# Appendix IV A Lesson Example: Linear function Topic Study: Select Options

00:02 Teacher: Hello! Class begins. In the last lesson, we learned the linear function. Do you remember its expression?

00:20 Students: (Answer together) y = kx + b.

00:28 Teacher: What do k and b mean here?

00:36 Students: (Answer together) Slope, intercept.

00:50 Teacher: Very good. This lesson is a topic-learning lesson. Today, we will learn how to apply linear functions to choose the lowest-cost production method. Please look at this situation.

01:20 Teacher: (Show the PowerPoint slide) In real life, enterprises often face multiple production methods, and the production cost of each method may be linearly related to the output. Our task is to find the lowest-cost production method among the two options based on the given cost data. In this situation, can we use the linear function model?

03:20 Student A: I think so. We can let variable y represent the cost and let variable x represent the output.

03:48 Teacher: Now, our problem becomes: How do we find the lowest cost of these two production methods? This is the problem we are going to solve today.

06:07 Teacher: (Show the PowerPoint slide, showing the cost data table of the two production methods at different outputs) Dear all of you, this is the production cost data provided to us by the two suppliers. You can see that for different outputs, each production method has a corresponding cost. Our task is to find the production method with the lowest cost based on these data.

08:10 (Students look at the data table carefully)

10:04 Teacher: What have you learned from the table?

10:15 Student B: These data do look very regular and can be fitted according to the linear relationship we learned before.

10:33 Teacher: Great observation! Indeed, we can assume that there is a linear relationship between production cost (y) and output (x), so how can we express it using the knowledge of linear function we have learned?

11:19 Student B: y = kx + b. Among them, k is the slope, representing the cost per unit of output; b is the intercept, which may represent fixed cost or startup cost.

11:50 Teacher: How do we determine the value of k and b?

12:08 Student C: We can use some of the data provided and calculate k and b.

13:02 Teacher: Okay. Then let’s follow this student’s idea and draw the points together.

13:21 (Student draw the points in the previously distributed learning sheets)

18:12 Teacher: Let’s take a look at the drawing of student D (show the drawing of student D to the whole class with a projector).

18:51 Teacher: Is your drawing the same?

18:53 Students: (answer together) Yes.

18:59 Teacher: I see that the two straight lines drawn by Student D have an intersection, so how should we choose the production method?

19:30 Student D: If the two straight lines have an intersection, then at this intersection, the costs of the two production methods are equal. On the left side of the intersection, the cost of one production method is lower; on the right side of the intersection, the cost of the other production method is lower. Therefore, we can choose the appropriate production method based on the expected output.

20:11 Teacher: What if we are not sure what the output will be?

20:19 Student E: You can make a rough estimate based on historical data.

20:54 Student F: You can make an estimate based on factors such as market demand and production capacity.

21:33 Student G: This company can adopt a flexible production strategy, such as cooperating with two suppliers at the same time and flexibly adjusting the production ratio according to market demand.

22:11 (Student nods to show understanding)

22:19 Teacher: Sounds like a good idea. (Show the cost data table of the two production methods at different outputs on the screen again) Now, we will divide into groups to solve the model.. Each group needs to use the linear function y = kx + b to fit the cost function of the two production methods based on these data.

23:49 (Students discuss in groups to solve k and b for two linear functions)

26:30 Teacher: (Walk to the group where Student C is) Your graphing looks good. Have you calculated two linear functions?

27:01 Student C: Yes. The first function is y=0.81x+355, and the second function is y=0.90x+304.

27:41 Teacher: Did other groups get this answer?

27:46 Students: (Answer together) Yes.

27:51 Teacher: Very good. We have practiced solving linear functions again. So, have you come to any conclusions?

28:10 Student H: Our group found that when the output is low, the second production method has lower costs; and when the output is high, the first production method has lower costs.

28:59 Teacher: Very good! So, how do we determine which production method has the lowest cost?

29:17 Student I: We can calculate the point where the costs of the two production methods are equal, that is, their intersection. On the left side of this point, choose the second production method; on the right side of this point, choose the first production method.

29:50 Teacher: Very good! Then we can record this conclusion in the learning sheet.

29:55 (Students organise the results)

30:10 Teacher: Dear all of you, now we have successfully calculated the cost functions of the two production methods and compared their cost differences. However, in practical applications, we may need to consider more factors. Next, let’s discuss the following situations together. (Show the PowerPoint slide)

(1. If the price of raw materials rises, the production cost will also increase accordingly. Which option should be chosen at this time?

2. As the service life of the equipment increases, the fixed costs of depreciation and maintenance will also increase accordingly. Which option should be chosen at this time?)

30:29 (Students discuss in groups)

31:28 Student G: In the first case, if the price of raw materials rises, the cost per unit of output will also increase, that is, the slope k will become larger, and we need to adjust the high function y = kx + b.

32:10 Teacher: Very good! You mentioned adjusting the slope k to reflect changes in raw material prices. So, what does the intercept b represent? Will it also be affected by raw material prices?

32:39 Student G: The intercept b represents fixed costs and will not be affected by fluctuations in raw material prices. Therefore, when raw material prices change, we only need to adjust the slope k.

32:52 Teacher: Very accurate! So for the second case, how should we choose?

33:48 Student J: We can add depreciation and maintenance costs to the model as a constant, such as adding a “c”. y=kx+b+c.

34:40 Teacher: Your group proposed a very creative idea. Do other students have any additions?

35:17 Student G: You can write b+c as a “b’”.

35:40 Teacher: In fact, it can be written as “b”. As an algebra, “b” can represent any number, and there is no need to introduce a symbol to distinguish it. So, does the slope k need to be adjusted?

36:11 Students: (Answer together) No.

36:20 Teacher: Depreciation and maintenance costs are fixed and have nothing to do with output. They will not affect the slope k, so the slope k does not need to be adjusted.

37:30 Teacher: Today, we learned how to use the knowledge of linear functions we have learned to choose the production method with the lowest cost, and discussed how to adjust the model according to specific circumstances. I hope everyone can use it flexibly in real life.

38:49 (Teacher assigns homework)

39:58 (Class over).