

Practice Exam - 6 - C1 -

THE DIG

For centuries adventurers and archeologists have ventured into the rainforests of South America in search of rumored lost cities.

A recent expedition funded by the South American Museum of Natural History has revealed the location of a promising dig site. Artifacts beneath an ancient structure have been discovered. Nikola, an accountant, was hired to estimate the cost of the dig.

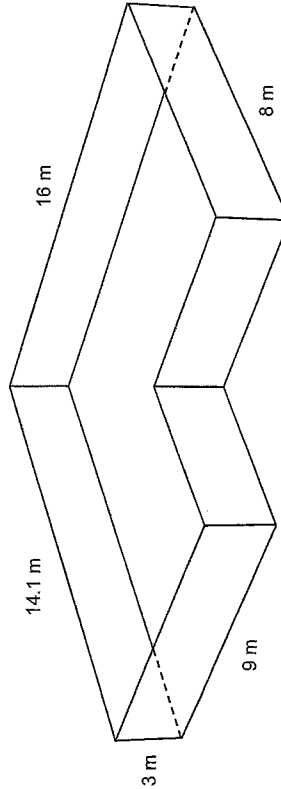
Nikola needs to determine the following: the excavation cost to dig up the pit, the cost for a tarp roof to cover the pit, the cost of the shellers to hold the artifacts, the costs to process the artifacts and the cost to hire the archeologists.

The museum has set a maximum budget of \$200 000 for this venture.

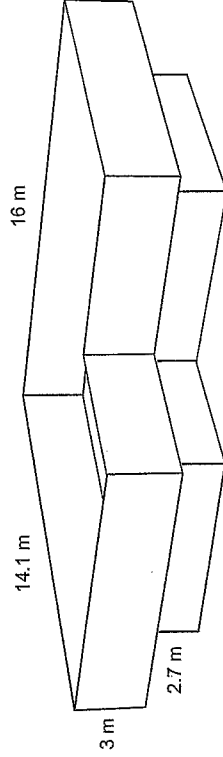
Will the excavation of this dig site be within the budget set by the museum?

Excavation

The first task is to excavate the site. The top layer of earth needs to be removed to create a pit. The first pit will be in the shape of an L-shaped prism, as shown below.



A smaller pit, similar to the first pit, will then be dug below it, creating two levels. The height of the smaller L-shaped prism will be 2.7 metres.



Cost of Excavation

A company will be hired to dig the pit and remove the earth. The cost of the excavation is determined by a linear function where the cost depends on the volume of earth that needs to be removed.

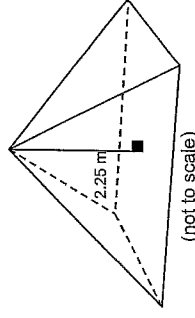
COST OF EXCAVATION IN RELATION TO THE VOLUME OF EARTH

Volume of Earth (m ³)	Cost (\$)
120	11 800
280	16 600

Tarp Roof

A tarp roof will be installed over the pit to protect it from the elements.

- It will be in the shape of a square-based right pyramid.
- The height of the pyramid will be 2.25 metres.
- It must overlap the pit by at least 2 metres on each side.
- The smallest possible tarp will be ordered.



The cost of the tarp is determined by the following function:

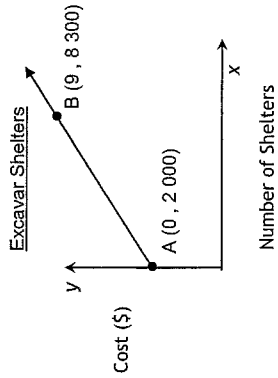
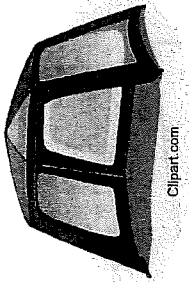
$$f(x) = 10.8x$$

where x : area of tarp in m²
and $f(x)$: cost in dollars.

Shelters for the Artifacts

Nikola asked two local companies, *AbriGo* and *Excavar*, for a quote on the cost of buying shelters.

The data relating the number shelters purchased and their cost for both companies is shown below.



AbriGo Shelters

Number of Shelters	Cost (\$)
2	4 300
6	5 900
12	8 300

In order to support both companies equally, Nikola orders the same number of shelters from both companies. He will also spend the same amount of money at each company.

Artifacts

The number of artifacts that may be discovered will determine cost of processing the artifacts and the number of archeologists needed for the dig.

Nikola consults the records of similar excavations done in nearby areas.

The data below are the number of artifacts discovered at 35 similar excavation sites, in ascending order.

100	120	245	270	300	330	400
420	440	460	550	590	600	615
620	620	655	700	750	780	800
830	840	850	900	900	920	1050
1050	1200	1200	1300	1400	1450	1450

Processing the Artifacts

Nikola needs to estimate that the number of artifacts found at this site and their processing costs.

- He will use the median number of artifacts from the 35 similar excavation sites.
- The site will most likely contain coins, fossils and ancient tools.

The number of fossils likely to be found is one hundred more than four times the number of tools. The number of coins is two hundred and fifty less than twice the number of fossils.

The cost to process all of these artifacts is shown in the table below.

Ancient Artifacts	Processing Cost per Item
Tools	\$80
Fossils	\$6
Coins	\$12

Archeologists

The hiring of archeologists will be based on the third quartile of the distribution of artifacts discovered at the 35 sites in case there are more artifacts than expected.

- Nikola would like to hire 1 archeologist for every 40 artifacts found.
 - The archeologists will be hired for five weeks.
- He has gathered information about the weekly salaries of archeologists according to their years of experience. The information is organized in the table below:

Years of experience	Weekly Salary (\$)
[0, 5 [600
[5, 10 [840
[10, 15 [1040
[15, 20 [1200
[20, 25 [1280

Nikola will use the table to determine the mean salary for an archeologist, and use this mean for his estimate.

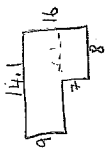
Will the excavation of this dig site be within the budget set by the museum?

Practice Exam-6-C1 Solution

The Dig

Show all your work.

Excavation

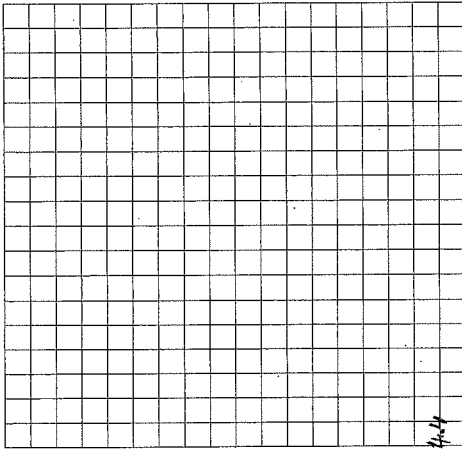


Big volume:
 $V = A_0h + A_1h$
 $= (14.1)(9)(3) + (7)(8)(3)$
 $= 380.7 + 168$
 $= 548.7 \text{ m}^3$

$K = \frac{2.7}{3} = 0.9$

Dimensions of smaller

$V = A_0h + A_1h$
 $= (12.69)(8)(2.7) + (7.2)(6.3)(2.7)$
 $= 277.53 + 122.472$
 $= 400.003 \text{ m}^3$



The use of the grid is optional

OR $K^3 = 0.729$
 $V_{\text{small}} = (548.7)(0.729)$
 $= 400.003 \text{ m}^3$

Total Volume to Excavate = $548.7 + 400.0023$
 $= 948.7023 \text{ m}^3$

Show all your work.

Cost of Excavation

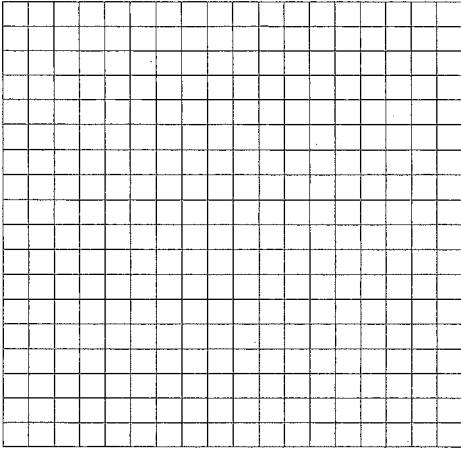
$a = \frac{16600 - 11800}{280 - 120}$
 $= 30$

$b = y_1 - ax_1$
 $= 11800 - (30)(120)$
 $= 8200$

$\therefore y = 30x + 8200$

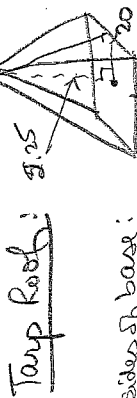
x: Volume y: cost.

$\therefore \text{Cost} : y = 30(948.7023) + 8200$
 $= 36661.069$



The use of the grid is optional

Show all your work.



sides of base:
 $16 + 2 + 2 = 20 \text{ m}$

$$S = \sqrt{\left(\frac{16}{2}\right)^2 + 7.25^2}$$

$$= \sqrt{10^2 + 2.25^2}$$

$$= \sqrt{105.0625}$$

$$= 10.25 \text{ m}$$

$$A_{\text{Lateral}} = \frac{p \cdot s}{2}$$

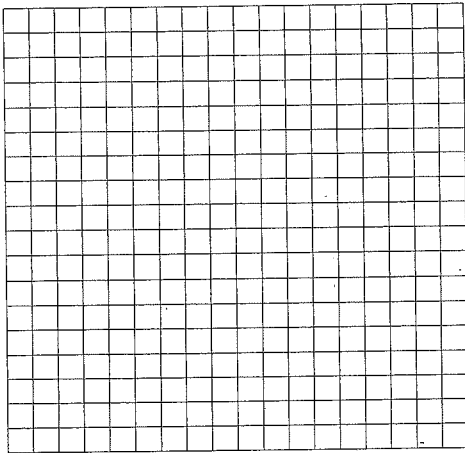
$$= \frac{4(20)(10.25)}{2}$$

$$= 410 \text{ m}^2$$

$$\text{Cost: } f(x) = (0.8)x$$

$$= 10.8(410)$$

$$= \$4,428$$



The use of the grid is optional

Show all your work.

Shelters:

$$\textcircled{1} a = \frac{8300 - 2000}{9 - 0} = 700$$

$$b = 2000$$

$$\therefore y_1 = 700x + 2000$$

$$\textcircled{2} a = \frac{5900 - 4300}{6 - 2} = 400$$

$$b = 4300 - 400(2)$$

$$= 3500$$

$$\therefore y_2 = 400x + 3500$$

$$y_1 = y_2$$

$$700x + 2000 = 400x + 3500$$

$$300x = 1500$$

$$x = 5$$

$$y_1 = 700(5) + 2000$$

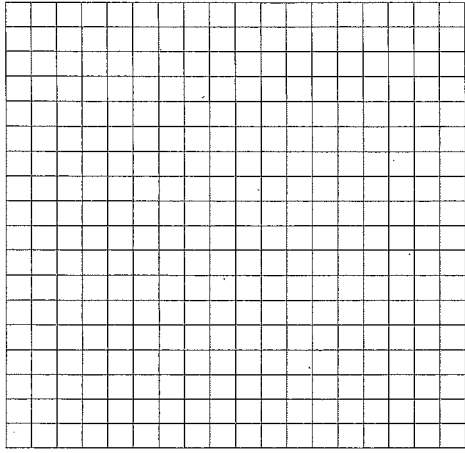
$$= 5500$$

$$y_2 = 400(5) + 3500$$

$$= 5500$$

$$\text{Total cost} = 11000$$

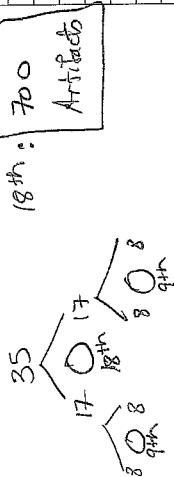
\therefore 5 shelters for \$11,000



The use of the grid is optional

Show all your work.

Artifacts:



Let tools = t

fossils = $100 + 4t$

Coins = $2(100 + 4t) - 250$
 $= 200 + 8t - 250$
 $= 8t - 50$

Total = $t + 100 + 4t + 8t - 50 = 700$

$13t + 50 = 700$

$13t = 650$

$t = 50$

cost

$\rightarrow 50(80) = 4000$

fossils = $100 + 4(50) = 300 \rightarrow 300(6) = 1800$

coins = $8(50) - 50 = 350 \rightarrow 350(12) = 4200$

Total cost = $4000 + 1800 + 4200$

$\boxed{\$10,000}$

The use of the grid is optional

Show all your work.

Archaeologists $\bar{x}_{years} = \frac{70600}{4960} = 14.23$

salary = 1040

OB = 920

frank: $\frac{920}{40} = 23 \times 5 weeks = 115$

total salary = $(1040)(23)(5)$
 $= 119,600$

Total Costs: $V = 948,702.3 m^3$

① Excavation	36,661
② Temp Rosh	4,428
③ Shelters	11,000
④ Processing	10,000

$\$ 62,089$
 200 Do.
 ex. 181,689
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The use of the grid is optional

Answer:

The excavation costs \$ 62,089

Yes, the project is within the budget set by the museum.

No, the project is not within the budget set by the museum.