LESSON MAKER PRO

Start and Change

Use linear models to describe what changes and what stays at the start.

GRADE 8 · 8A.DSP.A.36

8A.DSP.A.36 "Use a linear model of a real-world situation to solve problems and make predictions. a. Describe the rate of change and y-intercept in the context of a problem using a linear model of a real-world situation."

NAME _____ DATE _____

READ THE MODEL

In a linear model y = mx + b, m tells you how much y changes each time x increases by 1. The value b is y when x is 0, so it tells you the starting amount. To make a prediction, replace x with the value you want to test.

WORKED EXAMPLE

A reader has finished 17 pages and reads 9 more pages each day. Let x be the number of days and y be the total pages finished. Predict the total after 6 days.

1. Write the model: y = 9x + 17.
2. Replace x with 6: y = 9(6) + 17.
3. Calculate: y = 54 + 17 = 71.

Answer: After 6 days, the reader has finished 71 pages.

PRACTICE 6 problems

1 A sports equipment rental costs y = 3x + 8 dollars for x hours. What is the cost per hour? What is the starting fee?

ANSWER _____

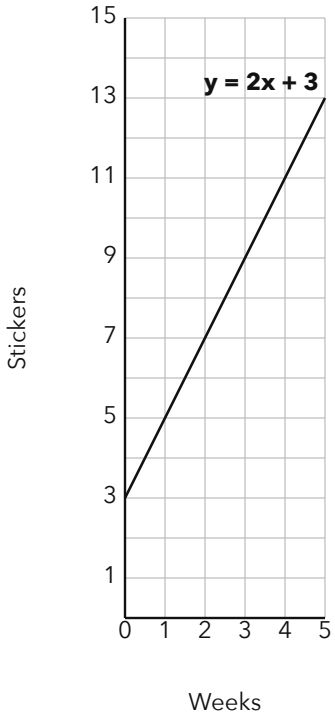
2 A phone's battery level is modeled by y = 25 - 2x, where x is hours since it was charged and y is the percent remaining. Describe the rate of change and the starting battery level.

ANSWER _____

3 A club's earnings are modeled by y = 5x + 12 dollars, where x is the number of items sold. Predict its earnings after selling 4 items.

ANSWER _____

4 The graph models the total number of stickers in a collection after x weeks. How many stickers are added each week? How many were in the collection at the start?



ANSWER _____

5 The table shows a linear model for the cost y, in dollars, of using a recording studio for x hours. Write the equation. Then find the cost for 5 hours.

RECORDING STUDIO COST

Hours, x	Cost, y ($)
0	11
2	19
4	27

ANSWER _____

6 The water in a tank is modeled by y = 40 - 5x, where x is minutes and y is gallons remaining. How much water remains after 3 minutes? What does the rate of change mean?

ANSWER _____

APPLY IT Show your work

1 A school club orders custom water bottles. The printer charges a $48 setup fee plus $7 per bottle. Let x be the number of bottles and y be the total cost in dollars. Write a linear model, explain what its rate and starting value mean, and predict the cost of 10 bottles.

WORK SPACE

ANSWER _____

2 A game download has 84 MB left at the start. Each minute, 12 MB downloads. Let x be the number of minutes and y be the MB left. Write a linear model, explain its rate and starting value, and predict how much is left after 5 minutes. If the rate stays the same, when will the download finish?

WORK SPACE

ANSWER _____

CHALLENGE One step up

The table shows donations during a gaming stream. Assume the total follows a linear model, where x is hours since the stream began and y is total dollars donated. Find the hourly rate, the amount donated when the stream began, and the predicted total at hour 8. Explain how you found the starting amount.

GAMING STREAM DONATIONS

Hours, x	Donations, y ($)
2	22
5	34

WORK SPACE AND ANSWER

ANSWER KEY

Start and Change

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A sports equipment rental costs y = 3x + 8 dollars for x hours. What is the cost per hour? What is the starting fee?	**$3 per hour; $8 starting fee**
2	A phone's battery level is modeled by y = 25 - 2x, where x is hours since it was charged and y is the percent remaining. Describe the rate of change and the starting battery level.	**The battery level drops by 2 percentage points per hour; it starts at 25%.**
3	A club's earnings are modeled by y = 5x + 12 dollars, where x is the number of items sold. Predict its earnings after selling 4 items.	**$32**
4	The graph models the total number of stickers in a collection after x weeks. How many stickers are added each week? How many were in the collection at the start?	**2 stickers per week; 3 stickers at the start**
5	The table shows a linear model for the cost y, in dollars, of using a recording studio for x hours. Write the equation. Then find the cost for 5 hours.	**y = 4x + 11; $31 for 5 hours**
6	The water in a tank is modeled by y = 40 - 5x, where x is minutes and y is gallons remaining. How much water remains after 3 minutes? What does the rate of change mean?	**25 gallons; the tank loses 5 gallons per minute.**

PART 2 · APPLY IT

1. **y = 7x + 48. The cost rises $7 per bottle, and the $48 starting value is the setup fee. Ten bottles cost $118.** Add the setup fee to the per-bottle cost: y = 7x + 48. Substitute x = 10 to get y = 118.
2. **y = 84 - 12x. The amount left drops by 12 MB per minute, and 84 MB was left at the start. After 5 minutes, 24 MB is left; the download finishes after 7 minutes.** Subtract 12 MB for each minute: y = 84 - 12x. At x = 5, y = 24; set y = 0 to find x = 7.

CHALLENGE

$4 per hour; $14 at the start; $46 at hour 8. Donations rise $12 over 3 hours, so the rate is $4 per hour. At hour 2, the total is $22, so subtract 2($4) to find the $14 starting amount.

Accept equivalent descriptions of a negative rate, such as 'decreases by 2 percentage points per hour.' In the challenge, students may also find the starting amount by extending the pattern backward.