

Which Is the Best Method?

Using Graphing, Substitution, and Linear Combinations

LEARNING GOALS

In this lesson you will:

- Use various methods of solving systems of linear equations to determine the better paying job.
- Use various methods of solving systems of linear equations to determine the better buy.

Successful businesses spend and earn large amounts of money. But how do they know what to spend their money on and how much money to spend? Often, these decisions are made by financial analysts. These professionals analyze financial records of the business and use them to help decide what financial decisions should be made. These financial records may include past performance of the company as well as comparisons between their company and other similar companies. The analysts may also try to predict future performance of the company using extrapolation. This analysis is then used to make decisions such as continuing or discontinuing a main part of the business, making or purchasing materials, or deciding whether to invest or lend any of their earnings. Of course, a financial analyst's goal is always to help the company make money, pay off any debts, and ensure the company remains stable for the long run.

What sort of pressures do you think financial analysts face day to day at their job? What mathematical knowledge might they need to know to make informed decisions? Is this a job you think you might be good at? Why or why not?

PROBLEM 1 Savin' on Cruisin'



The Bici Bicycle Company is planning to make a low price ultra-light bicycle. There are two different plans being considered for building this bicycle. The first plan includes a cost of \$125,000 to design and build a prototype bicycle. The materials and labor costs for each bike made under the first plan will be \$225. The second plan includes a cost of \$100,000 to design and build the prototype. The materials and labor costs for each bike made under the second plan will be \$275.



You recently got a job at Bici Bicycle Company as a financial analyst. You have been asked to analyze the costs for each proposed bicycle prototype and determine which plan Bici should follow. Use any method to determine your response.

Total Cost = design cost + materials and labor cost \times number of bikes built

$$1^{\text{st}} \text{ plan : total cost} = 125,000 + 225 \cdot b$$

$$2^{\text{nd}} \text{ plan : total cost} = 100,000 + 275 \cdot b$$

$$\begin{cases} y = 125,000 + 225x \\ y = 100,000 + 275x \end{cases}$$

$$\begin{array}{r} 125,000 + 225x = 100,000 + 275x \\ -100,000 \qquad \qquad -100,000 \\ \hline \end{array}$$

$$\begin{array}{r} 25,000 + 225x = 275x \\ -225x \qquad \qquad -225x \\ \hline \end{array}$$

$$\begin{array}{r} 25,000 = 50x \\ \underline{50} \qquad \qquad \underline{50} \\ \hline \end{array}$$

$$x = 500$$

$$y = 125,000 + 225x$$

$$y = 125,000 + 225(500)$$

$$y = 125,000 + 112,500$$

$$y = 237,500$$

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If the Bici Bicycle Company sells 500 bicycles, then it doesn't matter which option they use because making 500 bicycles will cost \$237,500 under both option one and two. However, if Bici plans to sell less than 500, then they should go with option 2 with the cheaper design costs. If they plan on selling more than 500 bicycles, then they should go with option 1 with the lower materials and labor costs.

If	$x < 500$, option 2
If	$x > 500$, option 1
If	$x = 500$, either

PROBLEM 2 We Offer Free Calls and Super Low Prices on Texts!



Demetrius is in search of a new cell phone plan. He is considering two different cell services from two different providers.

Bouncing Cell Service offers a monthly fee of \$99.99 and 200 free text messages per month. Once a user exceeds the free monthly number of text messages, each subsequent text message is \$0.05 per text. Rolling Cell Service offers a monthly fee of \$79.99 and 150 free text messages per month. Once a user exceeds the free monthly number of text messages, each subsequent text message is \$0.08 per text. Demetrius is unsure which plan to choose. He wasn't very careful with his last contract and paid a lot of extra money in charges for texts.



Write an email to advise Demetrius which plan to choose. Use any method to determine your response.

$$\text{Bouncing Cell Service: Monthly Cost} = 99.99 + 0.05(x - 200)$$

$$\text{Rolling Cell Service: Monthly Cost} = 79.99 + 0.08(x - 150)$$

$$\begin{cases} y = 99.99 + 0.05(x - 200) \\ y = 79.99 + 0.08(x - 150) \end{cases}$$

$$99.99 + 0.05(x - 200) = 79.99 + 0.08(x - 150) \quad \text{distribute}$$

$$99.99 + 0.05x - 10 = 79.99 + 0.08x - 12 \quad \text{combine like terms}$$

$$89.99 + 0.05x = 67.99 + 0.08x \quad \text{solve for } x$$

$$22.00 + 0.05x = 0.08x$$

$$\frac{22}{0.03} = \frac{0.03x}{0.03}$$

$$x = 733.\bar{3}$$

$$y = 99.99 + 0.05(733.\bar{3} - 200)$$

$$y = 126.66$$

Demetrius, if you send more than 733 texts per month, then you should go for the Bouncing Cell Service with the higher monthly fee but lower cost per text. If you send less than 733 text each month, then you should use Rolling Cell Service with the lower monthly fee and higher price per text.

PROBLEM 3

I've Got a Knack for Sales, But Which Company Should I Choose?



Jose interviewed for two different sales positions at competing companies. Reliable Robotics has offered Jose a salary of \$31,200 per year, plus a 9% commission on the total sales he makes per week. Robot Renegades will offer him \$26,000 per year, plus a 15% commission on the total sales per week.

Jose isn't sure which offer to accept. He's great at making a sale, but he's just not sure which job will be better in terms of his pay. He is confident that he can make \$2000 worth of sales each week.

Write an email to Jose with your recommendation of which job offers better compensation. Use any method to determine your response.

Reliable Robotics: Monthly Salary = $\frac{31,200}{12} + 0.09(\text{monthly sales})$

Robot Renegades: Monthly Salary = $\frac{26,000}{12} + 0.15(\text{monthly sales})$

$$\begin{cases} y = 2600 + 0.09x \\ y = 2166.66 + 0.15x \end{cases}$$

$$\begin{array}{r} 2600 + 0.09x = 2166.66 + 0.15x \\ -2166.66 \quad -2166.66 \end{array}$$

$$\begin{array}{r} 433.33 + 0.09x = 0.15x \\ -0.09x \quad -0.09x \end{array}$$

$$\frac{433.33}{0.06} = \frac{0.06x}{0.06}$$

$$x = 7222.22$$

$$\begin{array}{l} y = 2600 + 0.09x \\ y = 2600 + 0.09(7222.22) \end{array}$$

$$y = 3250$$

$$(7222.22, 3250)$$

* Jose would need to sell \$722.22 worth of equipment each month, in order for both jobs to pay the same monthly salary of \$3,250

Since Jose is confident that he can sell \$2,000 worth of sales each week, that means he can sell \$8,000 worth of sales each month. Since the break-even point is at \$7,222.22 worth of sales each month, Jose should choose Robot Renegades that offers the lower salary but higher commission.



Be prepared to share your solutions and methods.