

Problem Set #1

Mathematics 302—Chaos Theory
Dr. Peratt

1. Read this [excerpt from James Gleick's Chaos: Making a New Science](#).
 - (a) Identify each person who is named, and write a one sentence (brief) explanation of their main contributions to the field of Chaos Theory (i.e. what are they most known for?).
 - (b) According to Gleick, what are the major limitations of both small scale physics (particle physics) and large scale physics (cosmology such as that studied by Stephen Hawking)?
 - (c) Therefore, what deficiency does Chaos Theory appear to fill in our understanding of the universe? That is, what is it's "niche" – the thing that it does that neither Cosmology nor Particle Physics accomplish?
 - (d) According to Gleick, what revolutionary "eliminations" were caused by: (1) the Theory of Relativity, (2) the Theory of Quantum Mechanics, and (3) Chaos Theory.
2. Read this [Pioneer Press article, "Meet Dr. Chaos,"](#) about Jim Yorke, an applied mathematician from the University of Maryland.
 - (a) Identify each person who is named, and write a one sentence (brief) explanation of their main contributions to the field of Chaos Theory (i.e. what are they most known for?).
 - (b) According to Jim Yorke, chaos is what; it is what; it is what.
 - (c) This is what chaos is: it is what in the short run but not what.
 - (d) According to Jim Yorke, what is the essence of chaos theory?
3. Read this [Excerpt from A First Course in Chaotic Dynamical Systems](#) by Robert L. Devaney. Identify each person who is named, and write a one sentence (brief) explanation of their main contribution to the field of Chaos Theory (i.e. what are they most known for?). You will not understand every nuance of what he writes, nor are you expected to. However, this excerpt will give you a brief but important history and overview of Chaos Theory, along with the main players in its development.
4. Read this [Essay on Quantum Theory](#) by particle physicist Stephen Barr from the University of Delaware, and answer the following questions briefly but thoroughly:
 - (a) What is wave-particle duality?
 - (b) Describe the contributions of both Max Planck and Louis de Broglie to the wave-particle conundrum.
 - (c) What does the author describe as the main contributions of: (1) Newton's Theories, (2) Maxwell's Equations, (3) Einstein's Relativity, and (4) Quantum Theory.
 - (d) According to Barr, wave-particle duality is inconsistent in a blatant way, and this can be understood with a thought experiment. Briefly describe the inconsistency.
 - (e) The author identifies the three main interpretations of Quantum Theory as: (1) Copenhagen, (2) Many Worlds, and (3) Bohmian. For each one, write a sentence that describe the advantage and disadvantage of the interpretation.

NOT Required Reading: Only if you are interested, you may read [this article from Wired magazine](#) on some cutting edge, and controversial, developments in the field of Quantum Mechanics.