

Study Guide, Parts I & II:

Schneider's *A Beginner's Guide to Constructing the Universe*

Prepared by Rachel DeMille

This Study Guide is prepared as a companion to the Mentoring in the Classics Audio Series.

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This Month's Mentoring Content

The Introductory Mentoring Audio, provided via a link in your course email, consists of a small-group tutoring session including Oliver, Rachel, and daughters Emma (22) and America "Meri" (11).

Please take a moment to download your audio content to your computer immediately so you have uninterrupted access to it!

Ideas for Writing or Discussion:

- What is "math"?
- How does your definition of "math" differ after reading this book?
- Which of the 7 Steps of math study have you emphasized most in your life?
- Which step are you utilizing most with those you teach and mentor?
- Which step are you planning to emphasize most in the next while, in your own studies? In your teaching?
- What math terms do you use in everyday language?
 - What's the **difference**?
 - The **solution** is relatively simple.
 - You've got a big **problem**!
 - There are more **factors** than you're admitting.
 - The **sum** of the **parts** is **great than** the **whole**.
 - A **lesser** man would never have endured that.
- How can using math terms in your everyday language enhance your thinking, and help your children/students develop more fluency with the language of math? (exponential, rounded, fraction, dividend, quarter, equal, tangent,?)
- Have you found yourself thinking more about math during/since the time you have spent reading this book?
- What new patterns and problems have you noticed or entertained in your mind?

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Resources for Additional Study:

- [Math Resources on TJEd.org \[http://TJEd.org/Math-Sci/\]](http://TJEd.org/Math-Sci/)
- [What's Math Got to Do With It?](#)
- [Sensus Plenior/Sensus Solum](#)
- [Enhance your daily Math Vocabulary!](#)
- [Lockhart's Lament](#)
- [Florence Nightingale, Mathematician](#)
- [Math Games for Families and Children](#)
- [Math Classics for Adults](#)
- [Math Classics for Kids](#)
- [Math Videos to Inspire You](#)
- [Schneider's website and resources \(scroll down for fun links!\)](#)

What's Math Got To Do With It?



I've often said that the ***“Why”*** we teach something informs the ***“How.”***

Years ago Oliver wrote an introduction to a math course. He articulated ***“Why”*** we learn and teach math, and I think having this vision is not only inspiring and motivating, but really helps us focus our approach and methods.

He created a list of “values” that clearly articulates the meaning and purpose of math education, and (along with the introductory paragraphs written by the course instructor, Troy Henke) I share it here with you:

“Mathematics is an integral part of a statesman’s education Math teaches a person to think in a way that no other field does. As a person studies math, he learns to:

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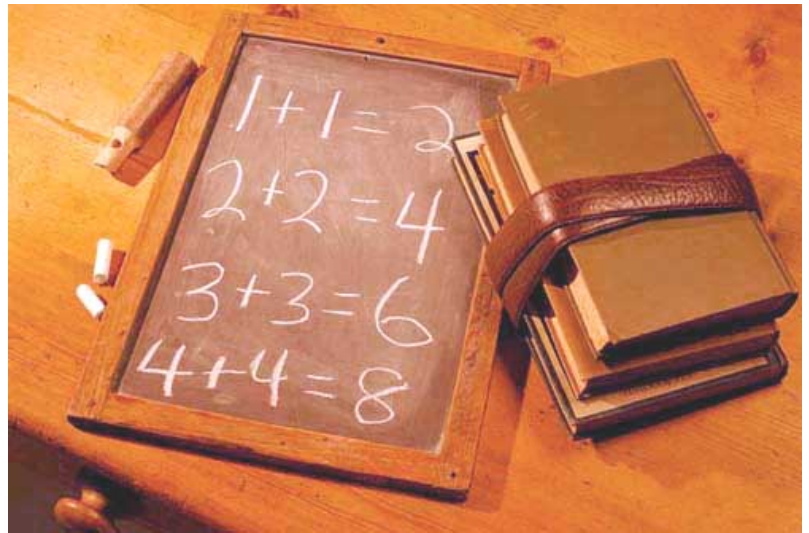
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1. Seek and recognize patterns
2. Explore the relationship between things
3. See similarities and also distinctions
4. Analyze logically but with a deep sense that there is a right answer and a set ideal worth detecting
5. Compare and contrast
6. See things in black and white
7. See infinite shades of grey and therefore avoid jumping to conclusions
8. Seek evidence for conclusions and check opinion with first-hand research
9. Put his own pen to paper before accepting what society tells him
10. Seek for absolutes
11. Remain open to surprising new information which makes past conclusions limited though perhaps still accurate

“Now, clearly, the practical art must also be mastered—we want you to be able to pass any standardized test with the highest marks.

“But more importantly, we want you to be able to think like an Archimedes, a Descartes, a Newton, a Sophie Germain, an Einstein.”



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How to Learn and Teach Math:

- 1. Discover stories about math, and those who use, study and love it.**
- 2. Fall in love with shapes, patterns, numbers, etc.**
- 3. Be, or find, a close example of a math-loving math student**
- 4. Use spreadsheets in every-day life**
- 5. Read Math Classics**
- 6. Study math problems, skills, techniques, language and testing**
- 7. Study the Greats on a higher level**

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Steps of Math Study

Study the Greats

Skills/
Tests

Read Math
Classics

Use Spreadsheets

Be or Find a Close Example

Fall in Love with Shapes and Numbers

Discover the stories of Math and those who
love it

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Level 5 Mentor Prompt on *A Beginner's Guide to Constructing the Universe*:

Using a pen in the margins and endsheets, or a separate notebook, record the conversation that occurs between Michael Schneider and yourself.

Capture your epiphanies and questions, and make a note of the things you want to share with others.

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Study Guide, Part II

Now that you've heard the Audio Debriefing Audio, check out these additional resources!

Best books to get you loving math:

- [***Math Doesn't Suck***](#) (Just ignore the title if it bugs you. The content is delightful!)
- [***Secrets of Mental Math***](#)
- [***Mathemagic \(Childcraft Volume 13\)***](#)
- Oliver's recommended, unofficial sequel to Schneider: [***The Tao of Physics***](#)

Best books to get your kids loving math:

- [**See our list here >>**](#)

More Resources:

- [This article totally blew our mind. \(PDF\)](#)
- [Bedtime Math \(free daily email with fun math for you to share with your kids – leveled for early, middle and later learners!\) >>](#)
- [You simply MUST check out this YouTube channel! Vi Hart >>](#)
- [Math Curricula for Home Learning \(PDF\)](#)
- [Why Americans Stink at Math \(NY Times\) >>](#)
- [More on "Liber" >>](#)
- [The Best Math Curriculum \(TJEd.org\) >>](#)
- [The Elegant Number 9 \(TJEd.org\) >>](#)
- [Let's Learn Times Tables \(PDF\) >>](#)
- [A Better Way to Teach Math \(NY Times\) >>](#)
- [Car Watching from Math Inspirations >>](#)
- [Measurement Scavenger Hunt from Math Inspirations >>](#)
- [Must Watch Chemical Reactions >>](#)
- [Right-brained Math: Concepts to Facts >>](#)
- [Don't Teach Math, Coach It \(NY Times\) >>](#)
- [Gnomes and Gnumbers: A Mathematical Tales \(FREE - available online or PDF \) >>](#)
- [How Many Things Are There? \(YouTube\) >>](#)

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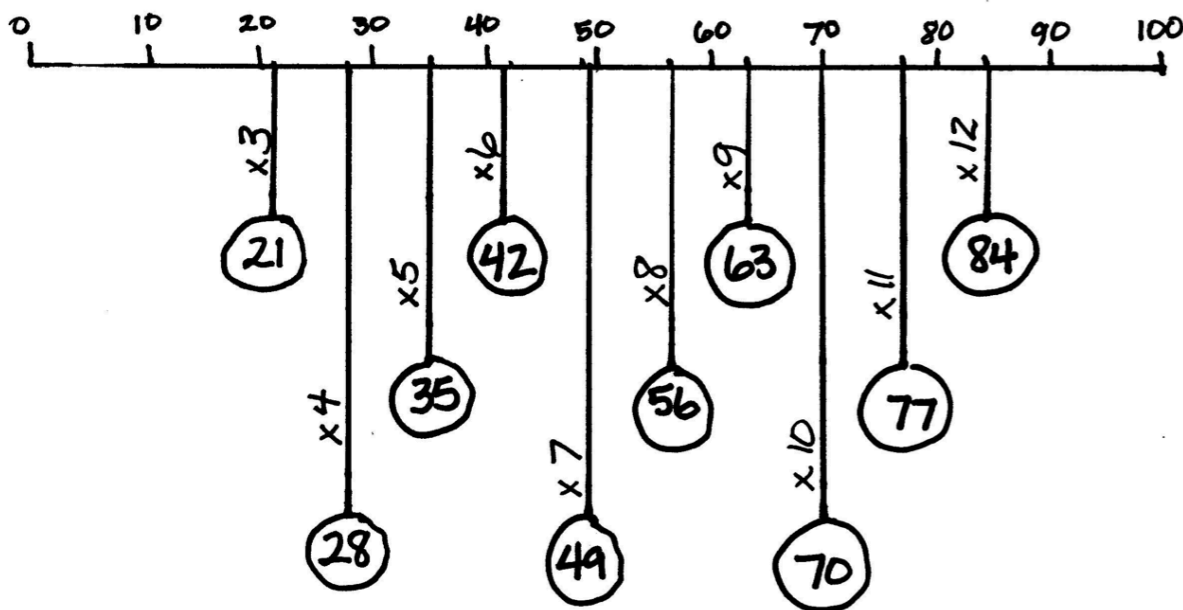
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- [Math Study Fun](#) (Be sure to use this in the context of the 7 Steps of math learning – and not to drill & kill!! ☺)
- [Flatland](#) (this quirky book is fun for math lovers, and utterly strange for everyone else)
- [Rithmatist](#) (this clean, fun adventure by fantasy writer Brandon Sanderson – appropriate for is features geometry!)
- The book Rachel mentioned toward the end: [Our Home](#)
- [The math-music video Rachel mentioned >>](#)
- On these blogs and YouTube channels, take some time and wander through related videos, posts, and other links! You'll find lots of food for mathematical though.

Here is a diagram of Rachel's "7 Pattern":



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Math Fun!

CAN YOU FIGURE OUT THESE MOVIE TITLES?

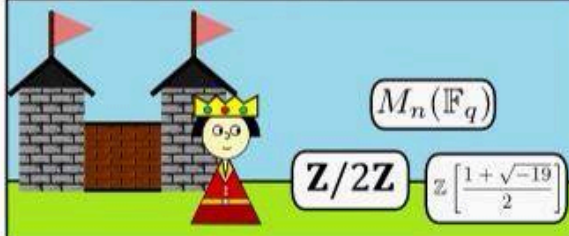
3.17514659 KG

$$\lim_{x \rightarrow a} f(x)$$

$$\left| \frac{ds}{dt} \right|$$

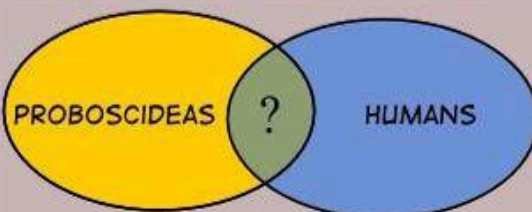


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[Check or submit your answers in the comments here >>](#)

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Ian's Notes on...

A Beginner's Guide to Constructing the Universe: The Mathematical Archetypes of Nature, Art, and Science a Voyage from 1 to 10

by Michael Schneider

Prepared by [Ian Cox](#)

Note: This is by no means a complete list of all the experiments and hands-on exercises found in this book. Have fun finding and doing the “To Do’s” throughout this book!

To Do:

Monad: Wholly One

1. Page 17 Half of a circle has the same area as a rolling circle within it.
 - a. Compare and contrast different shapes to a circle. Circles with the same perimeter cover more area.

Dyad: It Takes Two to Tango

2. Pg. 32 Doodle with the dyad.

Triad: Three-Part Harmony

3. Pg. 51 Construct a set of Borromean Rings. They only overlap while none interlock.
4. Pg. 53 Light is a mixture of colors. Ex White = Red, Green and Blue-violet. Additive vs. Subtractive colors.

Tetrad: Mother Substance

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5. Pg. 61 How to bring depth to the universe. Construct the tetrahedron.
6. Pg. 63 Tetrahedral wire frame and soap solution to make bubbles.
7. Pg. 67 Fill a jar with soil, water and air then shake it to discover the natural order of the elements.
8. Pg. 70-71 Two ways to construct a square.
9. Pg. 73 Construct square within a square etc.
10. Pg. 80 Salt in bowl of water crystallizes as the water evaporates.
11. Pg. 81 Rubber ball and chalk to draw the five elements.
12. Pg. 83 Construct the five elemental shapes.
13. Pg. 84-85 Two ways to construct a cube. Create a cube with wire and put it in bubble solution.
14. Pg. 86 Construct deltahedra
15. Pg. 87 Construct Icosahedra
16. Pg. 88 Construct a tetrahedron, octahedron, and an icosahedron.
17. Pg. 94 Self-discovery.

Pentad: Regeneration

18. Pg. 102 Cut an apple and pear at its equator to see their star/pentagon formation.
19. Pg. 103 Tie your shoes. You just made a “good luck” pentagon.
20. Pg. 105 Classic puzzle.
 - a. And how to cut out a star.
21. Pg. 111-112 Doodle and experiment with pentagons and pentagrams with paper construction.
22. Pg. 113 Inscribe life forms with pentagons and stars.
23. Pg. 119 The golden Mean: Divide a graph to get approximately 1.62 of the Fibonacci sequence. $1/89 =$ Fibonacci sequence.
24. Pg. 120 Experiment with any two numbers, divide them, and see the sequence approach pi (Φ).
25. Pg. 121 How to divide a line at the Golden Mean.
26. Pg. 122-3 Constructing Golden Mean calipers.

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- 27.Pg. 124-6 Explore Golden Mean ratios in nature and with the human body.
- 28.Pg. 130 Aesthetics of Φ , look around at common house items (3x5, 5x8).
- 29.Pg. 131 Construct a Golden Rectangle.
- 30.Pg. 132 Construct a 3-D Golden Frame.
- 31.Pg. 135 Find the Golden Mean with calipers on Notre Dame.
 - a. Pg. 136 On a Sarcophagus
- 32.Pg. 140 Spirals: Doodle some! Construct as well as compare and contrast the Archimedean Spiral vs. the Golden Spiral.
- 33.Pg. 142 Construct a Golden Spiral.
- 34.Pg. 145 The Golden Triangle and spiral.
- 35.Pg. 148 Self-replicating balance: Another way to see this principle of balance through change is to bend a piece of wire into a golden spiral and balance it by a pencil or straw through the eye.
- 36.Pg. 158 Observe streams, ponds, rowboats, etc.
- 37.Pg. 161 Observe clouds, weather, fire, flags, etc.
- 38.Pg. 165 See plants as energy.
- 39.Pg. 169 Look at leaves from the perspective of the sun.
- 40.Pg. 172 Build a plant replica.

Hexad: Structure-Function-Order

- 41.Pg. 179 Ponder Hexad: Structure-Function-Order
- 42.Pg. 183 Construct the Hexagon
- 43.Pg. 184 Observe symmetry's
- 44.Pg. 185 Designs and patterns
- 45.Pg. 186 Hexagonal knot
- 46.Pg. 187 Circumference relations
- 47.Pg. 187 Musical Hexagon
- 48.Pg. 191 Doodle Hexagons
- 49.Pg. 197 Construct Dodekagon
- 50.Pg. 199 Thirteen clay balls, twelve circle the one.
- 51.Pg. 205 Trace the Great Seal of the United States of America with a Hexagon.

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52.Pg. 213 “Square the Circle”

53.Pg. 216 Geometry of Stonehenge

Heptad: Enchanting Virgin

54.Pg. 225 Divide 360 degrees by 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

55.Pg. 226 Construct approximate heptagon

56.Pg. 228 Doodle with Athena’s web

57.Pg. 229 Make heptagon audible

58.Pg. 230 Construct a heptagon with knotted string, paper knot, and tooth picks.

59.Pg. 237 Experiment with music

60.Pg. 242 Construct a Lyre of Apollo

61.Pg. 247 Tracing paper over painting

62.Pg. 252 View rainbow with each eye individually.

63.Pg. 253 View color TV with a magnifying glass.

64.Pg. 263 Focus on “the heart “chakra.

Octad: Periodic Renewal

65.Pg. 267 Try to fold a piece of paper in half eight times.

66.Pg. 270 Create an octagon

67.Pg. 271 Hear proportions

68.Pg. 273 Trace octagons on creatures to see symmetry.

69.Pg. 274 Construct the breath of the compassionate.

70.Pg. 280 Guitar strings and periodic recurrence.

71.Pg. 281 Resonance, or vibrations, of a car.

72.Pg. 283 Doubling relations in the body.

Ennead: The Horizon

73.Pg. 308 Casting out nines in multiplications chart.

74.Pg. 312 How many symmetric shapes do nine coins make? Or, can you make?

75.Pg. 313 Create a labyrinth.

Dekad: Beyond Number

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- 76.Pg. 337 Birth of Decagon and internal patterns.
- 77.Pg. 340 Construct Islamic Tiling Pattern.
- 78.Pg. 342 “Paradise” art geometry.
- 79.Pg. 344 Geometry of St. John the Divine Cathedral.

Epilogue: Now That You’ve Constructed the Universe...

- 80.Pg. 348 What characters of geometry does this vegetable have?

“Take note of that which comes from without and that which comes from within.”

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