

These questions are designed to help you understand the material covered in week  $n$ ,  $n \in \mathbb{N}$  lectures. Exercise sheets will typically be handed out in the Tuesday lecture of week  $n + 1$ . You will get help on them in the exercise class on Wednesday of the same week. You should write up your solution to the starred question (\*) clearly and hand it in to your personal tutor during your week  $n + 2$  exercise class for feedback. Put your *full name and student number* on the top of your solution. It is important that you try to do all of the numbered questions. The extra question is for the more ambitious students.

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1. Prove that

$$\left| \frac{a}{b} \right| = \frac{|a|}{|b|}$$

for  $a, b \in \mathbb{R}$ ,  $b \neq 0$ .

- (\*)2. Determine the set of all real numbers  $x \in \mathbb{R}$  that satisfy

$$x^2 - 3x - 4 < 0$$

- (a) by solving the inequality, and  
(b) by plotting the graph of  $y = x^2 - 3x - 4$ .

3. Determine the set of all real numbers  $x \in \mathbb{R}$  that satisfy

$$|2x - 1| + |4x + 1| < 3$$

- (a) by solving the inequality, and  
(b) by plotting the graph of  $y = |2x - 1| + |4x + 1|$ .

4. Determine the set of all real numbers  $x \in \mathbb{R}$  that satisfy

$$\sqrt{1 - x^2} \leq -x$$

- (a) by solving the inequality, and  
(b) by plotting the graphs of  $y = -x$  and  $y = \sqrt{1 - x^2}$ .

Extra: Prove the arithmetic-geometric mean inequality

$$\sqrt{ab} \leq \frac{1}{2}(a + b) \quad , \quad a, b \geq 0 \quad .$$