



Scan for Multimedia



EXAMPLE 1



Identify Functions with Arrow Diagrams

Jonah is shipping five boxes for his uncle. Each box is the same size but a different weight. The cost to ship each box is shown. Should Jonah expect that the cost to ship a 15-pound box will be a unique cost?



Use Structure Is there a relationship between the weight of the box and the cost to ship the box? © MP.7

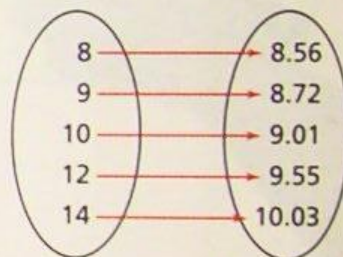
STEP 1 Organize the data using ordered pairs.



(input weight)	(output cost)
8	8.56
9	8.72
10	9.01
12	9.55
14	10.03

Any set of ordered pairs is a **relation**.

STEP 2 Use an arrow diagram to match each input value to its output value.



A relation is a **function** when each input is assigned exactly one output. For each input above, there is exactly one output. So, the relation is a function.

Jonah can expect that the cost to ship a 15-pound box will be a unique cost.

Try It!

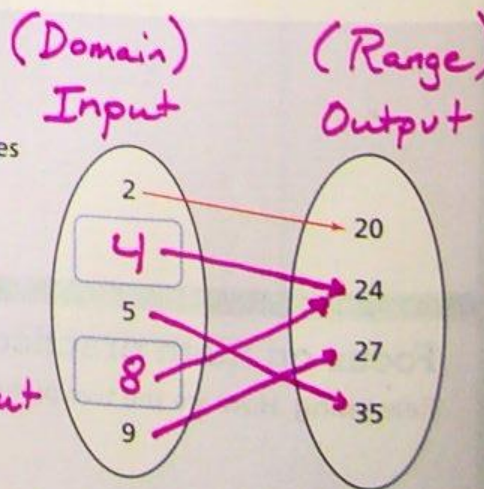
Joe needs to advertise his company. He considers several different brochures of different side lengths and areas. He presents the data as ordered pairs (*side length, area*).

(4, 24), (5, 35), (8, 24), (2, 20), (9, 27)

Complete the arrow diagram. Is the area of a brochure a function of the side length? Explain.

Yes, each input is assigned exactly one output

Convince Me! There are two outputs of 24. Does this help you determine whether the relation is a function? Explain.



is the relation a function? Explain.

Determine whether each input has exactly one output.

Two 9-year-olds have different heights.

Two 8-year-olds have different heights.

Age, x	Height, y
9	54
10	54
9	61
* 8	45
12	65
* 8	50

Look for Relationships

How might the two quantities be related? MP.7

No, this relation is not a function because two inputs have more than one output.

Try It!

Frank reverses the ordered pairs to show the heights and ages of the same six students. Is age a function of height? Explain.

Height (in.)	54	54	61	45	65
Age (years)	9	10	9	8	12

No b/c one input (54) is assigned two outputs

EXAMPLE 3



Interpreting Functions

Heather and her parents are going to an art museum for the day. The parking garage near the museum charges the rates shown in the sign.

A. Is the cost to park a function of time? Explain.

Each hour of parking time has a different cost. So the cost to park is a function of time.

B. If they stay at the museum for 6 hours, should they expect to pay more than \$25?

Yes, they should expect to pay more than \$25.

Time (hours)	Cost (\$)
Up to 1 hour	\$5
Up to 2 hours	\$10
Up to 3 hours	\$15
Up to 4 hours	\$20
Up to 5 hours	\$25

Try It!

Heather claims that she can tell exactly how long a family was at the museum by how much the family pays for parking. Is Heather correct? Explain.

No... A Family that pays \$15 could have stayed 2hrs 15 min or 2hr 30 min.

KEY CONCEPT



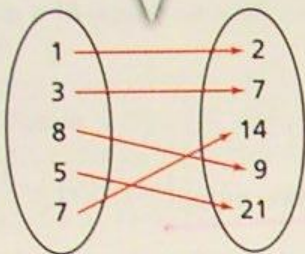
A relation is a function if each input corresponds to exactly one output. You can use an arrow diagram or a table to determine whether a relation is a function.

This relation is a function.

Explain...

Each input corresponds to exactly one output.

is assigned



This relation is not a function.

Explain...

Input	Output
2	4
5	10
4	8
2	6

One input is assigned two different outputs.

Do You Understand?

- Essential Question** When is a relation a function?

When each input (x) is assigned to exactly one output (y)

- Model with Math** How can you use different representations of a relation to determine whether the relation is a function? © MP.4

Arrow diagram: Two arrows can't start with the same input.

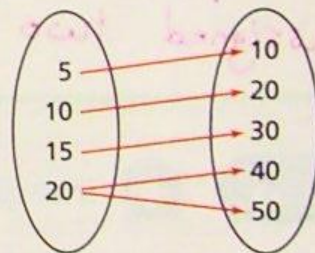
Table: Input values can't repeat.

- Generalize** Is a relation always a function? Is a function always a relation? Explain. © MP.8

A relation is NOT always a function but a function is always a relation.

Do You Know How?

- Is the relation shown below a function? Explain



- Is the relation shown below a function? Explain

Input	3	4	1	5	2
Output	4	6	2	8	5

- Is the relation shown below a function? Explain

$(4, 16), (5, 25), (3, 9), (6, 36), (2, 4), (1, 1)$