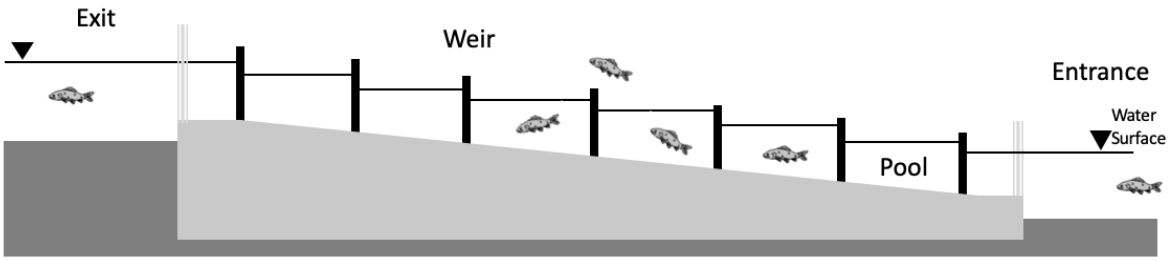
December Monthly Math Challenge
Middle School Level
Problem & Solution

Instructions: TEAMS coaches submit student answers to the question(s) below using the submission link on the TEAMS website. All submissions must be made during the month of December. Those submissions with correct answers will be entered into a drawing for a $25 Visa gift card, which will be sent to the student in care of the TEAMS coach.

Fish Passage Engineering

Fish passages are structures designed to help fish get past artificial and/or natural barriers present in waterways. Fish passages have been designed, constructed, and used across the nation where dams, locks, waterfalls, and other obstacles present in streams and river systems would otherwise prevent fish migration. Several different types of passage designs exist, including the common pool and weir design shown below. The pool and weir design incorporates several pools constructed in series that stimulates natural fish behavior to swim and/or jump upstream. By stepping up the water height incrementally in each pool, fish overcome the physical barrier that is adjacent to the passage.



Question 1

An individual pool within a proposed fish passage is specified with the following dimensions: Length (in m) = 4 times the maximum expected fish length, Width = 2.5 m, and Depth (in m) = 2 times the maximum expected fish length. If the maximum expected fish will be 150 cm long, the volume of an individual pool in gallons is

Solution

First determine the required pool length and convert the distance from cm to m

$$4\ x\ 150 = 600\ cm\ x\ \frac{1\ m}{100\ cm} = 6\ m$$

Next determine the required pool depth and convert the distance from cm to m

$$2\ x\ 150 = 300\ cm\ x\ \frac{1\ m}{100\ cm} = 3\ m$$

Next determine the pool volume

$$length\ x\ width\ x\ depth = 6\ m\ x\ 2.5\ m\ x\ 3\ m = 45\ m^3$$

Finally, convert from m^3 to gallons

$$45\ m^3\ x\ \frac{264.2\ gal}{1\ m^3} = 11{,}889\ gallons$$