Math 1448C
"Mathematics for Management"

Tuesday 3 October 2023

Instructor: dr Adam Abrams

Course topics

- Algebra
  - Absolute value, polynomials
  - Logarithms and exponents
  - Matrices and systems of linear equations
- Arithmetic and geometric sequences
- Calculus for $f(x)$
  - Asymptotes and limits
  - Derivatives
  - Integrals
  - Minimums and maximums
- Calculus for $f(x, y)$

Course format

- Lecture (Wykład) with dr hab. Jacek Serafin. Everyone:
  - 7:30 - 9:00 every Thursday in B-1 / 308
- Problem session (Ćwiczenia). Half of students in each:
  - 13:15 - 15:00 every Tuesday in B-4 / 2.26
  - 15:15 - 16:55 every Tuesday in B-4 / 2.26
- Grades and other course policies are available at

theadamabrams.com/1448

Course grades

Grades come from

- Best 4 out of **5 small quizzes** (10 minutes each),
- best 3 out of **4 medium quizzes** (15-20 minutes each),
- and **active participation** in problem sessions.

Maximum grade from all of those is 60 points.

- If you earn < 10 points, you fail the course.
- Otherwise, there is a table on the course website that shows the grade (2.0, … 5.0) for different numbers of points,
- The final exam is *optional*. If you do take it, the exam points determine your grade using a second table.

Accessibility

Department of Accessibility and Support for People with Disabilities (DDO)

- Office: C-13 rooms 109 and 107
- Telephone: 71 320 43 20
- Website: https://ddo.pwr.edu.pl/
- Email: pomoc.n@pwr.edu.pl

If you need any kind of accommodation, please write me an email.
I am happy to help.

English language and some polls

poles

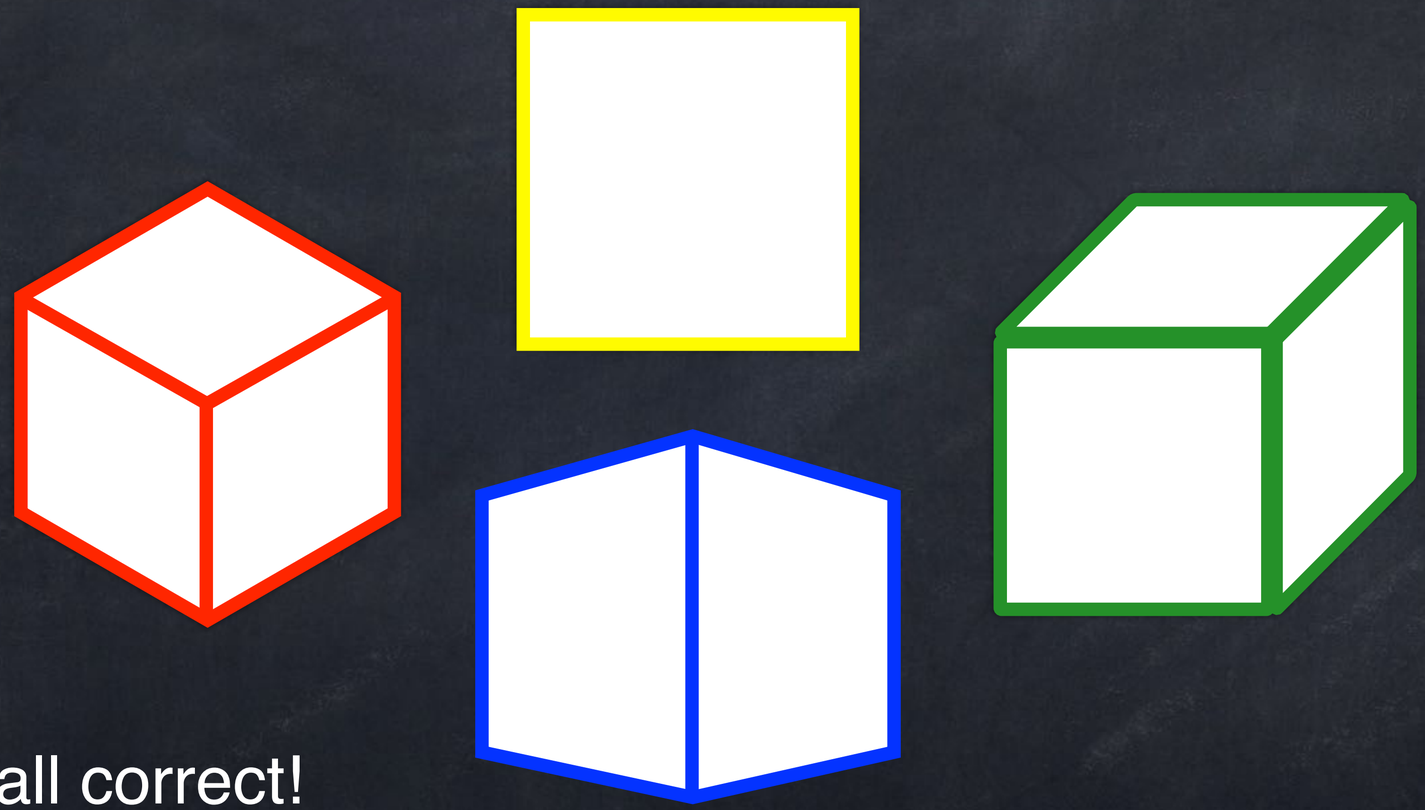
Poles

polls

$y = x^2$ $y = x^2 - 1$ $y = (x-1)^2$

(drawing graphs on the board)

Draw a cube



- These are all correct!
- If multiple people draw or talk about a cube, we need to be sure we are all thinking of the same thing.

Task 1: Give an equation for the line through the point $(5, 1)$ with slope 3.

Task 2: Solve $2x^2 + 7x - 15 = 0$.

Algebra review maybe

- "$6 \times a$" and "$6 \cdot a$" and "$6a$" all mean six times a.
- $6(a + b)$ can be re-written as $6a + 6b$.
- $3x - 12$ can be re-written as $3(x - 4)$. This is "factoring".
- $(x + 7)(y + 2)$ can be expanded to $xy + 2x + 7y + 14$.
- $(x + 7)^2$ can be expanded to $x^2 + 14x + 49$.

  In general, $(a + b)^2$ expands to $a^2 + 2ab + b^2$.
- $x^2 + 14x + 49$ can be factored as $(x + 7)^2$.

Be careful!

- $(a \times b)^2$ can be re-written as $a^2 \times b^2$.
- $(a + b)^2$ can **not** be re-written as $a^2 + b^2$.
  - Try it with actual numbers:
    $(2 + 3)^2 = 5^2 = 25$, but $2^2 + 3^2 = 4 + 9 = 13$.
  - Testing specific numbers can only show you when a rule is *false*.
    It cannot guarantee that a rule is correct because you might pick numbers where it accidentally works, like $(0 + 0)^2 = 0 = 0^2 + 0^2$.
- $\sqrt{a + b} \neq \sqrt{a} + \sqrt{b}$
- $\sin(a \cdot b) \neq \sin(a) \cdot \sin(b)$

Types of numbers

- **Natural** numbers: $0, 1, 2, 3, 4, \ldots$
  - In some books, only $1, 2, 3, 4, \ldots$
- **Integers**: $\ldots, -3, -2, -1, 0, 1, 2, 3, 4, \ldots$
- **Rational** numbers are all the numbers that *can* be written as one integer divided by another. Examples: $\frac{1}{2}$, $\frac{-2}{3}$, 1.5, 8, 0, $\frac{-5}{4}$
- **Real** numbers are all the values on a number line. Examples:

Types of functions

- **Polynomial**:

$$😉x^n + \cdots + 😊x^2 + 😐x + 😃$$

  Like with rational numbers, a function can be a polynomial even if it is written in a different way. Example: $(x+4)^2$.

- **Exponential function**:

$$😐 \cdot 🙂^x$$

- **Trig function**:

$$😐\sin(😐x + 😕) + 😃$$

  and similar for $\cos$, $\tan$, $\cot$, $\sec$, $\csc$.

- **Absolute value**

Absolute value

- Algebra idea: make numbers positive
- Geometry idea: measure distance

- We write $|x|$ for the **absolute value** of x.

- Examples: $|5|$ is 5 $\quad$ $|-3|$ is 3 $\quad$ $\left|-\frac{9}{2}\right|$ is $\frac{9}{2}$ $\quad$ $|37.2|$ is 37.2

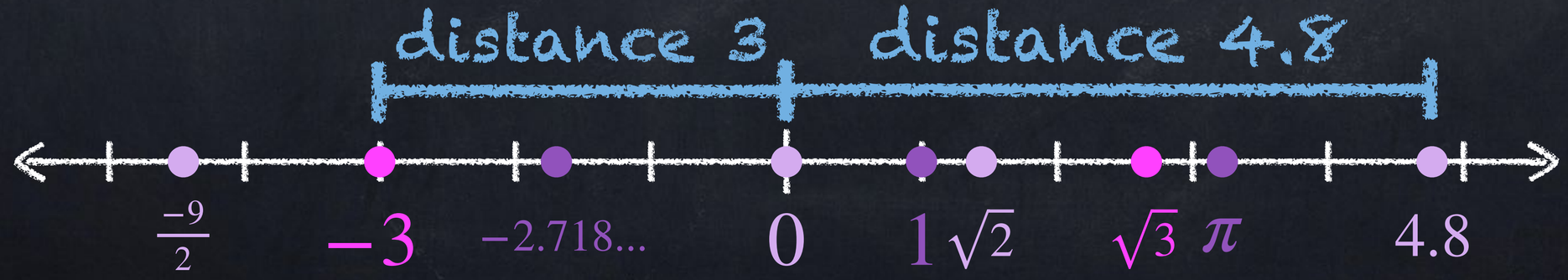
- Definition, version 1: $$|x| = \begin{cases} x & \text{if } x \geq 0, \\ -x & \text{if } x < 0. \end{cases}$$

Absolute value

- Algebra idea: make numbers positive
- Geometry idea: measure distance

- We write $|x|$ for the **absolute value** of x.

- Definition, version 2: $|x|$ is the distance between 0 and x.



Absolute value

How can we think of $5 - 3$ in terms of distances?

- First, what does $5 - 3$ mean?

How can we think of $5 - x$ in terms of distances?

Multiplication

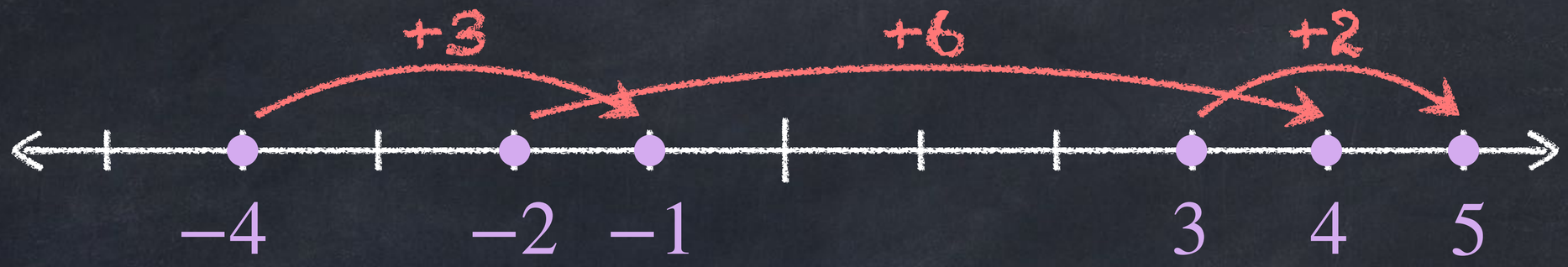
- What does 5×3 mean?
  - 
  - More advanced: no pictures, just $5 + 5 + 5$.

- What does $5 \times \frac{1}{3}$ mean? 5×9.2 ? $7.65 \times (-12)$?

- **Depending on the context, multiplication can have different meanings or interpretations.**
- This is also true for subtraction.

Subtraction

- What does $5 - 3$ mean **on a number line**?

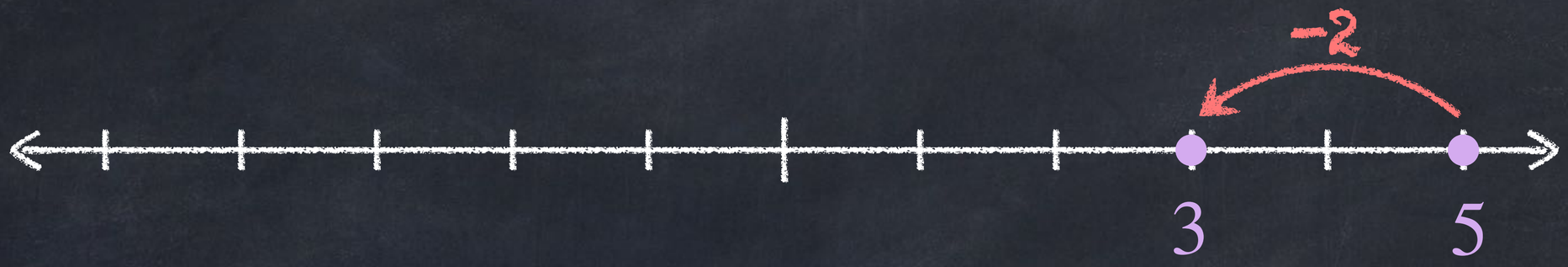


- Answer: The number $5 - 3$ describes how to move from 3 to 5.

In general, $b - a$ describes how to move from a to b.

Subtraction

- What does $5 - 3$ mean **on a number line**?



- Answer: The number $5 - 3$ describes how to move from 3 to 5.
- To go from 5 to 3 instead, we move *left*, which is why $3 - 5$ is negative.

In general, $b - a$ describes how to move from a to b.

Absolute value again

How can we think of $5 - 3$ in terms of distances?

- First, $5 - 3$ describes how to move from 3 to 5.
- The absolute value means we don't care whether the previous line gives a negative or positive value.
  - Whether you move left or right doesn't matter, only the distance.
- **Answer:** $5 - 3$ is the distance between 5 and 3.

How can we think of $5 - x$ in terms of distances?

- **Answer:** $5 - x$ is the distance between 5 and x.

Inequalities

$x \leq 5$

$x^2 \leq 9$

$x - 5 < 4$

Student ID: _ _ _ _ _ _ _

Name: _____

Preferred name: _____

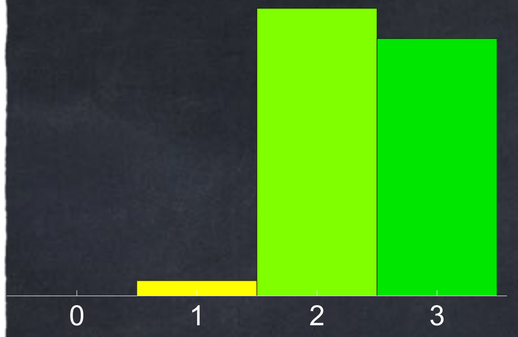
Favorite food:

Favorite book or movie or song:

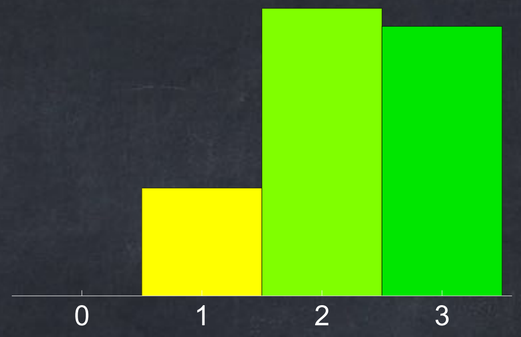
How well do you know…

	Not at all	Poorly	Okay	Well
Basic algebra	0	1	2	3
Equations for lines	0	1	2	3
Quadratic formula	0	1	2	3
Exponents	0	1	2	3
Logarithms	0	1	2	3
Trig functions	0	1	2	3
How to fly a helicopter 🚁	0	1	2	3

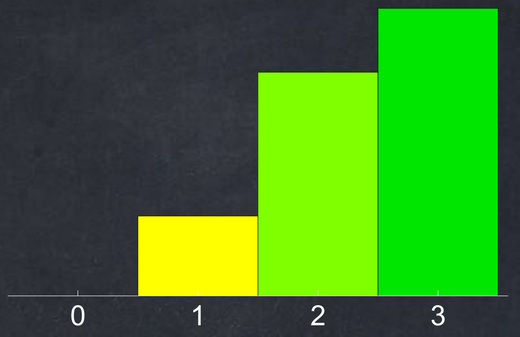
Basic algebra



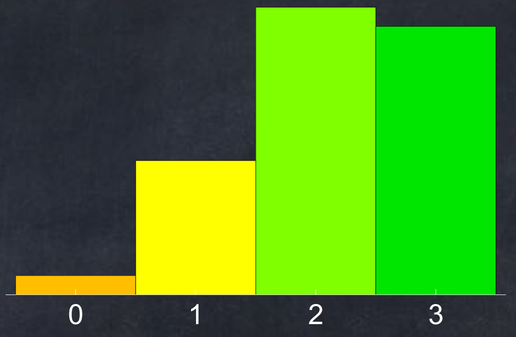
Equations of lines



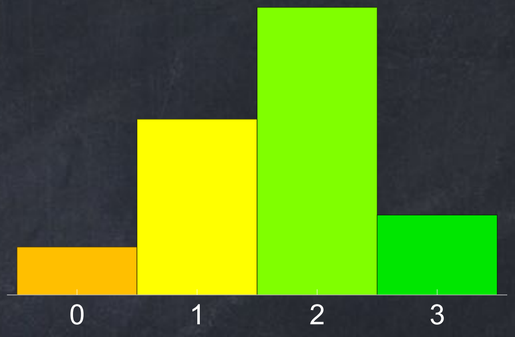
Quadratic formula



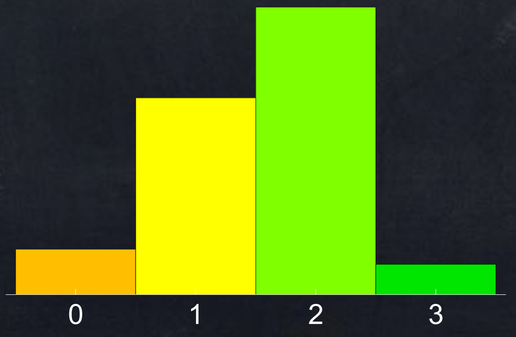
Exponents



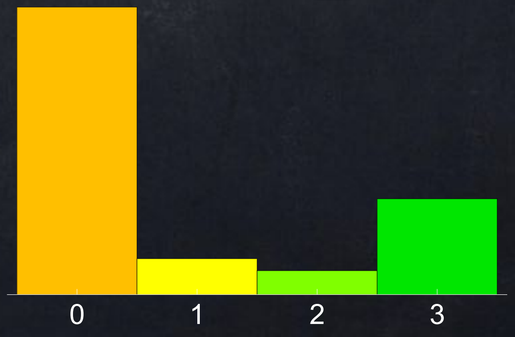
Logarithms



Trig functions



Flying 🚁



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How to fly a helicopter 🚁	0	1	2	3

1. The only way to become good at flying helicopters is to practice flying helicopters.

2. The only way to become good at doing mathematics is to practice doing mathematics.

Simply attending lectures and problem sessions is not enough!