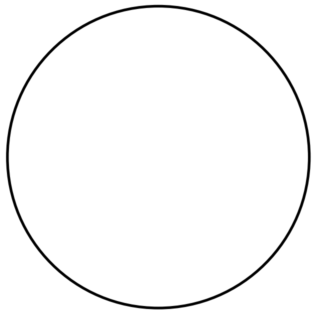
Real or Artificial Intelligence

MIND BLOWNG PUZZLES & PROBLEMS

Scientific calculators should not supplant number skills; computer algebra systems do not replace thinking and Artificial Intelligence still struggles with some of the simplest mathematics problems. Knowing when and how to use technology, particularly in an educational environment, is extremely important. We need to know more about how students learn, what engages them, what excites them and what challenges them. Technology can certainly provide a wealth of learning experiences, but just because we can, doesn't always mean we should. Regardless of which side of the technology fence you reside, students must still learn how to think, reason and problem solve.

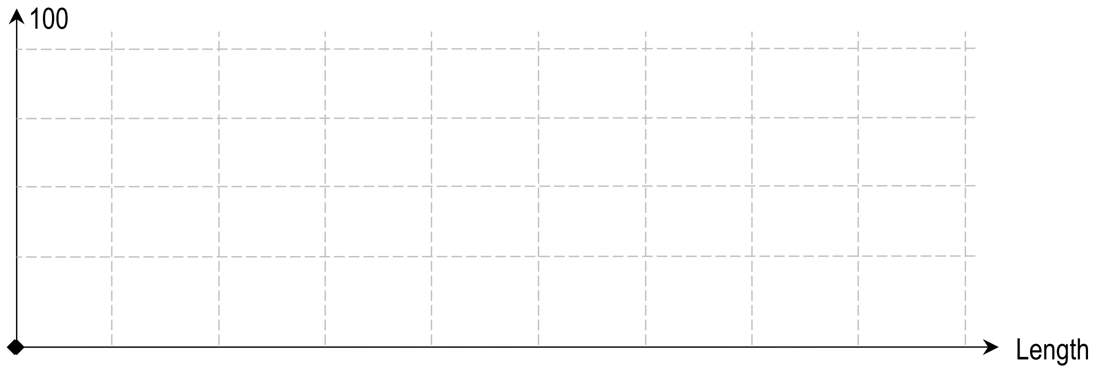
Problem 1: Chords – Part 1

A circle is drawn and a random chord is drawn inside the circle.
How long is the chord? If you were to repeat this experiment over and over, what would be the average length of the chord?



- Use the circle opposite to draw four random chords.
- Measure and record the length of each chord.
- These measurements will be collected to generate a reasonable sized sample.

Imagine a sample of 100 chords, what would you expect the distribution of chord lengths to look like?



Victorian Curriculum Assessment Authority

VCMMG366

Prove and apply angle and chord properties of circles.

Elaborations

- performing a sequence of steps to determine an unknown angle or length in a diagram involving a circle, or circles, giving a justification in moving from one step to the next
- communicating a proof using a logical sequence of statements
- proving results involving chords of circles

To determine the theoretical value for the average length of a randomly generated chord requires a reasonable knowledge and understanding of Year 12 calculus. To make this problem easier and more accessible, consider the problem:

A circle is drawn and a random chord is drawn inside. What is the likelihood the chord is longer than the side length of an equilateral triangle inscribed in the circle?

A calculator program has been written to generate lots of chords!

The distribution of chord lengths is recorded so too the proportion of chords longer than the side length of an inscribed equilateral triangle. The program can be used to gain an estimate for the true proportion.

Page 1.2: Run the "chord1" program. [Proportion stored in P]

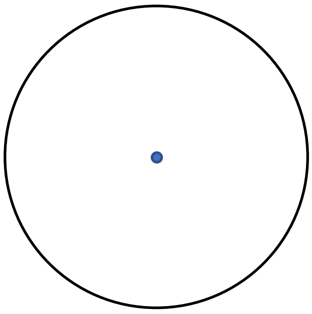
Page 1.3 Distribution of chord lengths for a circle of radius 100 units.

Page 1.4 Location of the centre of each chord.

Page 1.5 Dynamic representation of a chord and inscribed equilateral triangle, to assist with the subsequent proof.

Problem 2: Chords – Part 2

Assuming the midpoints of the chords in Problem 1 were randomly distributed through the circle, we can use this approach to draw a random chord. Place a dot randomly inside the circle. The dot represents the midpoint of your chord. Draw a line from the centre of the circle passing through the dot. The chord will be perpendicular to this line.



Page 1.2: Run the "chords2" program. [Proportion stored in P]

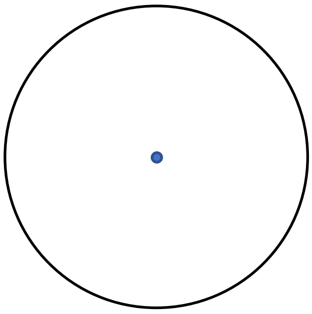
Page 1.3: Distribution of chord lengths for a circle of radius 100 units.

Page 1.4 Location of the centre of each chord.

Page 1.6 Dynamic representation of a chord and inscribed equilateral triangle, to assist with the subsequent proof.

Discuss and comment on your findings to date.

Problem 3: Chords – Part 3



Draw a line representing the radius of the circle. Place a point on the radius, some random distance from the centre of the circle. Imagine the radius is able to sweep around the circle, to this extent we have covered all the random points from Problem 2. The radius and perpendicular line can now be located anywhere in the circle. What proportion of these chords will be longer than the side length of an inscribed, equilateral triangle?

Run the Chord3() program and explore each of the above properties.

Page 1.8 includes a dynamic representation of this scenario. Use the diagram to help validate the proportion generated by the Chord3() program.

Discuss and comment on your findings.

Our chord journey has come to a perplexing conclusion, there is no doubt it will continue to challenge your thoughts on many levels. The next problem is known as the Keynesian Beauty Contest. It has been explored by many, including Nobel prize winning mathematician: John Nash. The problem is by no means trivial; indeed, it largely reflects the state of play for global stock markets. The recent movie: "Dumb Money" goes some way towards explaining this interesting problem.

Problem 4: Keynesian Beauty Contest

In 1935, John Maynard Keynes helped organise a contest. Entrants were required to pick the five most attractive faces from a collection of 100 photos. If entrants managed to pick the same five as the majority of participants they were placed in the prize draw. Some time later Alain Ledoux transformed the problem into a purely mathematical context:

"Pick a number between 0 and 100. Once all the entries have been submitted, the mean of all the entries will be calculated, that value will be multiplied by 2/3. The person who is closest to this quantity will be the winner."

What number should you enter?

More Problems Every Week

Whilst the handout concludes here, there are many more problems to be explored amongst the slides. The problems on these slides can be sourced for free from the magical Maths-Pad (Mouse Pad / Oversized Coffee Coaster). Each week a new problem can be sourced by using your phone or web-browser. The collection of puzzles in the slides have come from this space.

"The purpose of technology, specifically AI, is not to replace human intelligence, but to augment it." [P. Fox – Texas Instruments]

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