General information

This file contains the solutions for the self-evaluation test. Before reading, have you found ways to double-check your answers yourself? Have your compared with some colleague who, like you, has attempted the exercises?

Trigonometry

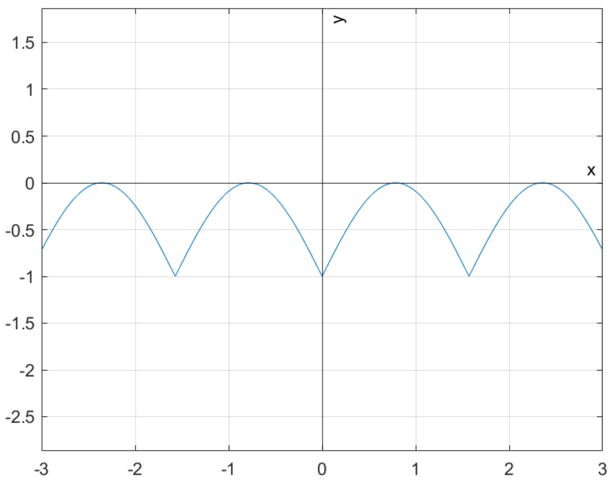
A) $\frac{\sqrt{2}}{2}$

B) Restricted to the interval $x \in [0, 2\pi)$,

$$x \in \left[\frac{\pi}{3}, \frac{5}{3}\pi\right]$$

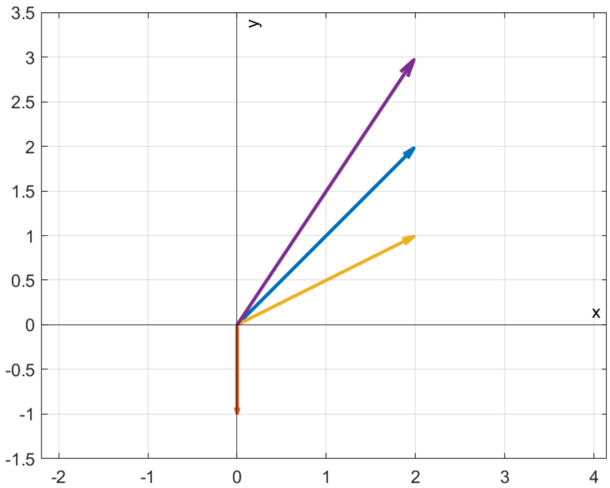
C) $x = \frac{\pi}{6} + \frac{2}{3}k\pi \quad , \quad k \in \mathbb{Z}$

D) The graph of $y = |\sin(2x)| - 1$ is



Vectors

A) The vectors **a** (in blue), **b** (in red), **a+b** (in yellow) e **a-b** (in purple) are as follows:



B) $\frac{3}{4}\pi$

C) There are two perpendicular vectors and they are

$$\left(-\frac{12}{\sqrt{10}},+\frac{4}{\sqrt{10}}\right);\left(+\frac{12}{\sqrt{10}},-\frac{4}{\sqrt{10}}\right)$$

D) The vector is $\left(-\sqrt{3},1\right)$

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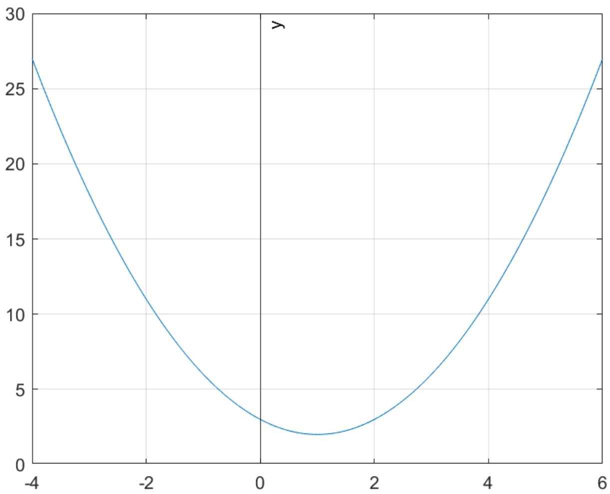
Inequalities of polynomials and fractions

A) $\forall x \in \mathbb{R}$
The parabola $y = x^2 - 2x + 3$ is as follows



B) $x \in (-2, 1) \cup (2, +\infty)$

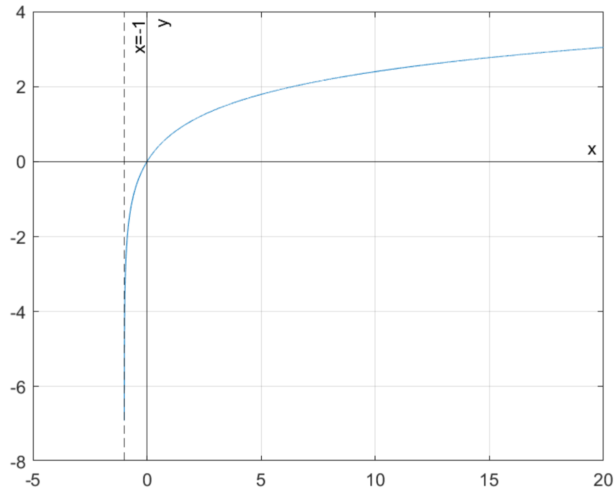
C) $x \in (-\infty, -4)$

D) $x \in (-1, 0] \cup [2, 3)$

Logarithms

A) 0

B) The graph $y = \ln(x+1)$ is as follows



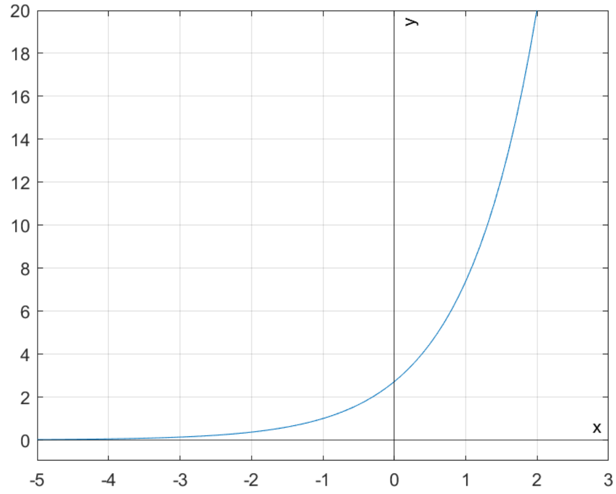
C) $x \in \left(-2, -\sqrt{3}\right) \cup \left(+\sqrt{3}, +2\right)$

D) $x \in (-2, -1) \cup (0, 3)$

Exponentials

A) $x = -3$

B) The graph $y = e^{(x+1)}$ is as follows

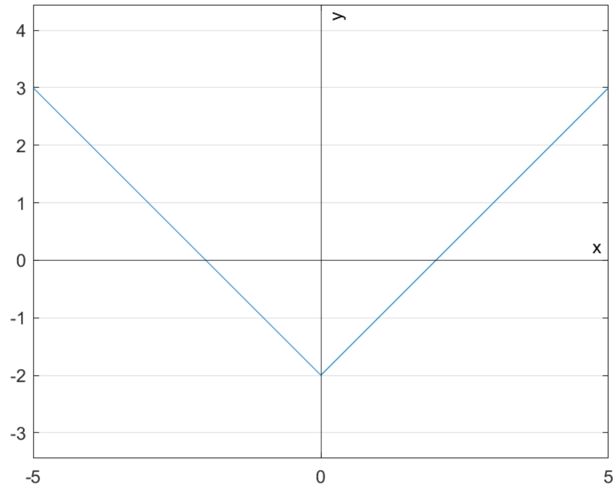


C) $x \in (-\infty, -2) \cup (-1, +\infty)$

D) $x \in (1 + \ln(2), +\infty)$

Modulus

A) The graph $y = |x| - 2$ is as follows



B) $x = \pm\sqrt{7}, x = \pm 1$

C) $x \in (-\infty, 0] \cup [3, \infty)$

D)

$$\text{for } x > \pi/3 \quad x \in \left(\frac{\pi}{3} + 2k\pi, \frac{\pi}{2} + 2k\pi\right) \cup \left(\frac{7}{6}\pi + 2k\pi, \frac{7}{3}\pi + 2k\pi\right) \quad k \in \mathbb{N}$$

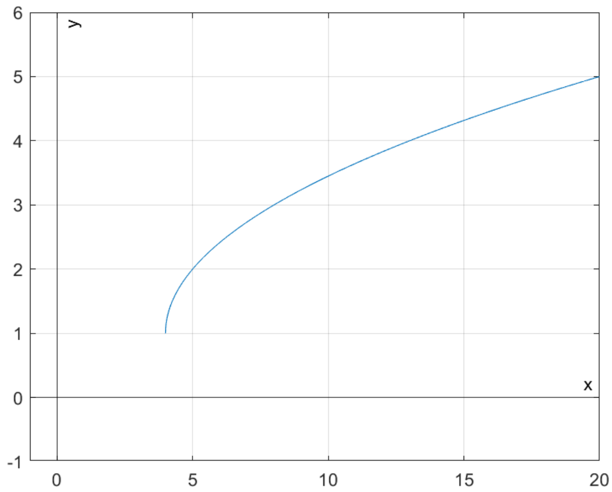
$$\text{for } x \leq \pi/3 \quad x \in \left(\frac{\pi}{6} - 2k\pi, \frac{\pi}{3} - 2k\pi\right) \cup \left(-\frac{5}{3}\pi - 2k\pi, -\frac{\pi}{2} - 2k\pi\right) \quad k \in \mathbb{N}$$

Note: the solution can be written in various equivalent ways. To compare your solution with the one proposed here, we suggest representing the intervals on a sketch of the real line.

Radicals

A) $x = 17$

B) The graph $y = \sqrt{x-4} + 1$ is as follows

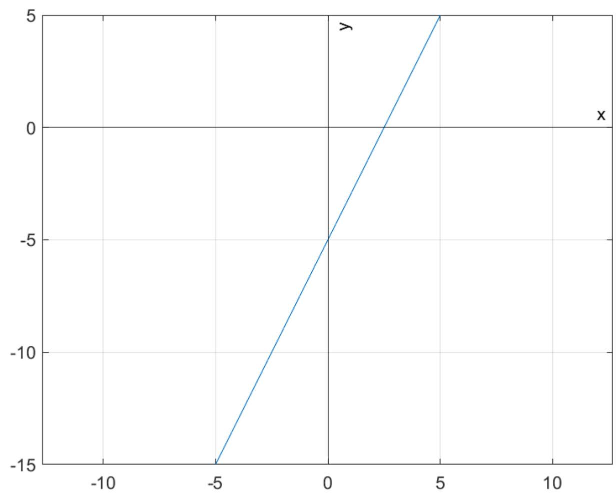


C) $x \in (-3, 3)$

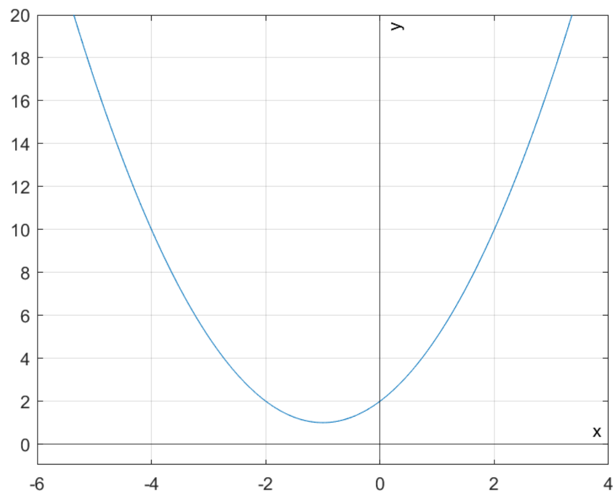
D) $x \in [3, 7)$

Geometry

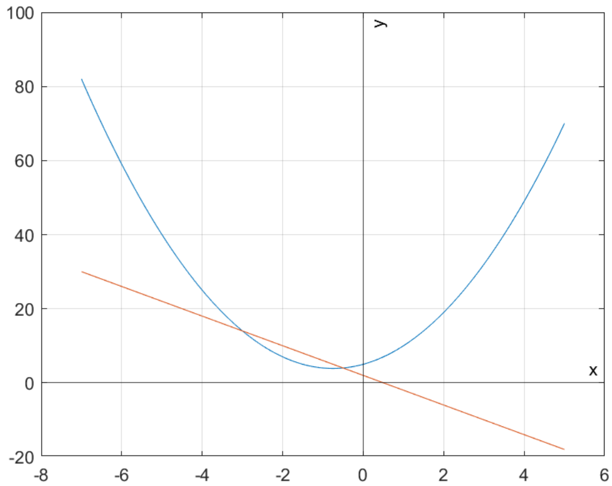
A) The line $y = 2x - 5$ is as follows



B) The parabola is $y = x^2 + 2x + 2$ and is as follows



C) The points of intersection are $(-3, 14)$ e $\left(-\frac{1}{2}, 4\right)$ and the two graphs are as follows



D) In two points

Suggestions for interpreting the result

- A sufficient background in mathematics should allow you to answer correctly all type A and B questions and a few questions of type C or D.
- If for a certain topic you had problems only on questions of type C or D, your preparation for that given topic can still be improved. You can do it independently by studying high school textbooks. We also suggest that you participate in the pre-courses of September organized by the engineering department of the University of Roma Tor Vergata and to ask our tutors for suggestions about how you fill in the gaps in your knowledge.
- If for a certain topic you had problems on question B, your preparation for that particular topic is weak. This is a major wake-up call. Deficiencies should be addressed as soon as possible. Again, the starting point is self-study on high school textbooks. If these gaps are still present in the first half of the first year of the engineering degree, we suggest you participate in the tutorials.
- If for a certain topic you have not answered correctly question A it is very probable that, for that topic, you need to start again from the basics. You probably have significant gaps in your knowledge. It is important to remedy this immediately. We suggest that you start self-study right away using high school textbooks and, should these gaps still be present in the first semester of the first year, contact the mentoring group and follow the mentoring tutorials on that topic.
- If you answered all the questions correctly, you probably don't need further support. Even if your mathematical preparation is very good, we still suggest you study basic mathematics, perhaps in a group with less skilled colleagues. Explaining a process often helps to better understand it in some aspects.