



# The ProbLemma's Channel Season 3 Guide

## Season 3 Episode 1: The Index Of Tools

- All the problem-solving approaches studied so far, across seasons 1 and 2, are indexed by the episodes in which they were defined and practiced

## Season 3 Episode 2: An Integral Transformation

- Problem **S3M1** solved, show that for all  $\theta, x$  real, with  $x > 1$ , and  $n = 1, 2, 3, 4, 5 \dots$  it is the case that:

$$\int_0^{\pi} \left( x + \sqrt{x^2 - 1} \cos(\theta) \right)^n d\theta = \int_0^{\pi} \frac{d\theta}{(x - \sqrt{x^2 - 1} \cos(\theta))^{n+1}}$$

- Problems **S3M2/3/4** formulated:
  - Problems **S3M2/3/4**: deduce in at least 3 distinct ways an alternative expression (a product) for the following finite sum:

$$\sum_{k=0}^n \cos(a + k\theta)$$

## Season 3 Episode 3: One Telescope, Two Telescopes

- Problem **S3M2** solved

## Season 3 Episode 4: A Complex Approach

- Problem **S3M3** solved

## Season 3 Episode 5: Euclid Says

- Problems **S3M4** solved
- Problem **S3P1** formulated:
  - **S3P1**: find the period of oscillation of a triangular spring oscillator

## Season 3 Episode 6: Triangular Spring Oscillator

- Problem **S3P1** solved
- Problem **S3CS1** formulated:
  - **S3CS1**: sort 3 integers creatively, without the popular containers and/or industrial strength algorithms

## Season 3 Episode 7: 3-Integer Sort, A Discovery

- Problem **S3CS1** solved

- Problem **S3M5** formulated:
  - **S3M5**: construct a point, N, inside of a right triangle, ABC, such that the magnitudes of all the angles NAB, NBC and NCA are all equal one another

#### Season 3 Episode 8: Brocard Points Introduction

- Problem **S3M5** solved
- Problem **S3M6** formulated:
  - **S3M6**: invent a way to evaluate finite sums based on a popular approach that is used in combinatorial analysis to prove binomial identities

#### Season 3 Episode 9: Summation By Double-Counting

- Problem **S3M6** solved
- Problem **S3P2** formulated:
  - **S3P2**: find the distance covered by a bouncing material point

#### Season 3 Episode 10: Infinity In Physics

- Problem **S3P2** solved
- Problem **S3CS2** formulated:
  - **S3CS2**: suggest a Turing Machine-friendly algorithm for testing if a given point is located outside or inside of a given triangle

#### Season 3 Episode 11: A Point-in-triangle Detection Algorithm

- Problem **S3CS2** solved
- Problem **S3M7** formulated:
  - **S3M7**: find a way to integrate a binomial differential  $x^m(a + bx^n)^p dx$

#### Season 3 Episode 12: Integration Of Binomial Differentials

- Problem **S3M7** solved
- Problem **S3M8** formulated:
  - **S3M8**: use the integration of binomial differentials machinery developed in the previous problem in order to evaluate the following infinite sum:

$$\sum_{n=1}^{+\infty} \frac{1}{n(n+1)(n+2)\dots(n+p)}, \quad p \geq 2$$

#### Season 3 Episode 13: Binomial Differentials Slay Infinite Sums Before Breakfast

- Problem **S3M8** solved
- Problem **S3P3** formulated:
  - **S3P3**: distinguish a sphere from an identical ball of same radius and mass

Season 3 Episode 14: Sisyphus Versus Spherical Chickens Of Uniform Density

- Problem **S3P3** solved
- Problem **S3CS3** formulated:
  - **S3CS3:** construct a single-pass algorithm for sorting **0s** and **1s**

Season 3 Episode 15: Single-pass Janus Sort

- Problem **S3CS3** solved
- Problem **S3M9** formulated:
  - **S3M9:** construct an equilateral triangle on 3 parallel straight lines

Season 3 Episode 16: An Equilateral Triangle On 3 Parallel Straight Lines Construction

- Problem **S3M9** solved
- Problem **S3M10** formulated:
  - **S3M10:** reconstruct a square given 4 points that belong to one side of that square each

Season 3 Episode 17: 4-Point Square Reconstruction

- Problem **S3M10** solved
- Problem **S3P4** formulated:
  - **S3P4:** find the normal and the tangential accelerations as functions of time of a point that moves along a parabola with its acceleration vector staying parallel to the  $y$ -axis at all times

## The ProbLemma's Channel Season 3 Index

Problem Number	Formulated In	Solved In
S3M1	<a href="#">Season 2 Episode 55</a>	<a href="#">Season 3 Episode 2</a>
S3M2	Season 3 Episode 2	Season 3 Episode 3
S3M3	Season 3 Episode 2	Season 3 Episode 4
S3M4	Season 3 Episode 2	Season 3 Episode 5
S3P1	Season 3 Episode 5	Season 3 Episode 6
S3CS1	Season 3 Episode 6	Season 3 Episode 7
S3M5	Season 3 Episode 7	Season 3 Episode 8
S3M6	Season 3 Episode 8	Season 3 Episode 9
S3P2	Season 3 Episode 9	Season 3 Episode 10
S3CS2	Season 3 Episode 10	Season 3 Episode 11
S3M7	Season 3 Episode 7	Season 3 Episode 8
S3M8	Season 3 Episode 8	Season 3 Episode 9
S3P3	Season 3 Episode 9	Season 3 Episode 10
S3CS3	Season 3 Episode 10	Season 3 Episode 11
S3M9	Season 3 Episode 11	Season 3 Episode 12
S3M10	Season 3 Episode 12	Season 3 Episode 13
S3P4	Season 3 Episode 13	Season 3 Episode 14
S3CS4	Season 3 Episode 14	Season 3 Episode 15
S3M11	Season 3 Episode 15	Season 3 Episode 16
S3M12	Season 3 Episode 16	Season 3 Episode 17
S3P5	Season 3 Episode 17	Season 3 Episode 18
S3CS5	Season 3 Episode 18	Season 3 Episode 19
S3M13	Season 3 Episode 19	Season 3 Episode 20
S3M14	Season 3 Episode 20	Season 3 Episode 21
S3P6	Season 3 Episode 21	Season 3 Episode 22
S3CS6	Season 3 Episode 22	Season 3 Episode 23
S3M15	Season 3 Episode 23	Season 3 Episode 24
S3M16	Season 3 Episode 24	Season 3 Episode 25

S3M28	Season 3 Episode 25	Season 3 Episode 26
S3M29	Season 3 Episode 26	Season 3 Episode 27
S3M30	Season 3 Episode 27	Season 3 Episode 28
S3M31	Season 3 Episode 28	Season 3 Episode 29
S3M32	Season 3 Episode 29	Season 3 Episode 30
S3M33	Season 3 Episode 30	Season 3 Episode 31
S3M34	Season 3 Episode 31	Season 3 Episode 32
S3M35	Season 3 Episode 32	Season 3 Episode 33
S3M36	Season 3 Episode 33	Season 3 Episode 34
S3M37	Season 3 Episode 34	Season 3 Episode 35
S3M38	Season 3 Episode 35	Season 3 Episode 36
S3M39	Season 3 Episode 36	Season 3 Episode 37
S3M40	Season 3 Episode 37	Season 3 Episode 38
S3M41	Season 3 Episode 38	Season 3 Episode 39
S3M42	Season 3 Episode 39	Season 3 Episode 40
S3M43	Season 3 Episode 40	Season 3 Episode 41
S3M44	Season 3 Episode 41	Season 3 Episode 42
S3M45	Season 3 Episode 42	Season 3 Episode 43
S3M46	Season 3 Episode 43	Season 3 Episode 44
S3M47	Season 3 Episode 44	Season 3 Episode 45
S3M48	Season 3 Episode 45	Season 3 Episode 46
S3M49	Season 3 Episode 46	Season 3 Episode 47
S3M50	Season 3 Episode 47	Season 3 Episode 48
S3M51	Season 3 Episode 48	Season 3 Episode 49
S3CS3	Season 3 Episode 49	Season 3 Episode 50
S3P1	Season 3 Episode 50	Season 3 Episode 51
S3M52	Season 3 Episode 51	Season 3 Episode 52
S3M53	Season 3 Episode 52	Season 3 Episode 53
S3P2	Season 3 Episode 53	Season 3 Episode 54
S3M54	Season 3 Episode 54	Season 3 Episode 55