D. to put in view or make evident

interpret

C. in a function, the ratio of the change in the dependent value with respect to the change in the independent value

linear function

B. a function that can be written in the form

*y* = *mx* + *b*, where *m* and *b* are real numbers; consists of a set of ordered pairs all lying on the same line

rate of change

A. to explain in understandable terms; to understand according to personal beliefs

display

**Words to Know**

*Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.*

**Warm-Up** Linear vs. Nonlinear Functions



**?**

**W2K**

functions.

**Identify**

functions.

**Identify**

**Lesson Goals**

**Use** graphs and tables to determine whether a function has a constant rate of change.

**Lesson Question**

**2**

**4**

**Linear vs. Nonlinear Functions**

**Linear function**

**Nonlinear function**

**have a constant rate of change**

**Has a constant**

**of change**

**Slide**



**Finding the Rate of Change**

The **rate of change** is the change in one quantity with respect to another quantity. Use the table to **interpret** the rate of change.

Change in input − 2 = 1

Change in output 165 − 110 = 55

Rate of change = 1 

55

|  |  |
| --- | --- |
| ***x*** | ***y*** |
| 2 | 110 |
| 3 | 165 |
| 4 | 220 |
| 5 | 275 |

**Slide**

# Recognizing Rate of Change from Tables

## EXAMPLE

This table **displays** the approximate height and distance traveled by a soccer ball that was kicked across a field.

*Write whether each column represents a function that is nonlinear or linear.*

**Height (yd)**

**4**

**Time (s)**

**Length (yd)**

0

+ 1

0

+ 5.3

0

+ 17

1

5.3

17

+ 17

+ 1

+ 2.7

2

8

34

+ 17

3

+ 1

9.8

+ 1.8

51

**Slide**

# Rate of Change from a Graph

## EXAMPLE

This shows the length and height traveled by a soccer ball.

*y*

|  |  |  |
| --- | --- | --- |
| **Time (s)** | **Height (yd)** | **Length (yd)** |
| 0 | 0 | 0 |
| 1 | 5.3 | 17 |
| 2 | 8 | 34 |
| 3 | 9.8 | 51 |
| 4 | 7.7 | 68 |

60

1

50

40 1

17

7 

1

1

20

30

10

**7**



*x*

1

2

3

4

So since we have a rate of change, that tells us that this graph shows a linear function.

**Slide**

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# Finding the Rate of Change from a Graph

## EXAMPLE

This shows the length and height traveled by a soccer ball.



|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 10 | *y* |  |  |  | 1 |  |  |  |  |  |
|  |  |  | 1 | .8 |  |  |  |  |  |  |
| 8 |  |  | 1 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | |
| 6 |  |  |  |  |  |  |  |  |
|  |  | 1 |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | 2 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | *x* |
|  |  | 1 |  | 2 |  | 3 |  | 4 |  |  |

|  |  |  |
| --- | --- | --- |
| **Time (s)** | **Height (yd)** | **Length (yd)** |
| 0 | 0 | 0 |
| 1 | 5.3 | 17 |
| 2 | 8 | 34 |
| 3 | 9.8 | 51 |
| 4 | 7.7 | 68 |

Since these rates are constant, this is considered a function.

**Slide**

**12**

# Linear and Nonlinear Functions in Real-World Situations

## REAL-WORLD CONNECTION

There are 24 hours in one day. The total hours is a function of the days. Does this situation represent a linear or nonlinear function?

*Complete the table.*

|  |  |
| --- | --- |
| **Days** | **Hours** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *y* |  |  |  |  |  |  |  | |  |
|  |  |
|  |  |  |  |  |  | 1 |  |  |  |  |
| 80 |  |  |  |  |  |  |  |  |  |  |
|  |  |
| 60 |  |  |  | 24 |  |  |  |  |  |  |
|  |  |  | 1 |  |  |  |  |  |  |  |
| 40 |  |  |  |  |  |  |  |  |  |  |
|  |  | 24 |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | *x* |
|  |  | 1 |  | 2 |  | 3 |  | 4 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

There is a rate of change. This confirms a relationship or function between days and hours.



**Summary** Linear vs. Nonlinear Functions

**?**

What is the difference between linear and nonlinear functions?

**Lesson Question**

**Answer**

*Use this space to write any questions or thoughts about this lesson.*