



Kangaroo Math Contest 2024

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Date: Thu 21 Mar 2024 @ 12:30 in MF 11/12

- Duration: 75 minutes
- Number of problems: 30
- Answer type: 1-of-5 MC
- Allowed aids: Only use scrap paper (no calculator)
- Topics: Number Theory, Geometry, Algebra, Combinatorics
- Difficulty: Varies from (very) easy to hard(er)

Remarks

- It isn't an exam
- It is for *fun*, ... and you can learn things
- It consists of (out-of-the-box) problems, not (standard) exercises
- Engineers are (need to be) *problem solvers*
- You compete against the problem set, not against others
- Time limit matters (unfortunately)
- Don't expect to solve every problem; (almost) nobody does
- Discuss and reflect afterwards (also fun)

Advice

- Read & look carefully
- Exactly one of the answers is correct
- Don't guess: better to leave *open*
- Check that you enter your answer in the correct row
- Use scrap paper (include question number)
- Draw your own *picture* / make a *table*
- Try to verify each of the answers, instead of not looking at them
- Practice, practice, practice, ...

Practicing

- Don't look at solutions
 - Unless you have solved it, or tried every other technique
 - The answer is not interesting
 - What matters is how you could have found it (yourself)
- Get back to unsolved problems later
 - In the meantime work on easier problems
- Ask/find a hint

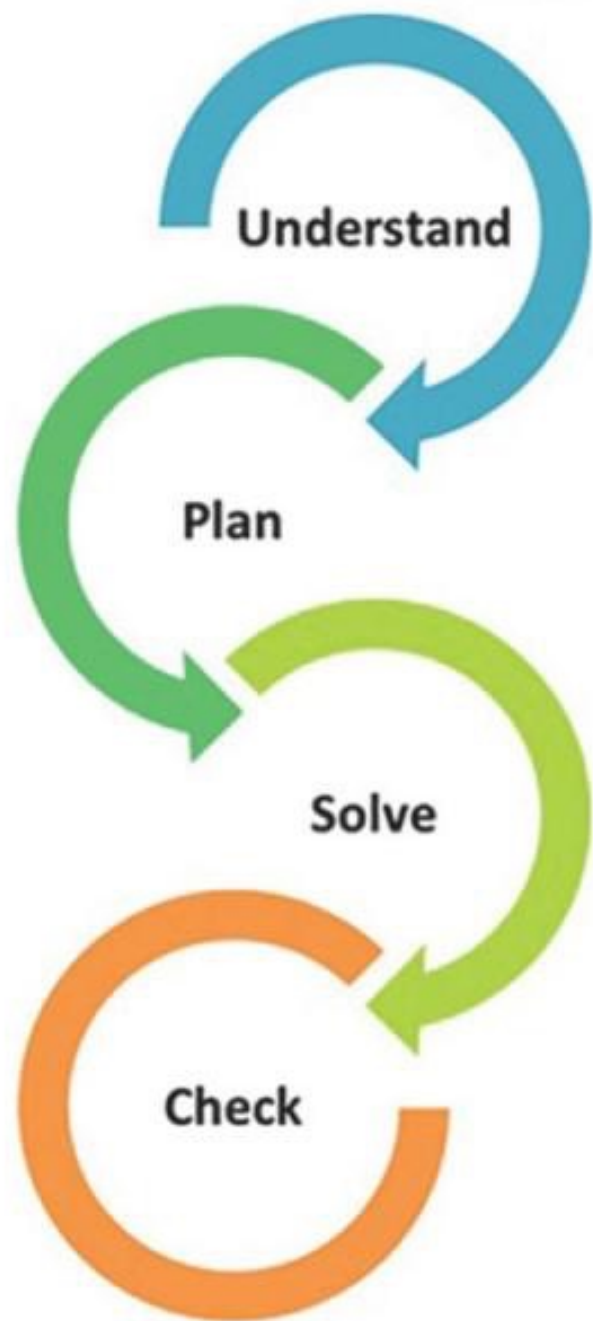
Statistics 2022

Versie	Vraag Nr	Rang Nr	Gegeven Antwoord					weet niet
			A	B	C	D	E	
wizEXPERT	1	1	0,95%	86,67%		3,81%		8,57%
	2	8	6,67%	5,71%	6,67%	7,62%	62,86%	10,48%
	3	9	10,48%	4,76%	5,71%	61,90%	1,90%	15,24%
	4	17	5,71%	43,81%	4,76%	20,00%	4,76%	20,95%
	5	11	7,62%	6,67%	9,52%	55,24%	0,95%	20,00%
	6	2	4,76%	73,33%	9,52%	1,90%		10,48%
	7	3	1,90%	1,90%	2,86%	73,33%	5,71%	14,29%
	8	12	55,24%	7,62%	20,00%	0,95%	2,86%	13,33%
	9	4	2,86%	8,57%	0,95%	2,86%	73,33%	11,43%
	10	18	6,67%	2,86%	9,52%	6,67%	43,81%	30,48%
	11	13	4,76%	6,67%	7,62%	55,24%	2,86%	22,86%
	12	20	1,90%	3,81%	4,76%	39,05%	21,90%	28,57%
	13	25	17,14%	7,62%	11,43%	26,67%	5,71%	31,43%
	14	5	0,95%	68,57%	6,67%	10,48%	1,90%	11,43%
	15	6	65,71%	4,76%	2,86%	3,81%	3,81%	19,05%
	16	14	4,76%	9,52%	13,33%	52,38%	1,90%	18,10%
	17	21	10,48%	3,81%	38,10%	3,81%	18,10%	25,71%
	18	19	4,76%	39,05%	5,71%	13,33%	7,62%	29,52%
	19	15	0,95%	13,33%	52,38%	2,86%	6,67%	23,81%
	20	16	1,90%	2,86%	3,81%	47,62%	15,24%	28,57%
	21	23	2,86%	4,76%	6,67%	29,52%	10,48%	45,71%
	22	26	26,67%	9,52%	2,86%	2,86%	4,76%	53,33%
	23	10	57,14%	5,71%	0,95%	2,86%	3,81%	29,52%
	24	7	7,62%	2,86%	65,71%	2,86%	1,90%	19,05%
	25	24	4,76%	7,62%	29,52%	2,86%	7,62%	47,62%
	26	22	5,71%	32,38%	3,81%	6,67%	22,86%	28,57%
	27	28	5,71%	3,81%	22,86%	6,67%	5,71%	55,24%
	28	27	6,67%	0,95%	9,52%	9,52%	26,67%	46,67%
	29	29	11,43%	9,52%	6,67%	8,57%	3,81%	60,00%
	30	30	7,62%	11,43%	11,43%	4,76%	1,90%	62,86%

Polyá's Problem Solving Principles

- Famous book: *How to Solve It* (1945)
- **Understand**
- **Plan**
- **Do**
- **Check**
- If necessary, **Repeat**
- **Reflect**

The Four-Step Problem-Solving Process



Understand

1. Read sentence by sentence
2. Decode the problem
3. Think about your thinking
4. Retell the story

Plan

1. Decide on a heuristic
 - Draw a model/diagram
 - Make a table
 - Look for pattern
 - Make a systematic list
 - Work backwards
 - Guess & Check

Solve

- Using the known to find the unknown
- Stay focus with what you want to find
- Review and reflect if unable to solve

Check

1. For Accuracy
 - Use logical reasoning
 - Work alternative solutions
 - Re-do
 - Work backwards
2. For required units

Heuristics (also see *How to Solve It*)

- Introduce names (variables)
- Set up equations
- Start with small(er) cases, and tabulate results
- Simplify the problem
- Look for patterns
- Keep focus on what is asked for
- Use symmetry
- Working backwards
- Guess and check

Future

- LIMO (Landelijke Interuniversitaire Mathematische Olympiade)
- Create and submit problems

References

- Dutch Kangaroo website: <https://w4kangoeroe.nl>
- G. Polya, *How to Solve It*, 1945
 - https://en.wikipedia.org/wiki/How_to_Solve_It
 - PDF is easy to find online
 - Summary: <https://math.berkeley.edu/~gmelvin/polya.pdf>
 - Poster: <https://blogs.adelaide.edu.au/maths-learning/2020/11/19/the-solving-problems-poster/>
 - Slides:
https://www.henrikbachmann.com/uploads/7/7/6/3/77634444/polya4steps_numirai2021.pdf