

M102: Modeling with Linear Functions and Equations

Pre-Badge Task

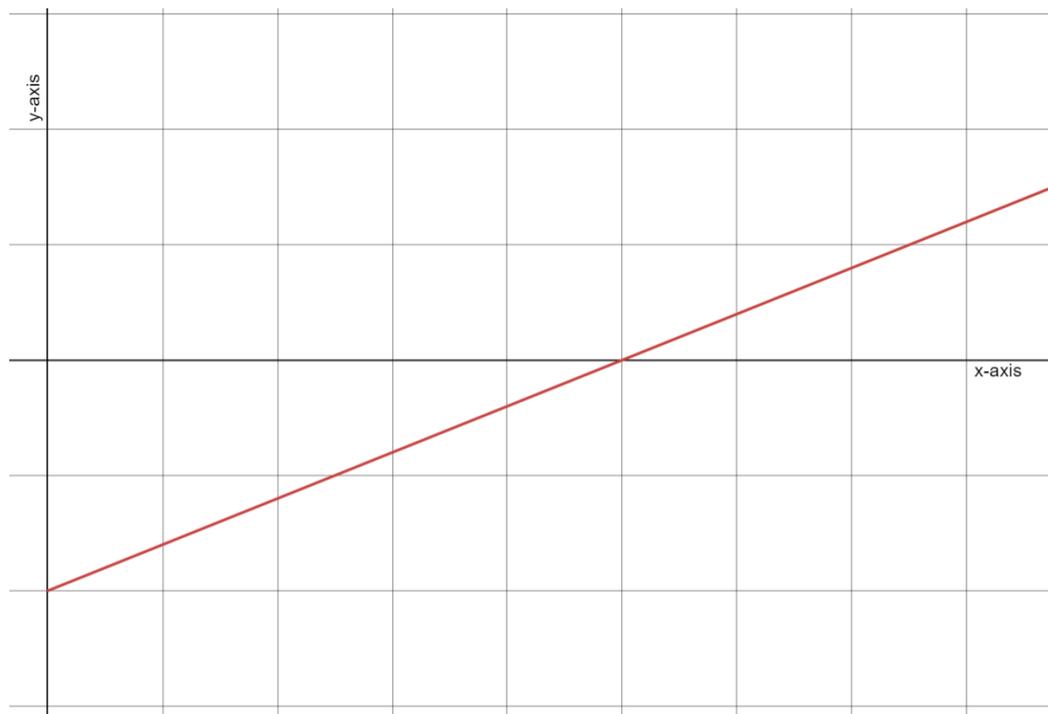
Teacher Scoring Guide

New Badge Alert!

This task will provide a preview of what we will be learning during the M102 - Modeling with Linear Functions and Equations Badge. You already know so much math, so use this task to share any understanding that you have before we start our learning. You will have a chance to do the same task at the end of the badge to see how your thinking has evolved.

The Task

Use the graph below to answer the questions that follow.



The following pages include sample student responses in **blue font**, as well as additional scoring comments in **red font**.

QUESTION 1 Describe at least three things that you know or notice about this graph.



Answers will vary. Possible student responses:

1. A line crosses the x - and y -axes.
2. The axes are not labeled, so I don't know the size of the unit
3. The slope of the line is positive.
4. The graphed line appears to intersect the y -axis at -2 units.
5. The graphed line appears to intersect the x -axis at 5 units.

Students can respond with any 3 observations here. Just look for logical observations. They don't need to be related to linear observations at this point.

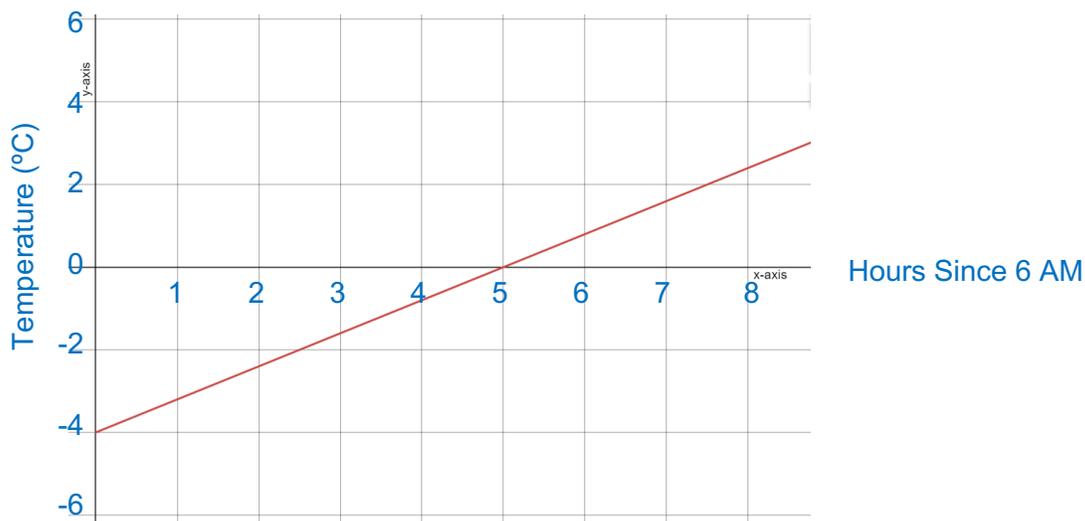
QUESTION 2

- a. What real-world situation could this graph represent?
- b. Based on the situation, describe what the variables x and y represent.
- c. Based on the situation, create labels and a scale for the graph.

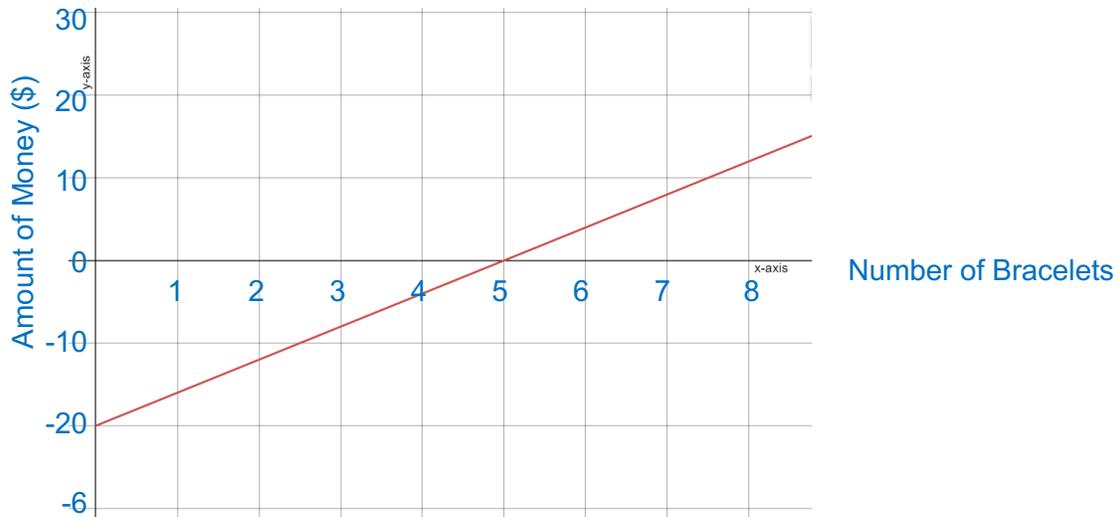


Answers will vary. Look for the labeling of the graph to show a consistent scale as well as descriptive names of the x - and y -axes. Possible student responses:

- a. The temperature from the time I woke up at 6 am until the time school was over.
- b. The x -variable represents the time in hours since I woke up at 6 am, and y -variable represents the temperature in degrees, Celsius.
- c. See labels below.



- The number of bracelets I sold at a craft fair and the amount of money I earned from those bracelets.
- The x-variable represents the number of bracelets I sold, and the y-variable represents amount of money I made selling those bracelets.
- See labels below.



QUESTION 3

- What are the coordinates of the x-intercept? What does this point mean in this situation?
- What are the coordinates of the y-intercept? What does this point mean in this situation?



Answers will vary. Students need to be able to link the intercepts on their graph to the situation they described in Question 2. Possible student responses:

- The x-intercept is (5, 0). It means that 5 hours after I woke up (at 11 am), the temperature reached 0 degrees Celsius.
 - The y-intercept is (0, -4). It means that the temperature was -4 degrees Celsius when I woke up at 6 am.
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- The x-intercept is (5, 0). It means that I had to sell 5 bracelets before I broke even and was able to start earning money beyond my initial costs.
 - The y-intercept is (0, -20). It means that I started with a cost of \$20 to make the bracelets. I needed to spend \$20, therefore negative profit, to buy supplies.

QUESTION 4 Write an equation that represents the relationship between the variables.



The variables the student uses and the scale the student defines in Question 2 needs to be reflected in their equation here. Possible student responses:

$$y = \frac{4}{5}x - 4 \quad \text{or} \quad y = 0.8x - 4 \quad \text{or} \quad 4x - 5y = 20$$

[This equation has a slope of $\frac{4}{5}$ and y-intercept of -4 because each unit on the y-axis is 2°C. If the student chooses a scale of 1 unit for each square on the coordinate grid, then the equation would be $y = \frac{2}{5}x - 2$ or its equivalent.]

$$y = 4x - 20 \quad \text{or} \quad 4x - y = 20$$

[This equation has a slope of 4 and y-intercept of -20 because each unit on the y-axis is \$20.]

QUESTION 5 What are the coordinates of one other point on the line? What does this point mean in this situation?



Again, make sure the point referenced here aligns to the situation and scale chosen by the student in Question 2. Possible student responses:

Another point would be (7.5, 2). This point means that 7.5 hours after I woke up (at 1:30 pm), the temperature was 2 degrees Celsius.

Another point would be (8, 12). This point means that when I've sold 8 bracelets, I made \$12 in profit.

QUESTION 6 Why is a line the best way to graphically represent the relationship between variables?



*The student's response needs to be consistent with their answer to Question 2.
Possible student responses:*

The line shows how the temperature rises as time elapses. Since time and temperature are continuous, a line is the best way to represent that relationship.

A line would not be the best way to show this relationship if the rise in temperature wasn't constant (4 degrees every 5 hours). But for my example, the rise in temperature was constant.

The line shows the amount I make for the number of bracelets I sell. Since the relationship is that I make \$4 for each bracelet, a line is best to represent this linear relationship.