§3.6: Another Look at Formula, Functions, and Problem Solving

Learning Objectives:
1. Create functions using relationships defined on the coordinate plane
2. Create functions using geometric relationships
3. Create functions by combining basic formulas

Functions and Relationships Defined on the Coordinate Plane

Example: A triangle is inscribed within one lobe of a cubic function as shown, with its base along the x-axis and its upper vertex on the graph of the cubic. If the cubic is defined by \( y = 16x - x^3 \),
a. Find a function of a single variable that models the area of all such triangles.
   What is the domain of this function?
b. Find the area if \( x = 2 \).

\[
A = \frac{1}{2} b \cdot h \\
A(x) = \frac{1}{2} (4)(16x - x^3) \quad 0 \leq x \leq 4 \\
0 < x < 4
\]
Functions and Geometric Relationships

Example: J.P. is attempting to figure out how much fuel remains in his underground storage tank during a ZA. Unfortunately, all he has on hand are a few yardsticks that he could duct tape together. If his homemade tank is a trapezoidal prism with the dimension shown,

a. Find a formula J.P. can use to convert the depth of the fuel (measured in inches $x$ using his yardstick) to volume $V(x)$ in gallons. (*Hint:* One gallon equals 231 cubic inches.)

b. Find the amount of fuel remaining when its depth is 1 ft.

c. If J.P.’s emergency generator uses 1 gal of fuel per hour, how long would his generator last with his current fuel supply?

$$A_T = \frac{1}{2} (b_1 + b_2) h$$
Create Functions by Combining Basic Functions

Example: The Texashellron Corporation is building a new pipeline to connect its refinery to an offshore drilling station located 10 mi from shore, 8 mi down the coast. If it costs $20,000/mi to lay the pipe underwater, but only $5,000/mi to lay the pipe underground,

a. Find a function that will model the total cost of the pipeline.

b. Find the cost of the pipeline if 6 mi of pipe are laid underground and the rest is laid underwater.

c. How far down the shore should the pipeline be built underground before turning offshore and placing the rest underwater?