From toys, analog clocks and powered wheelchairs to lawn mowers, cars and rockets, gears and motors are part of many of the tools mechanical engineers create that make life safer and more convenient. This set of problems is adapted from MATHCOUNTS problems written in 2010 by the Association for Unmanned Vehicle Systems International Foundation (AUVSI) and explores how gears and motors work together in mechanical engineering projects.

2.1 Gears of different sizes are often described by the number of teeth around their circumference. A gear ratio, or the relationship between the numbers of teeth on 2 gears meshed together, is equal to the number of teeth on the gear on the output side divided by the number of teeth on the gear on the input side. When a series of gears forms a gear train, as shown, we multiply the gear ratios of each pair of meshed gears to calculate the gear train’s gear ratio. What is the gear ratio of the gear train at left if the input side is on the right? Express your answer as a common fraction.

2.2 A gear ratio also can represent the ratio of the diameters of the meshed gears, equal to the diameter of the output gear divided by the diameter of the input gear. If an output gear has a diameter of 56cm and Chantel needs a gear ratio of 7:3 for a pair of gears in a space shuttle she is helping to design, what must the diameter of the input gear be?

2.3 Gears can be used to increase or decrease the speed of a motor. The speed of an output gear is equal to the speed of the input gear multiplied by the reciprocal of the gear ratio. For the gear train shown below, a motor with a speed of 150 rpm is attached to the leftmost (input) gear. What is the speed of the final rightmost (output) gear?

Submit your answers to all 5 Problems of the Day on Friday, Feb. 21 at mathcounts.org/potw to earn certificates + entry into prize drawings!
When I was young...

“I was tinkering in my dad's shop at age five.”

Jack Shepard