# Welcome to MAT137!

UNIVERSITY OF TORONTO

September 10th, 2018

# Information about this section:

Jean-Baptiste (JB) Campesato

@ campesat@math.toronto.edu

⚠ Please start the subject with "MAT137:"

Room MP202. Schedule:

- Monday, 4pm to 5pm
- Wednesday, 4pm to 6pm

Website for this section:

http://www.math.toronto.edu/campesat/mat137.html

(no need to copy the slides in your notes, they are online)

# Resources:

MAT137 website: `http://uoft.me/MAT137`
**Visit this webpage regularly**, it contains:
- The outline of the course (read it!)
- The videos!
- Announcements
- Piazza: an online forum
- Timetable for the office hours
  (you can attend any office hours, not only mine)
- And more…

Precalculus resources:
`http://uoft.me/precalc`

Enrol in a tutorial!

# Goals of the course

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- **Calculus:** understanding of the basic concepts and results of calculus.
- **Mathematical logic:** being able to understand a mathematical proof and being able to write (even a short) proof.
- **Problem solving:** improving your problem solving skills to react when you face a problem which is new to you.

# Organization:

**Before each lecture: watch the indicated videos.**

During each lecture, I will give you the list of the videos you will have to watch before the next lecture.
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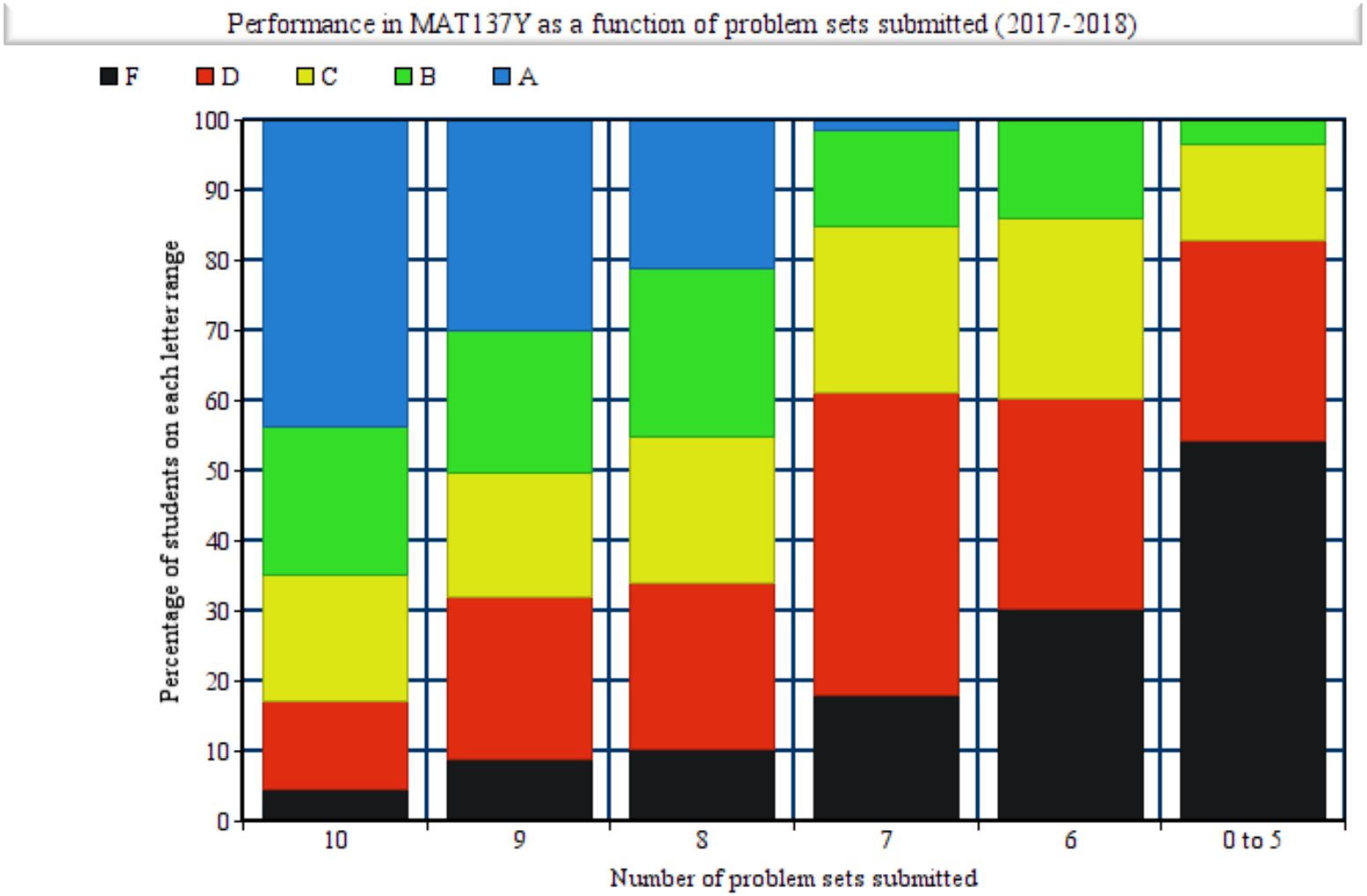
For Wednesday (Sep 12), watch the videos:

- Sets: 1.1, 1.2
- Quantifiers: 1.3, 1.4, 1.5, 1.6

# How did the students do last year?

It depends on how many problem sets they submitted:



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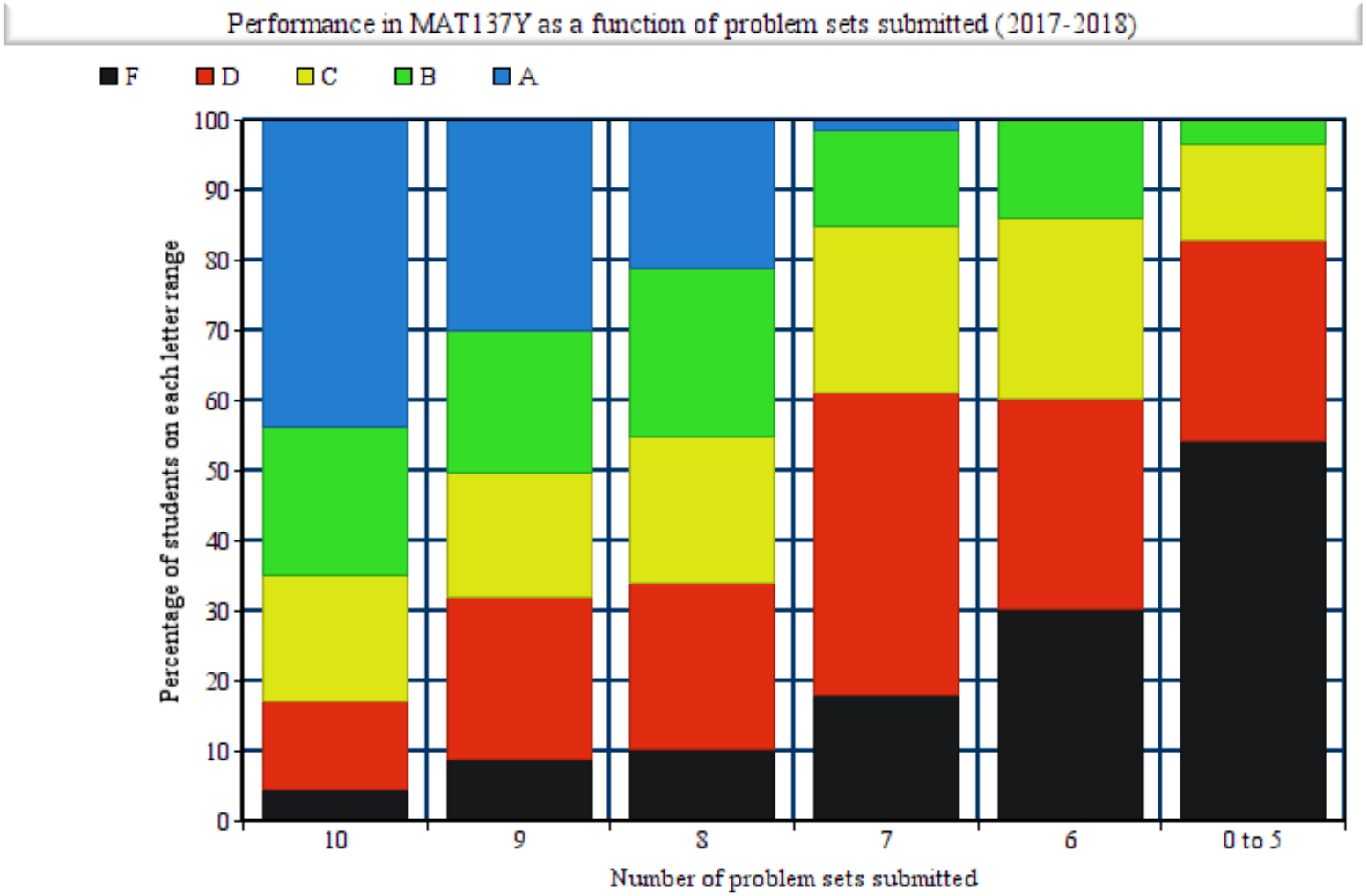
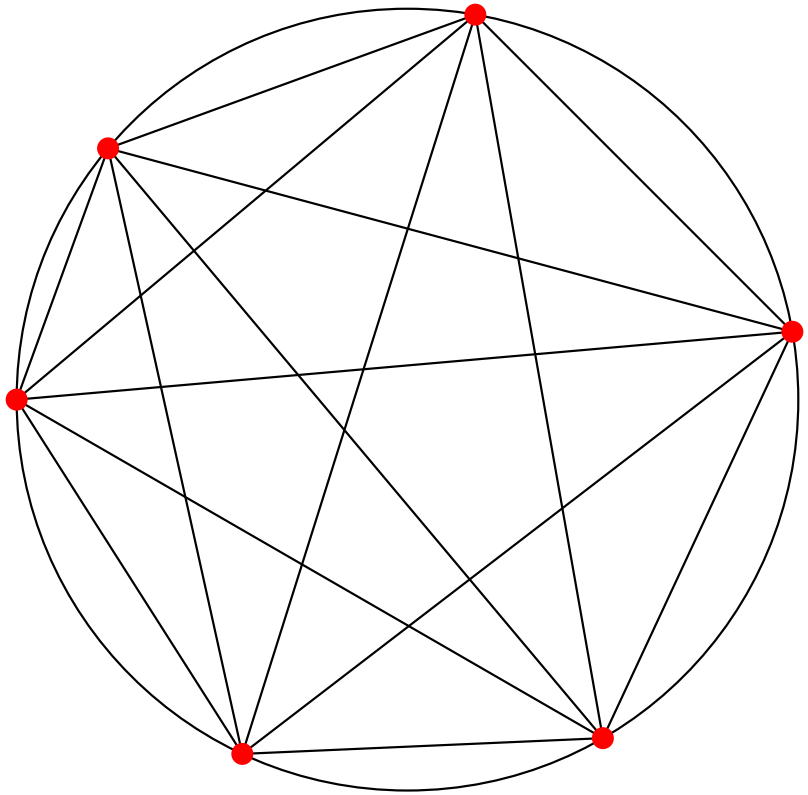



**Advice:** work on the problem sets, *practice makes perfect*.

# A warm up problem

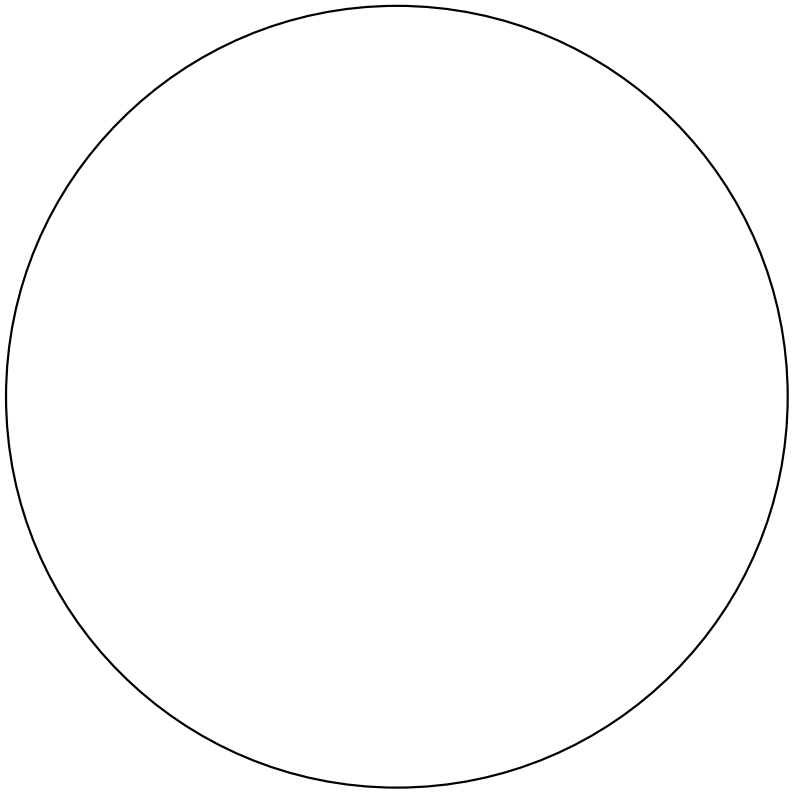
Put $n$ points on a circle and then join each pair of these points by a line segment.[1]

**In how many regions is the circle divided?**



[1] We assume that inside the circle, three of these line segments never intersect at the same point.

# A warm up problem: how many regions do we obtain?



| # of points | # of regions |
|---|---|
| 1 | |
| 2 | |
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| 6 | |

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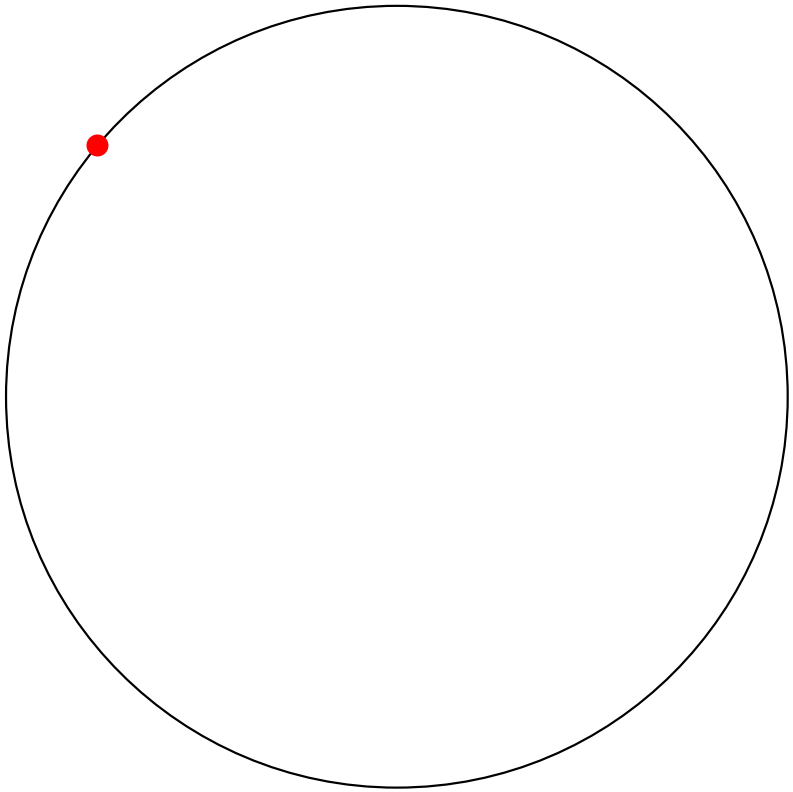

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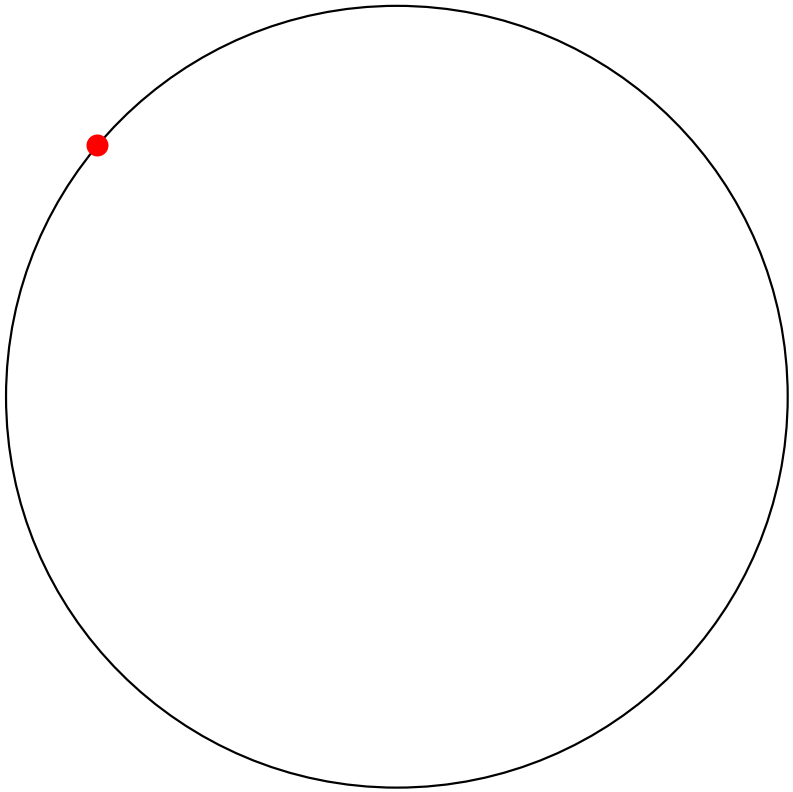

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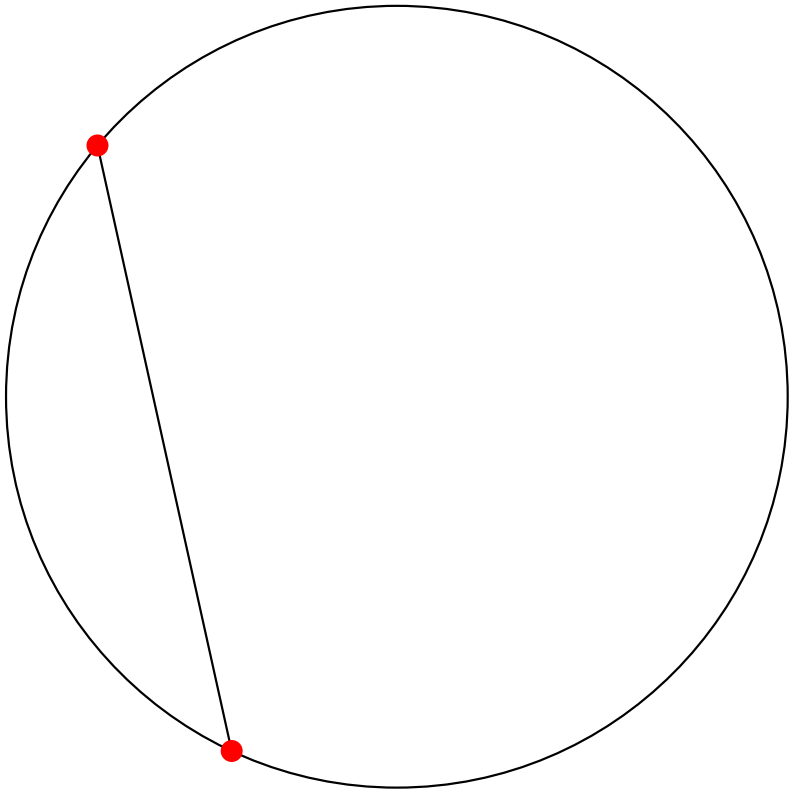

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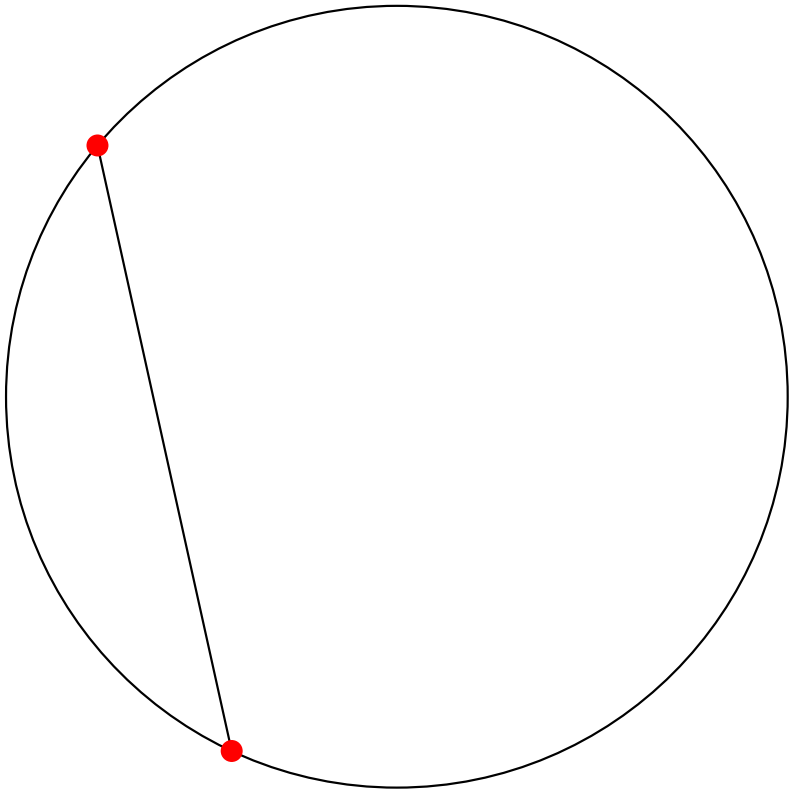

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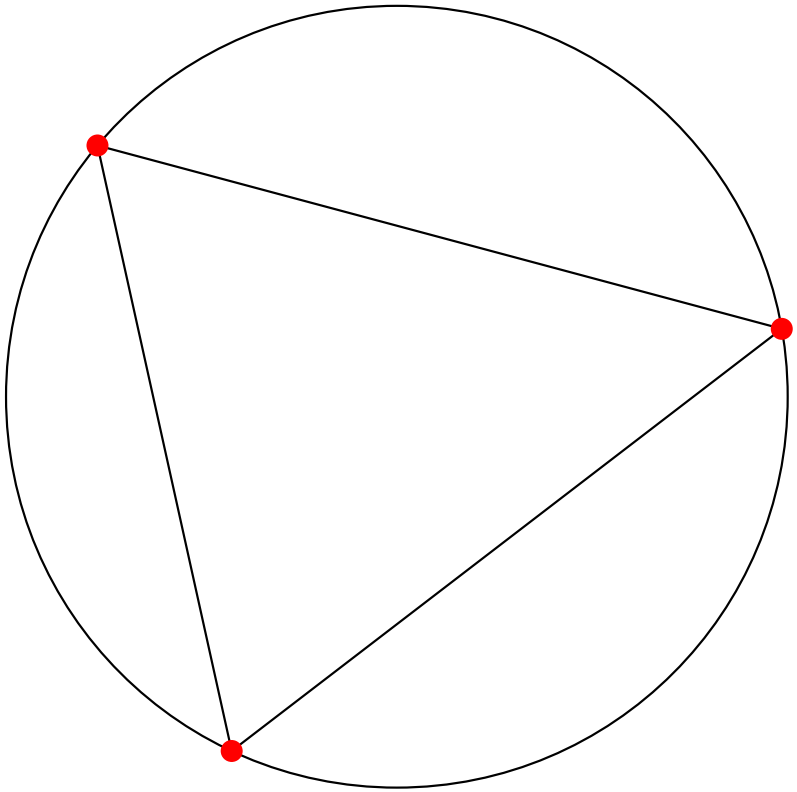

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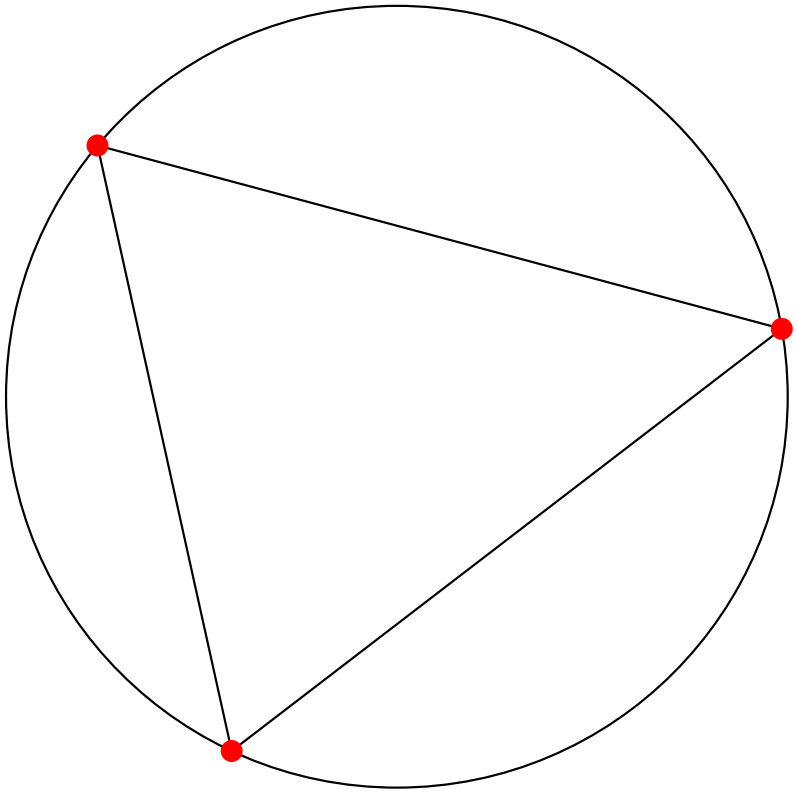

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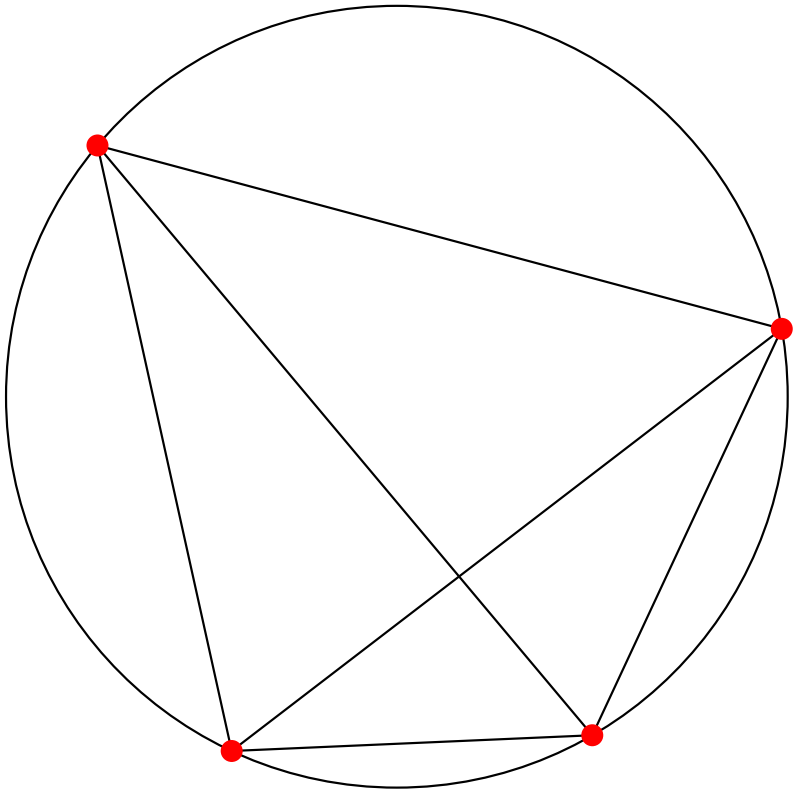

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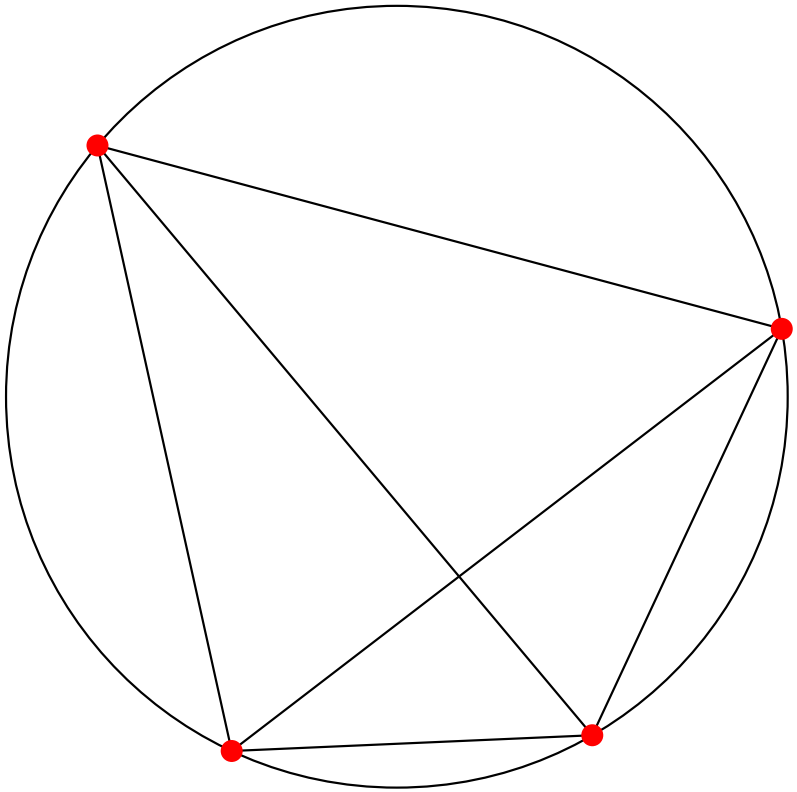

| # of points | # of regions |
|---|---|
| 1 | 1 |
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| 3 | 4 |
| 4 | 8 |
| 5 | |
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Any idea for a general formula?

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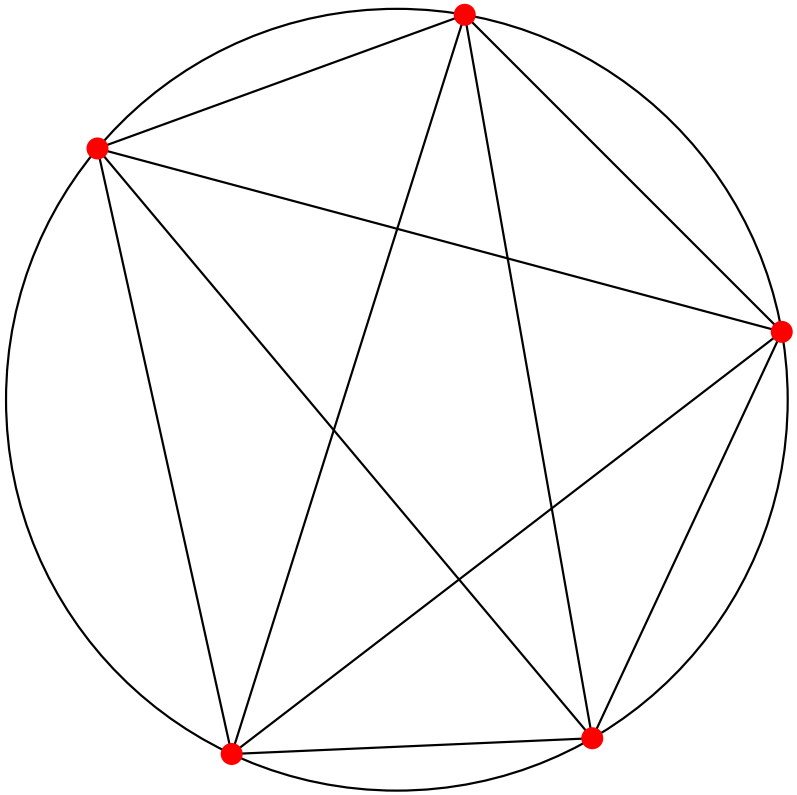

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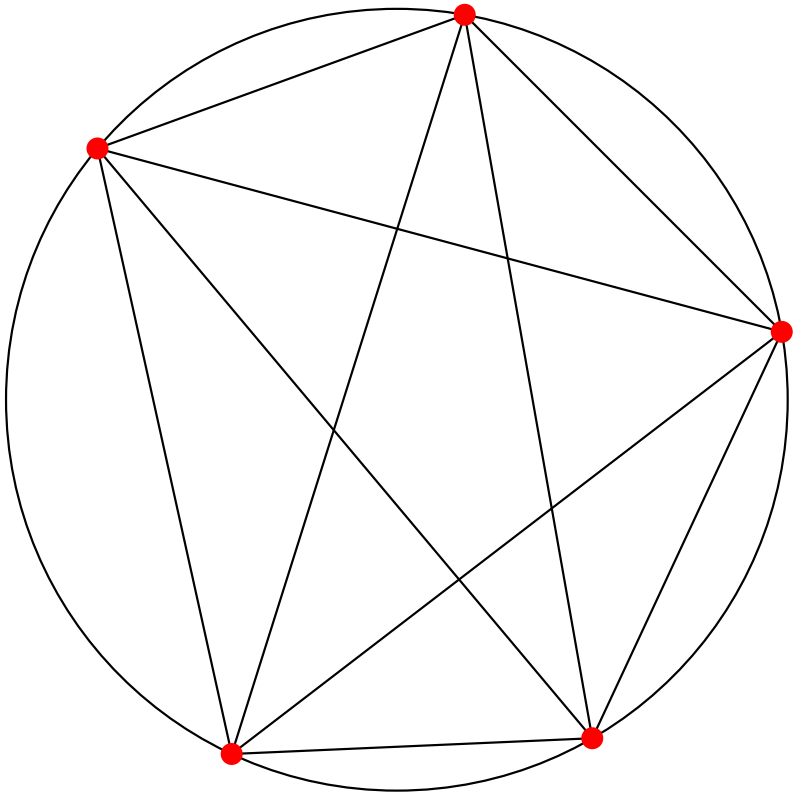

| # of points | # of regions |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 4 |
| 4 | 8 |
| 5 | 16 |
| 6 | |

Any idea for a general formula?
Does it still hold?

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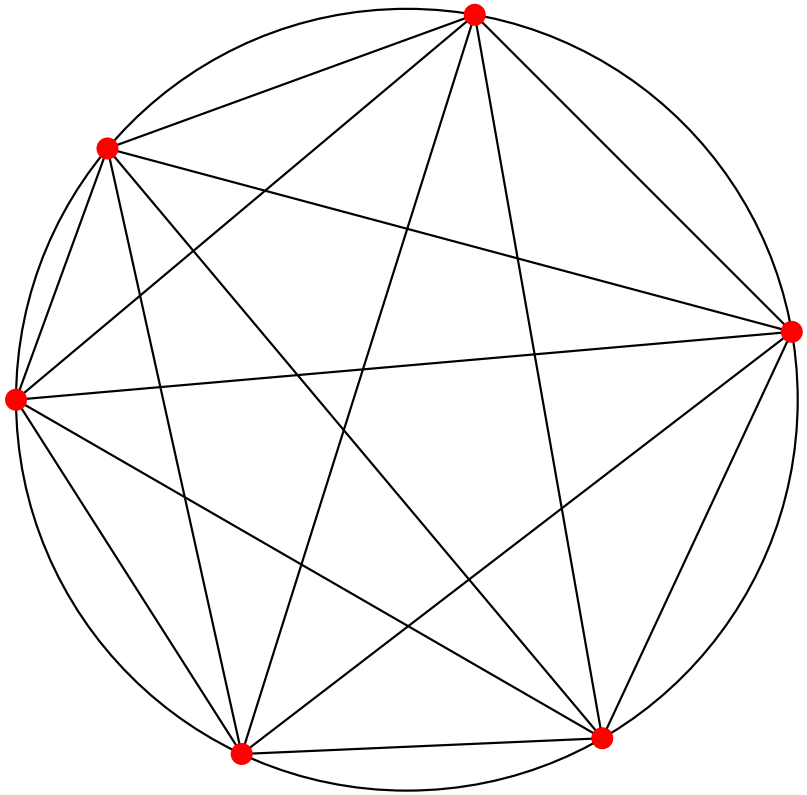

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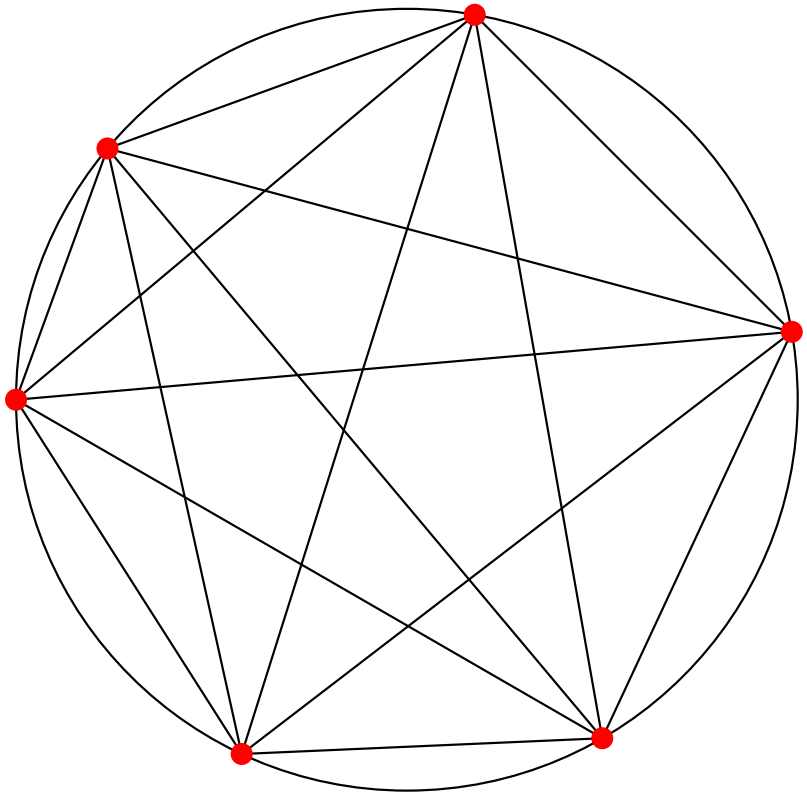

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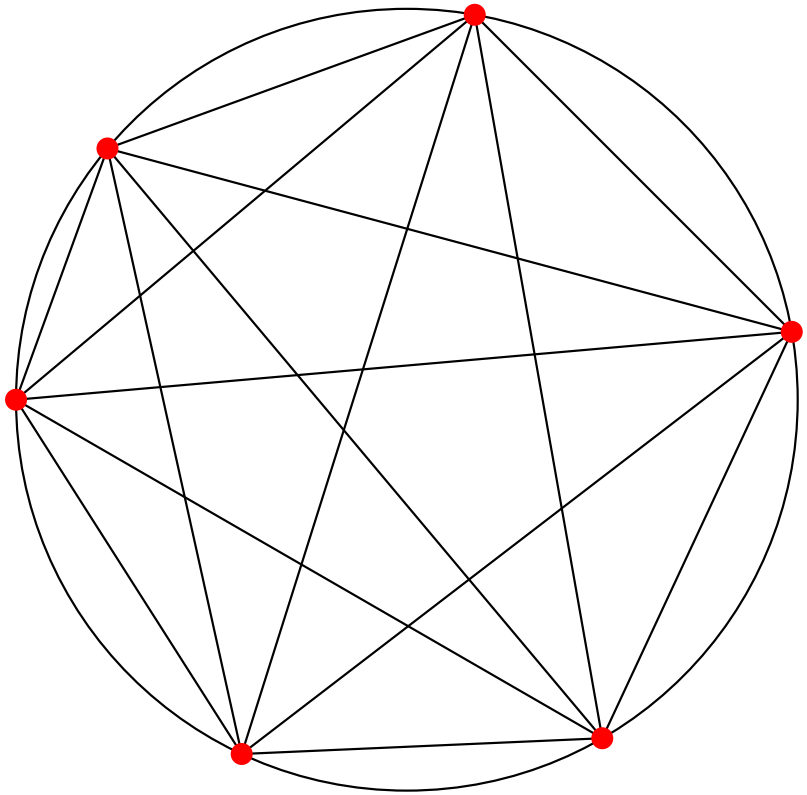

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Does it still hold?
Hmmm…Let's count again! Just to be sure…

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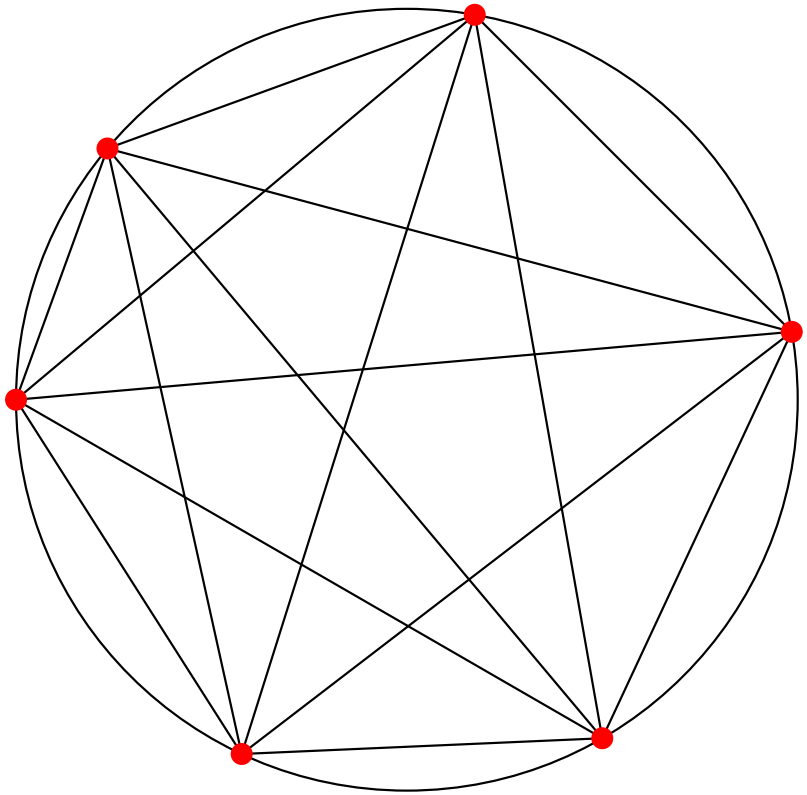

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| 6 | ~~32~~ 31 |

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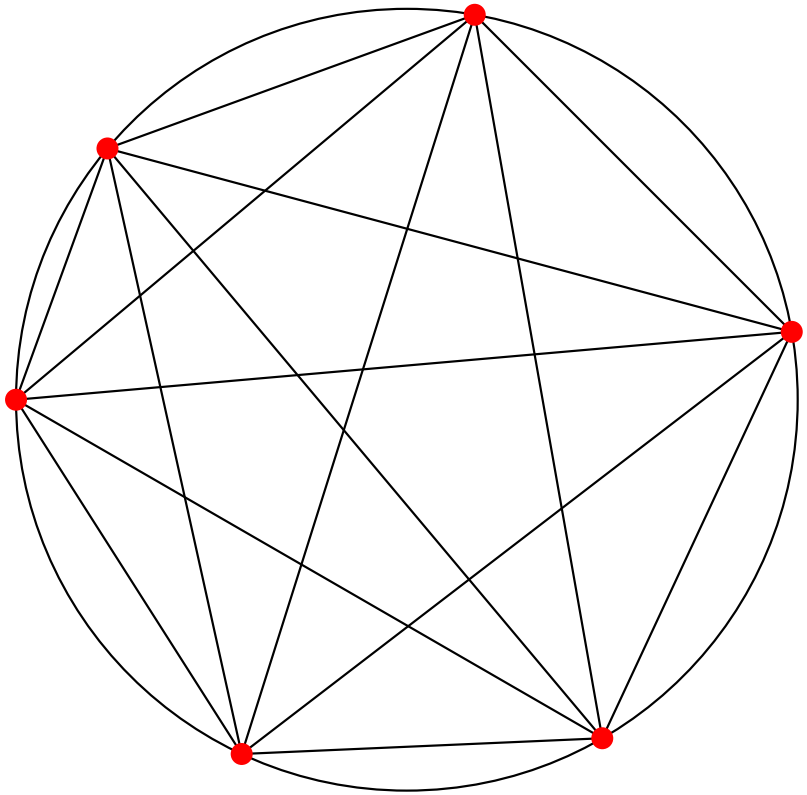

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Actually, the formula is not $2^{n-1}$ but

$$\binom{n-1}{0}+\binom{n-1}{1}+\binom{n-1}{2}+\binom{n-1}{3}+\binom{n-1}{4} = \frac{n}{24}(n^3-6n^2+23n-18)+1$$

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## Conclusion

Examples are great to help you to understand new things, to find new ideas, to guess a formula…
But they are not enough!
We need **proofs** to be sure that a result is true in general.

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## Conclusion

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But they are not enough!
We need **proofs** to be sure that a result is true in general.

⚠ Warning: I didn't say that examples are useless.

They are very important. I use them a lot when I want to understand a mathematical notion which is new to me.

When you face a new mathematical result, I *strongly* encourage you to "challenge" it on examples.
It may help you to better understand it!

# Another warm up problem

Which of the following statements are equivalent to this one:

"No two students in this class are not on fire."

1. "For any pair of students in this class, at least one of them is on fire."
2. "At least two students in this class are on fire."
3. "All student in this class, except at most one, are on fire."
4. "At least two students in this class are not on fire."
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 Just in case, notice the location of the closest extinguisher…☺