Mathematics I, test 1a
WS 2016/2017

1) Find all real solutions of the equation
$$3^{1+x} + 3^{1-x} = 10.$$
Solution: $x \in \{\pm 1\}$.

2) Find all real solutions of the equation
$$\big||x+3| - 2\big| \geq 1.$$
Solution: $x \in (-\infty, -6] \cup [-4, -2] \cup [0, \infty)$.

3) Sketch the graph of the function
$$f(x) = |2\cos x - 1| + 1.$$
Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, test 1b
WS 2014/2015

1) Find all real solutions of the equation
$$2\log_2^2 x = \log_2 8 - \log_2 x^5.$$
Solution: $x \in \left\{\sqrt{2}, \frac{1}{8}\right\}$.

2) Find all real solutions of the equation
$$|x+2| - |2x-2| \geq -8.$$
Solution: $x \in [-4, 12]$.

3) Sketch the graph of the function
$$f(x) = \tan|-\pi x|.$$
Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, test 2a
WS 2014/2015

1) Find all real x for which the following expression is defined:
$$\sqrt{\log(2 - x - x^2)}.$$
Solution: $x \in \left[\frac{-1-\sqrt{5}}{2}, \frac{-1+\sqrt{5}}{2}\right]$.

2) Find all real solutions of the equation
$$1 - |\sin x| = \cos^2 x.$$
Solution: $x \in \left\{k\frac{\pi}{2};\ k \in \mathbb{Z}\right\}$.

3) Sketch the graph of the function
$$f(x) = |\log(2x) - 1|.$$
Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, test 2b
WS 2014/2015

1) Find all real x for which the following expression is defined:
$$\log\sqrt{3 + x - x^2}.$$
Solution: $x \in \left(\frac{1-\sqrt{13}}{2}, \frac{1+\sqrt{13}}{2}\right)$.

2) Find all real solutions of the equation

$$\sin^2 x = \cos^2 x + \frac{1}{2}.$$

Solution: $x \in \{\pm\frac{\pi}{3} + k\pi;\ k \in \mathbb{Z}\}$.

3) Sketch the graph of the function

$$f(x) = \left|\frac{x-1}{2x+1}\right|.$$

Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, test 3a
WS 2014/2015

1) Find all real x for which the following expression is defined:

$$\sqrt{\frac{x+2}{5+x-2x^2}}.$$

Solution: $x \in (-\infty, -2] \cup \left(\frac{1-\sqrt{41}}{4}, \frac{1+\sqrt{41}}{4}\right)$.

2) Find all real solutions of the inequality

$$|2x+1| - |2-x| > 4.$$

Solution: $x \in (-\infty, -7) \cup \left(\frac{5}{3}, +\infty\right)$.

3) Sketch the graph of the function

$$f(x) = \left|\frac{x/2+2}{x-1}\right|.$$

Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, test 3b
WS 2014/2015

1) Find all real x for which the following expression is defined:

$$\log\frac{x^2+x-8}{x-1}.$$

Solution: $x \in \left(\frac{-1-\sqrt{33}}{2}, 1\right) \cup \left(\frac{-1+\sqrt{33}}{2}, +\infty\right)$.

2) Find all real solutions of the inequality

$$\big||2x-1| - 3\big| \le 2.$$

Solution: $x \in [-2, 0] \cup [1, 3]$.

3) Sketch the graph of the function

$$f(x) = \big|\log|x-1| - 2\big|.$$

Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, test 4a
WS 2014/2015

1) Find all real solutions of the inequality

$$\sqrt{x^2+x-6} \ge \sqrt{x^2+2x-8}.$$

Solution: $x \in (-\infty, -4] \cup \{2\}$.

2) Find all real x for which the following expression is defined:

$$\sqrt{\log\big(2 - \big|5 - |2-x|\big|\big)}.$$

Solution: $x \in [-4, -2] \cup [6, 8]$.

3) Sketch the graph of the function

$$f(x) = \left|e - e^{|1-x|}\right|.$$

Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, test 4b
WS 2014/2015

1) Find all real x for which the following expression is defined:

$$\sqrt{\log\bigl(|3x-1| - |3-2x|\bigr)}.$$

Solution: $x \in (-\infty, -3] \cup [1, +\infty)$.

2) Find all real solutions of the inequality

$$\log(x^2 + x - 2) \geq \log(x^2 - 2x - 3).$$

Solution: $x \in (3, +\infty)$.

3) Sketch the graph of the function

$$f(x) = \left|\frac{2 - x/3}{3 - 2x}\right|.$$

Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, test 5
WS 2014/2015

1) Find all real x for which the following expression is defined:

$$\sqrt{\log_2(1 + \sin x) + 1}.$$

Solution: $x \in \bigcup_{k\in\mathbb{Z}} \left[-\frac{\pi}{6} + 2k\pi, \frac{7\pi}{6} + 2k\pi\right]$.

2) Find all real solutions of the inequality

$$\bigl|2 - |1 - 4x|\bigr| > 1.$$

Solution: $x \in \left(-\infty, -\frac{1}{2}\right) \cup \left(0, \frac{1}{2}\right) \cup (1, +\infty)$.

3) Sketch the graph of the function

$$f(x) = \bigl|\log|x-2| - 1\bigr|.$$

Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.

Mathematics I, example test
WS 2014/2015

1) Find all real solutions of the equation

$$2\cos^2 x = 2\sin^2 x - 1.$$

Solution: $x \in \left\{\pm\frac{\pi}{3} + k\pi;\ k \in \mathbb{Z}\right\}$.

2) Find all real solutions of the equation

$$\frac{x+1}{x+2} < \frac{x-2}{x-3}.$$

Solution: $x \in \left(-2, \frac{1}{2}\right) \cup (3, +\infty)$.

3) Sketch a graph of the function

$$f(x) = \left|\frac{2x+1}{x-2}\right|.$$

Indicate important values, e.g. intersections with axes, horizontal or vertical asymptotes, etc.