

KEY POINTS

Section 5.5 Modeling with Linear Functions and Equations

- Writing linear functions
- Recognizing linear functions
- Using linear functions to make predictions
- Constraint Equations

Background

Section 5.5 Modeling with Linear Functions and Equations

We have seen that linear functions model situation in which one quantity is varying at a constant rate of change with respect to another.

When we are working with real-world situations, we have to find out if the situation is actually modeling a linear function, but how do we do that?

Example

Section 5.5 Modeling with Linear Functions and Equations

The question is how do we decide whether a linear function models the data that we are given?

d , depth (m)	150	175	200	225	250	275	300
H , temp (C)	5.50	5.75	6.00	6.25	6.50	6.75	7.00

How do you think we can determine if this is a linear function?

rate of change
graph the table
find an equation

Example

Section 5.5 Modeling with Linear Functions and Equations

Is the temperature data in the table linear with respect to depth? If so find a formula for temperature H , as a function of depth, d , for depth ranging between 150 m to 300 m.

d , depth (m)	150	175	200	225	250	275	300
H , temp ($^{\circ}\text{C}$)	5.50	5.75	6.00	6.25	6.50	6.75	7.00

$$\frac{\Delta y}{\Delta x} = \frac{.25}{25}$$

$$\frac{\Delta y}{\Delta x} = .01$$

$$H(d) = 5.50 + .01(x - 150)$$

$$= 5.50 + .01x - 1.5$$

$$H(d) = 4 + .01x$$

Background

Section 5.5 Modeling with Linear Functions and Equations

There is a simple rule that we can follow that will help us to determine if the information we are dealing with is a linear function or not.

RECOGNIZING VALUES OF A LINEAR FUNCTION

Values of x and y in a table could be values of a linear function $f(x) = mx + b$ if the same change in x -values always produce the same change in the y -values.

Example

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Modeling with Linear Functions and Equations

$$\frac{10}{5} = 2$$

$$\frac{8}{4} = 2$$

$$\frac{6}{3} = 2$$

Which of the following tables could represent values of a linear function?

x	20	25	30	35
y	17	14	11	8

+5 +5 +5
-3 -3 -3

$$m = -\frac{3}{5}$$

x	2	4	6	8
y	10	20	28	34

+2 +2 +2
+5 +4 +3
+10 +8 +6

Not
Linear

Discussion

Section 5.5 Modeling with Linear Functions and Equations

We have just looked at ways to determine if functions are linear or not and have learned some shortcuts as to how to determine this.

The examples that we just worked on allowed us to find a function for the temperature for depths ranging from 150 m to 300 m. We can also use our function to make predictions.

Use the function from our first example to predict the temperature at the following depths. Are these predictions reasonable?

$$H(d) = 47.01d$$

a.) 260m

$$47.01(260)$$

$$12226.6$$

$$H(d) = 66$$

b.) 350m

$$H(d) = 7.5$$

c.) 25m

$$H(d) = 4.25$$

Discussion

Section 5.5 Modeling with Linear Functions and Equations

There are also times when we write linear equations, that we will write them in standard form. Remember that standard form is $Ax + By = C$.

When we have linear equations in standard form they are useful for describing *constraints*, or situation involving limited resources.

Example

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A newly designed motel has S small rooms measuring 250 ft^2 and L large rooms measuring 400 ft^2 . The designers have $10,000 \text{ ft}^2$ of available space. Write an equation relating S and L .

$$10000 = 250S + 400L$$

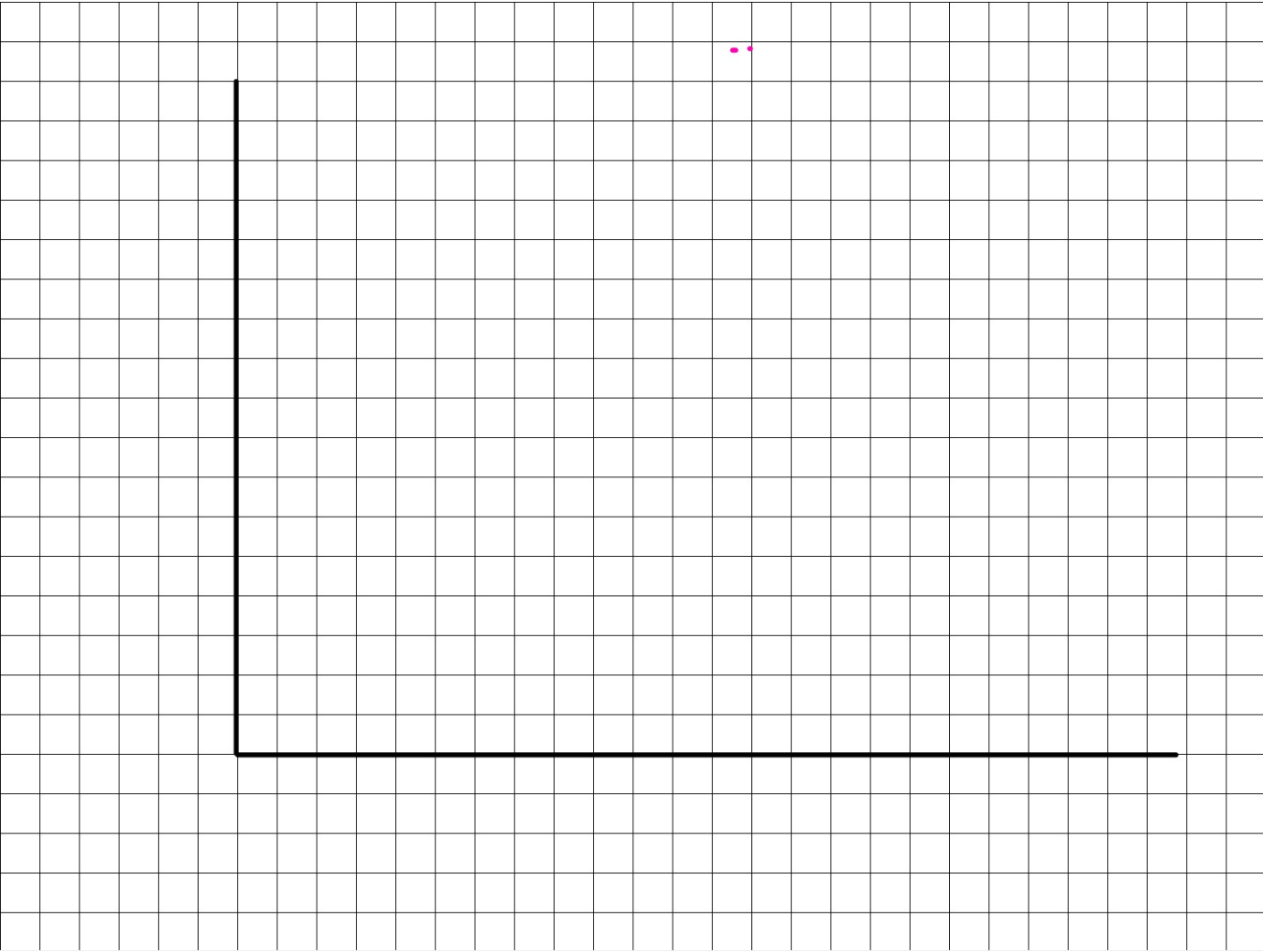
Example

Section 5.5 Modeling with Linear Functions and Equations

The equation $250S + 400L = 10,000$ that we just found is called a *constraint equation* because it describes the constraint that floor space places on the number of rooms built. Constraint equations are usually written in standard form.

Revised plans for the motel provide for a total floor space of 16,000 ft². Find the new constraint equation. Sketch a graph of both constraint equations. How do they compare?

$$16000 = 250s + 400L$$



Homework

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Modeling
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