



NAUTILUS GEARS

ALWAYS MOVING • ALWAYS CHANGING • ALWAYS WORKING TOGETHER

MML ACCOLADES 2018 ARTIFACT

INTRODUCTION Mathematics is the language of science. It provides the structure by which we develop, understand, and communicate models of our complex world. Mathematical structures are emergent within nature and often perceived by humans as beautiful. For example, the logarithmic spiral is a self-similar spiral curve that is routinely observed in nature, including nautilus shells, hurricanes, spiral galaxies, sunflower heads, romanesco broccoli, and in the interception flight patterns of birds and insects. As a defining property, the shape remains identical with each successive curve even as the size of the spiral increases at a specific growth rate. In a golden spiral, this growth rate is equal to the golden ratio (ϕ). Mathematician Jacob Bernoulli was particularly enamored with the logarithmic spiral. One was to be engraved on his headstone along with the phrase "Eadem mutata resurgo" ("Although changed, I shall arise the same"). But mistakenly, an Archimedean spiral was engraved there instead.

ATTRIBUTION This year's MML Accolade Artifact was selected to represent the practical importance of mathematics in our achievements and in connecting our work within the MML community and beyond. The dual rotating nautilus gears symbolize that we are *Always Moving, Always Changing, and Always Working Together*.

PREPARATION & ANALYSIS The nautilus gears were generated by applying a cosine gear and pitch function along the curve of a logarithmic spiral using a growth rate of 1.17. The original closed complex function in Maple script is credited to Dr. Laczik Bálint and the original open source rendered stereolithography files are credited to designer Misha Tikh. Each Nautilus Gears Artifact was 3D printed by laser sintering a bed of PA2200 nylon powder in 120 micron thick layers. The density of the laser-sintered parts is 0.93 g/cm³. The color blue is associated with freedom, intuition, imagination, expansiveness, inspiration, trust, loyalty, sincerity, wisdom, confidence, and intelligence. The color white is associated with light, goodness, illumination, understanding, beginnings, possibility, humility, and sincerity. Each base was machined from southern yellow pine, hand burnished, and sealed by Matthew Staymates and Jessica Staymates.

DIMENSIONS (l x w x h) Gears: 93 mm x 47 mm x 9 mm | Base: 75 mm x 37 mm x 19 mm | $\sigma = \pm 0.5\text{mm}$

DESIGN TEAM JESSICA STAYMATES • MATTHEW STAYMATES • JOSHUA MARTIN • STACY SCHUUR
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