

Burying Garbage

(adapted from Connected Mathematics)

A city with a population of 100,000 has just completed the construction of a new landfill for its garbage. The base of the hole measures 500 feet by 200 feet and is 75 feet deep. A family of four throws away an average of .4 cubic feet of compacted garbage a day. How long will it be before the city needs to construct a new landfill?

Be sure to show all your work and to explain your approach and reasoning.

Make a math representation and a math connection.

Use as much math language as possible.

Grade Level 6 – 8

Burying Garbage (*adapted from Connected Mathematics*)

A city with a population of 100,000 has just completed the construction of a new landfill for its garbage. The base of the hole measures 500 feet by 200 feet and is 75 feet deep. A family of four throws away an average of .4 cubic feet of compacted garbage a day. How long will it be before the city needs to construct a new landfill?

Be sure to show all your work and to explain your approach and reasoning.

Make a math representation and a math connection.

Use as much math language as possible.

Context

This task was given to students during a geometry unit on volume and surface area of prisms. Prior to being assigned this task, the students had “discovered” the formula for volume of a rectangular prism by constructing boxes out of centimeter graph paper and filling the boxes with centimeter cubes.

What This Task Accomplishes

This task was used as an assessment piece for a volume unit. It provided the students with a practical, real world application of the geometry they had been studying.

Time Required for Task

Most students completed the task within a 45 minute class period.

Interdisciplinary Links

Science

Students can conduct science investigations into finding the volume of differently shaped containers.

Social Studies

This problem also ties in with an American Studies environmental unit by initiating discussion about landfills, waste, and recycling.

Teaching Tips

To make this task more or less complicated you can adjust numbers presented in the task.

Suggested Materials

Calculators, paper

Possible Solutions

The landfill can hold 7,500,000 ft³ of compacted garbage. With 10,000 ft³ of garbage thrown out each day, the landfill will be filled to capacity in 750 days or in 2 years and 20 days.

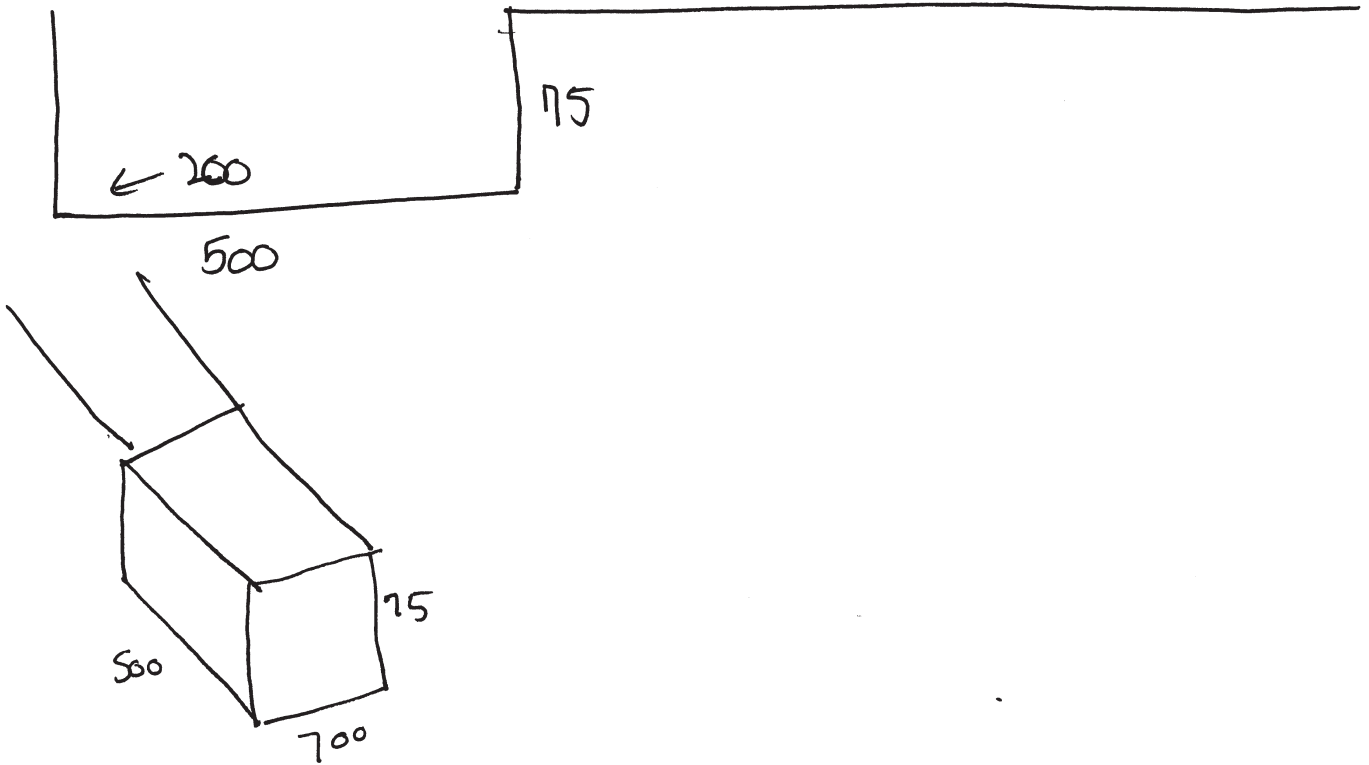
Benchmark Rubric

Novice	<ul style="list-style-type: none"> The novice recognizes the need for finding the volume of a rectangular prism, but is unable to work with the population factor. Some math language may be used, and rudimentary diagrams attempted.
Apprentice	<ul style="list-style-type: none"> The apprentice has an approach that works for solving part of the problem. The student correctly calculates the volume of the landfill and addresses the population numbers unsuccessfully. Some math language is used, but no math representations or connections are attempted.
Practitioner	<ul style="list-style-type: none"> The practitioner successfully calculates the volume of the landfill and the number of days until it is filled. The student explains the approach and reasoning used and all work is present. The student uses appropriate and accurate math language.
Expert	<ul style="list-style-type: none"> The expert successfully calculates the volume of the landfill and the number of days until it is filled. The student clearly explains the approach and reasoning used and makes a relevant math connection (i.e. converting 750 days to two years, 20 days or commenting on the need for recycling or a larger landfill). The expert uses appropriate and accurate math language and includes a representation to communicate an aspect of the solution.

Author

Nancy Harlow Pejouhy teaches 8th grade at Woodstock Union Middle School in Woodstock, Vermont. She is a math network leader for the Vermont Department of Education and serves on various state committees for math assessment.

Novice



I found the volume $500 \times 700 \times 75$ 10000 =

A. $7,500,000 \text{ ft}^3$

25,000

thru away 10,000 feet of garbage

? I could figure
but

Some math language
is used.

Diagrams are
attempted.

The student found the volume
of the landfill but was unable
to proceed from there.

Apprentice

① $l \times w \times h$

$200 \times 500 \times 75 = 7500000$
 $100,000 \div 4 = 25,000$ families
 of 4 trash per day do fill the dump
 $25,000 \times .04 = 1000$ of
 It will take 7500

Little math language is used.

An incorrect answer is achieved.

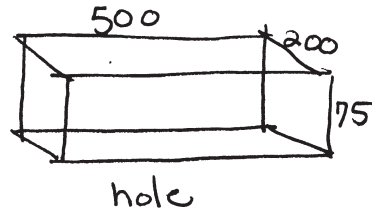
The student has an approach that works for finding the volume of the landfill and unsuccessfully attempts to address the population aspect.

Practitioner

1. 10,000 cubic feet a day

7,500,000 in hole

750 day it will take to fill up
2 years and 20 days



A. 7,500,000

$$100,000 \div 4 \times 4 = 10,000$$

garbage a day

the hole $500 \times 200 \times 75 = 7,500,000$ cubic feet.

B. It will take 750 days of 2 years 20 day to fill up the garbage pit.

$$7,500,000 \div 10,000 \text{ cubic feet of garbage a day} = 750 \text{ days.}$$

All work is shown and organized.

Correct answers are achieved for all parts of the problem.

Math language is used throughout.

Expert

Burying Garbage

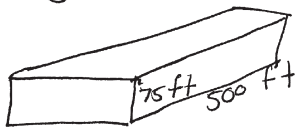
$$200 \text{ ft} \times 500 \text{ ft} \times 75 \text{ ft} = 7,500,000 \text{ ft}^3 \quad \text{Volume of pit}$$

$$(100,000 \div 4) \times .25 = 10,000 \text{ ft}^3 \quad \text{Volume of garbage thrown out each day}$$

$$7,500,000 \div 10,000 = 750 \text{ days}$$

First of all I calculated the volume of the pit (see drawing) I came up with $7,500,000 \text{ ft}^3$. Then since I knew that a family of four would throw away $.4 \text{ ft}^3$ of garbage per day (not all families how four people) then I assumed that four people would still throw out the same amount as a four person family. $100,000 \text{ people} \div 4 = 25,000 \text{ groups}$
 $25,000 \times .4 = 10,000 \text{ ft}^3 \text{ per day}$
 $7,500,000 \text{ ft}^3 \div 10,000 \text{ ft}^3 \text{ per day} = 750 \text{ days}$
 It would take 750 days or 2 years 20 days to fill the landfill.

In my experience this is rather inefficient so I think the landfill should be larger.



landfill

The student explains the approach and reasoning used.

Accurate math language is used throughout.

All work is shown.

The student makes a relevant observation.