Introduction to Modeling

A Collection of Lists

Definition: A *model* is a representation of reality; a *mathematical model* is a model which uses mathematical objects (like functions and equations) to represent reality.

Properties of Models:

Purpose: a model's purpose is the type of questions that the model can be used to answer.

Resolution: a model's resolution is the level of detail that it can obtain.

Accuracy: a model's accuracy is how well it represents reality (within its Purpose and Resolution).

Flexibility: a model's flexibility is the range of realities that it can accurately represent.

Modeling Cycle:

Identification: form initial question, identify possible features

Simplification: identify significant features and relationships (make ASSUMPTIONS)

Evaluation: express relationships mathematically and solve them analytically, qualitatively, numerically or however.

Interpretation: express solution in terms of reality, answer the original question

Verification: test the results of the model against reality, test the assumptions

Common Modeling Mistakes:

Oversimplification: remove significant features, making the model inaccurate or inflexible

Kitchen-Sinkification: keep every possible feature, making the model impossible to solve (related to Immeasurability)

Overextension: using a model for a reality beyond its flexibility, or using a model beyond its purpose (related to Oversimplification)

Living in Math World: never testing the results of the model to see if they make sense

Immeasurability: include quantities that are impossible to measure to the accuracy needed