

SOLUTIONS

Practice Exam 4B

Try taking this version of the practice exam under testing conditions: no book, no notes, no classmate's help, no electronics (computer, cell phone, television). Give yourself one hour to work and wait until you have tried your best on all of the problems before checking any answers.

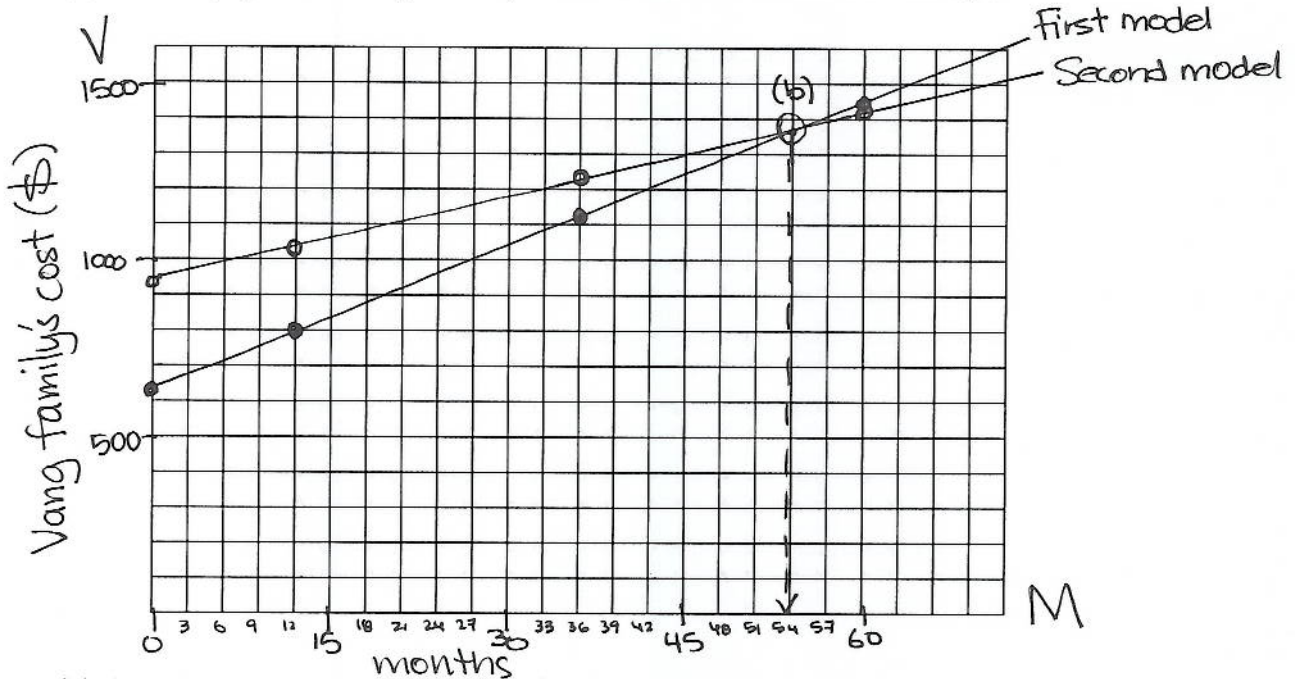
1. The Vang family want to buy a new washing machine. The first model costs \$645 and then \$13.29 per month to run or another, more efficient, model costs \$940 and then \$7.82 per month to run. If M is the number of months and V is the Vang family's total cost (in \$), then the equations and some comparable values (to the nearest \$) are:

First model: $V = 645 + 13.29M$

Second model: $V = 940 + 7.82M$

M	12	36	60
First model:	804.48	1,123.44	1,442.40
Second model:	1,033.84	1,221.52	1,409.20

- (a) Draw a graph illustrating both equations. Be sure to include the intercepts.



- (b) According to your graph, approximate what is the **payback time** (the number of months for which the total costs of each washing machine are equal)? Answer and indicate the point on the graph where you can check.

≈ 54 months payback time

The problem continues ...

- (c) Set up and solve a system of linear equations to find the payback time.

$$\begin{array}{r} 645 + 13.29M = 940 + 7.82M \\ -645 \qquad \qquad -645 \end{array}$$

$$\begin{array}{r} 13.29M = 295 + 7.82M \\ -7.82M \qquad \qquad -7.82M \end{array}$$

$$\begin{array}{r} 5.47M = 295 \\ \hline 5.47 \qquad \qquad 5.47 \end{array}$$

$$M = 53.93... \approx 54 \text{ months}$$

- (d) If the manufacturer offers a \$25 rebate on the more efficient model, how does that change the payback time? Adjust your equation and set up and solve a new system. OR carefully explain some other way of figuring it out.

$$940 - 25 = 915$$

$$\begin{array}{r} 645 + 13.29M = 915 + 7.82M \\ -645 \qquad \qquad -645 \end{array}$$

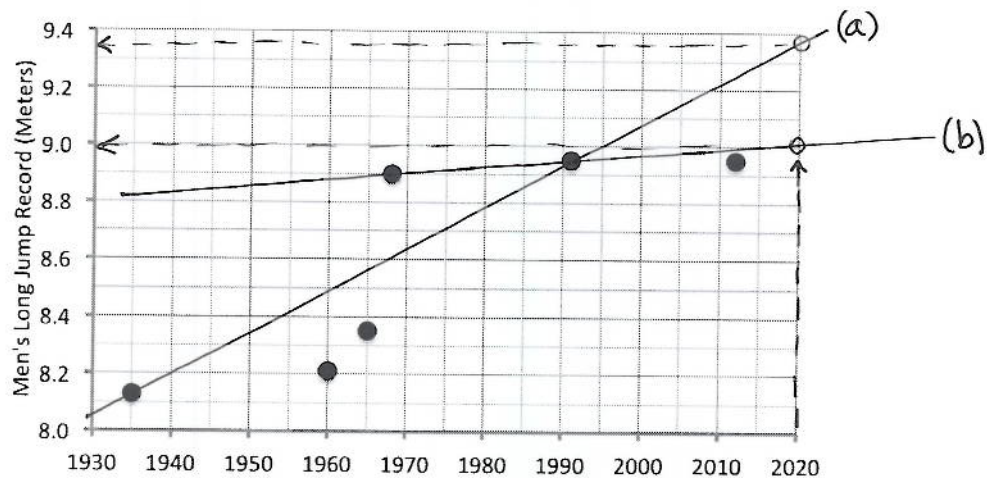
$$\begin{array}{r} 13.29M = 270 + 7.82M \\ -7.82M \qquad \qquad -7.82M \end{array}$$

$$\begin{array}{r} 5.47M = 270 \\ \hline 5.47 \qquad \qquad 5.47 \end{array}$$

$$M = 49.36... \approx 50 \text{ months}$$

⇒ shortens payback time by 4 months

2. It's been a long time since anyone broke the record for the men's long jump. In 1935 Jesse Owens jumped 8.13 meters. The record was next broken 25 years later (in 1960) by Ralph Boston who jumped 8.21 meters. He broke his own record several times over the next few years, including being surpassed briefly by Igor Ter-Ovanesyan. Ralph's final record was 8.35 meters in 1965. Not to be outdone, Igor tied the record in 1967. Then in 1968, Bob Beamon jumped 8.90 meters. That record held for 23 years, until Mike Powell jumped 8.95 meters in 1991 (much to Carl Lewis' dismay). Powell's record still stands 21 years later, in 2012. Source: Wikipedia (Long Jump)



- (a) Draw in the line connecting the data from 1935 and 1991. Use it to predict the long jump record in 2020.

≈ 9.37 meters

- (b) Draw in the line connecting the data from 1968 and 1991. Use it to predict the long jump record in 2020.

≈ 9.00 meters

- (c) Which of your lines do you prefer, and why?

Line (a) is better because line (b) is too flat.

3. Arjun just graduated from college but is living with his uncle for the summer to save money. They agreed that Arjun would do chores and some light renovations instead of paying rent. Arjun has been doing around 5 hours of work a week for the past 8 weeks, but still owes his uncle another 30 hours of work.
- (a) What was the original agreement? That means, how many hours of work did Arjun promise his uncle?

$$\begin{array}{ccccccc}
 30 & + & 5 \times 8 & = & \boxed{70 \text{ hours}} \\
 \uparrow & & \uparrow & & \uparrow \\
 \text{still} & & \text{did so} & & \text{originally} \\
 \text{owes} & & \text{far} & & \text{owed}
 \end{array}$$

- (b) Name the variables and write an equation relating them, assuming Arjun continues to do 5 hours a week of work.

H = amount of work Arjun owes his uncle (hours) ~ dep

W = time since their agreement (weeks) ~ indep

$$\boxed{H = 70 - 5W}$$

$$\text{Check: } 70 - 5 \times 8 = 30 \checkmark$$

- (c) How many more weeks will it take Arjun to finish the work he promised? Show how to solve the equation.

↪ owes 0 hours

$$\begin{array}{rcl}
 \cancel{70} - 5W & = & 0 \\
 -\cancel{70} & & -70
 \end{array}$$

$$\begin{array}{rcl}
 -\cancel{5}W & = & -70 \\
 \hline
 & & -5
 \end{array}$$

$W = 14$ weeks since the original agreement

- 8 weeks already worked

$$= \boxed{6 \text{ weeks to go}}$$

4. The local zoning commission is considering a plan to expand housing in the city, as measured in the number of residential units. But with more residential units come more shops, offices, schools, recreational facilities, churches, and other commercial property. Currently the city has 3,500 residential units and 1,575 acres of commercial property. If the proposal is passed and completed, the city will have a new total of 3,600 residential units and 1,620 acres of commercial property. You can assume this increase is linear.

- (a) Name the variables and summarize the given information in a table.

R = amount of residential housing (res. units) ~ indep
 C = amount of commercial property (acres) ~ dep

R	C
3,500	1,575
3,600	1,620

- (b) How many new acres of commercial property are there for each new residential unit built?

$$\text{slope} = \frac{1620 - 1575}{3600 - 3500} = (1620 - 1575) \div (3600 - 3500) = \boxed{.45 \text{ acres per res. unit}}$$

- (c) Write an equation relating the variables. Hint: first find the intercept.

$$\text{intercept} = 1575 - .45 \times 3500 = 0$$

direct proportion!?

$$.45 \times 3600 = 1620 \checkmark$$

$$\boxed{C = .45 R}$$

- (d) If the city decides to limit the amount of land to 1,600 acres of commercial property, approximately how many residential units can there be? Use successive approximation, displaying your guesses in a table.

R	3,500	3,600	3,550	3,560	3,555
C	1,575 LOW	1,620 HIGH	1,597.5 LOW	1,602 HIGH	1,599.75 OK

$\approx 3,555$
res. units

- (e) Now answer the question by setting up and solving an inequality.

$$\begin{array}{r} .45R \leq 1600 \\ \hline .45 \quad .45 \end{array}$$

$$R \leq 3555.55 \Rightarrow \boxed{\approx 3,555 \text{ res. units}}$$