),(-4,+\infty)$, no extrema, $\mathcal{R}_f = (-\frac{\pi}{2},\frac{\pi}{4})\cup(\frac{\pi}{4},\frac{\pi}{2})$, $f''(x) = \frac{-4x-14}{(2x^2+14x+25)^2}$, f is convex on $(-\infty,-4),(-4,-\frac{7}{2})$ and concave on $(-\frac{7}{2},+\infty)$, at $x=-\frac{7}{2}$ f has the inflection point.

It is a good idea to try it by yourself at home and then check the solution with me. I will also try to answer your questions (you can send them prior by e-mail).