Practice Activities

Determining Whether a Relation Is a Function

1. Which of the following sets of ordered pairs represents a function?

   a) { (2, 5), (3, 8), (2, 11), (4, 14) }

   b) { (1, 6), (2, 6), (3, 6), (4, 6) }

   c) { (0, 3), (1, 7), (0, 9), (3, 7) }

   d) { (5, 2), (5, 4), (5, 6), (5, 8) }

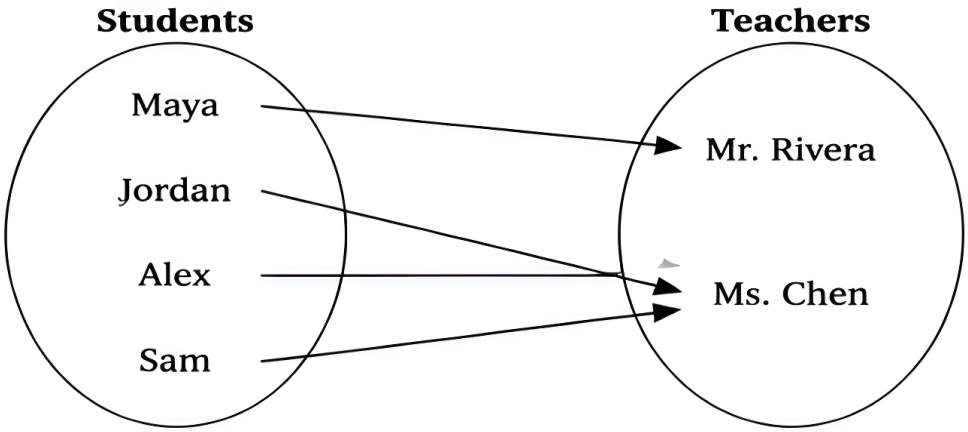
2. The table below shows the number of customers who visited a coffee shop each hour one Saturday morning.

Hour (x)	Customers (y)
9 AM	34
10 AM	47
11 AM	52
12 PM	47

   Does this table represent a function? Explain your reasoning using the definition of a function.

3. A relation is a function only if every output value is different from every other output value. True or False?

4. The mapping diagram below shows a relation between students and their homeroom teachers.



   Does this mapping diagram represent a function? Explain how you know.

5. Determine whether each set of ordered pairs is a function or not a function. Justify each answer.

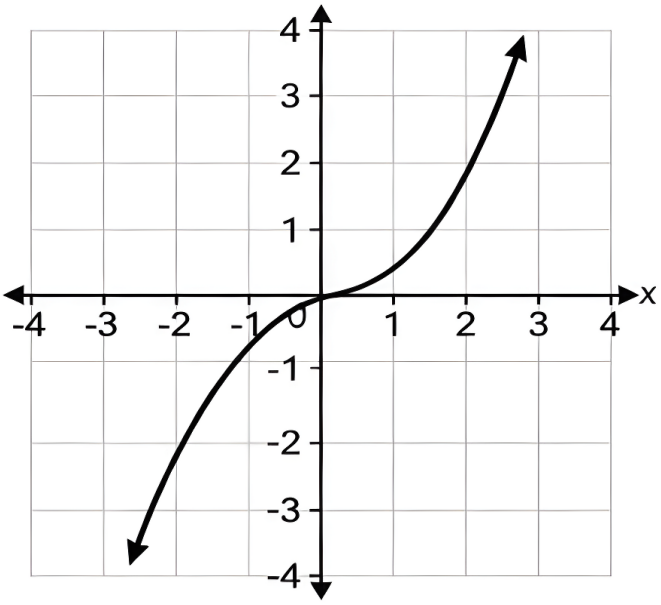
a) { (−4, 0), (−2, 3), (0, 6), (2, 9) }

b) { (7, 1), (8, 3), (9, 5), (7, 2) }

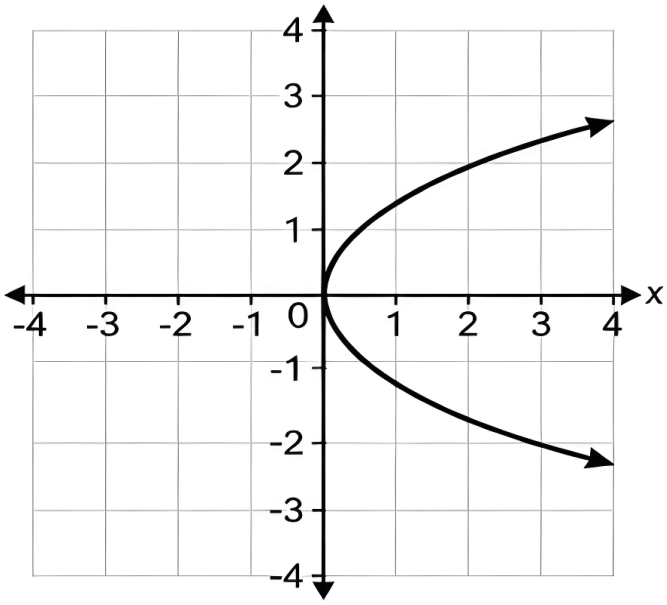
c) { (0, 0), (1, 1), (4, 2), (9, 3) }

6. Look at the two graphs below and apply the Vertical Line Test to each one.

Graph A



Graph B



For each graph, state whether it represents a function and explain how the Vertical Line Test supports your conclusion.

7. Fill in the blank: In a mapping diagram, a relation is NOT a function if any _____ has more than one arrow leaving it.

8. Marcus listed the following ordered pairs to represent the relationship between the number of items he bought and the total cost at a school supply store:

{(1, $1.25), (2, $2.50), (3, $3.75), (4, $5.00)}

a) Is this relation a function? Explain.
b) What is the input? What is the output?
c) In this situation, what would it mean if the relation were NOT a function?

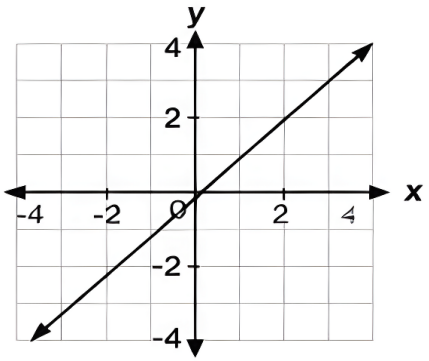
9. A mapping diagram for a science class grade book shows:

Inputs (Student)		Outputs (Quiz Score)
Alex	→	88
Maya	→	92
Jordan	→	75
Alex	→	81

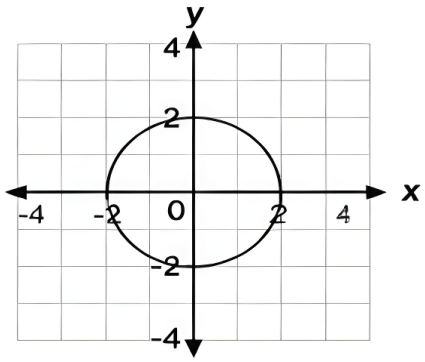
Is this relation a function? Identify the specific problem and explain what it means in the context of the grade book.

10. Which graph below represents a function?

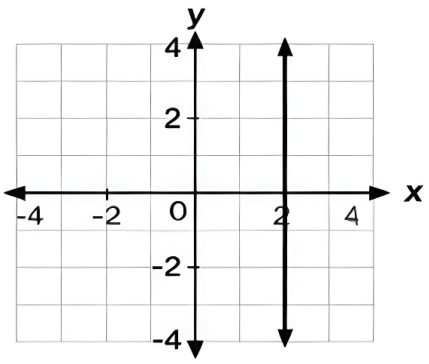
A.



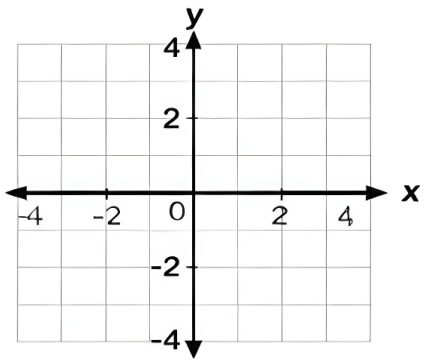
B.



C.



D.



a) Graph A only
b) Graphs A and D
c) Graphs B and C
d) Graph C only

11. Maya says that the relation { (3, 7), (3, 7), (5, 12) } is NOT a function because the input 3 appears twice. Is Maya correct? Explain your reasoning.

12. A local gym charges members based on their membership plan. The table below shows a record of five members and their monthly fees.

Member ID (x)	Monthly Fee (y)
1001	$29.99
1002	$49.99
1003	$29.99
1004	$29.99
1005	$49.99

a) Does this table represent a function? Explain.

b) Two inputs share the output $29.99. Does this violate the function rule? Why or why not?

13. A vending machine is programmed so that pressing button A3 always delivers a bag of pretzels, button B2 always delivers a granola bar, and button C1 always delivers water.

a) Explain why this vending machine models a function.

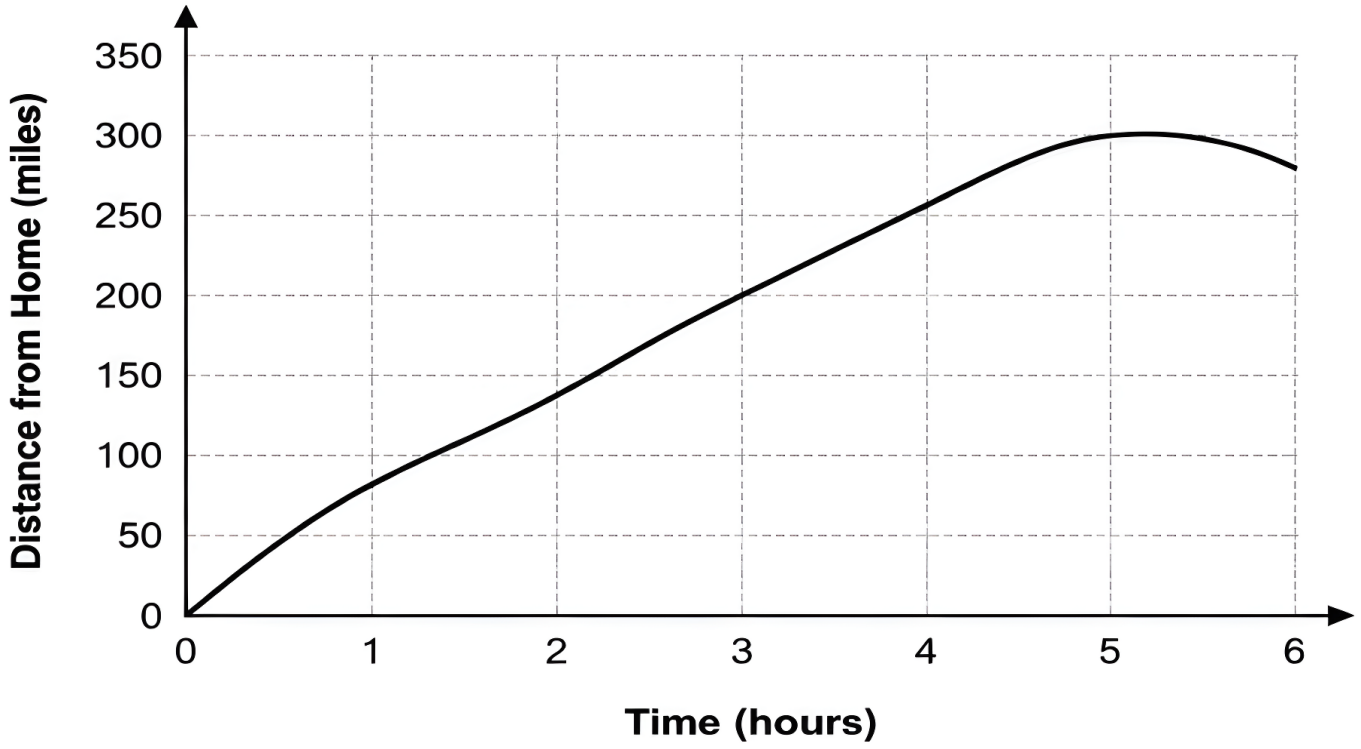
b) Describe a change to the machine that would make it no longer represent a function.

14. Three students analyzed the relation { (–1, 4), (0, 4), (1, 4), (2, 4) } and reached different conclusions:

- **Alex** said it is a function because all outputs are the same.
- **Jordan** said it is NOT a function because all outputs are the same — each input should have a unique output.
- **Sam** said it is a function because each input appears exactly once.

Which student(s) reached the correct conclusion? Which student(s) made an error? Explain the mistake in the incorrect reasoning.

15. The graph below shows the relationship between time (in hours) and a car's distance from home (in miles) during a road trip.



a) Apply the Vertical Line Test to this graph. Does it represent a function?

b) What does the input represent in this situation? What does the output represent?

c) Explain in your own words what it would mean if this graph did NOT pass the Vertical Line Test in the context of the road trip.

Answer Key

1. **b)** { (1, 6), (2, 6), (3, 6), (4, 6) }

Each x-value (1, 2, 3, 4) appears exactly once. Even though all outputs are the same (6), each input has exactly one output. This is the only set where no x-value is repeated with a different output.

- Option a): x = 2 appears with outputs 5 and 11 → not a function.
- Option c): x = 0 appears with outputs 3 and 9 → not a function.
- Option d): x = 5 appears with outputs 2, 4, 6, and 8 → not a function.

2. Yes, this table represents a function.

Each hour (9 AM, 10 AM, 11 AM, 12 PM) appears exactly once as an input. No hour is paired with two different customer counts. Even though 34 and 47 both appear as outputs, the rule only applies to inputs. Each input has one and only one output.

3. False.

The function rule only restricts inputs, not outputs. Multiple inputs can share the same output without violating the function definition. What matters is that each input maps to exactly one output.

4. Yes, this mapping diagram represents a function.

Each student (Maya, Jordan, Alex, Sam) has exactly one arrow leaving them, pointing to exactly one teacher. The fact that two students share the same teacher is allowed — outputs can be repeated. No input points to two different outputs.

5. a) **Function.**
x-values are –4, –2, 0, 2. Each appears exactly once. No repeated inputs.

b) **Not a function.**
x = 7 appears twice — once with output 1 and once with output 2.
The same input maps to two different outputs.

c) **Function.**
x-values are 0, 1, 4, 9. Each appears exactly once.
Every input has exactly one output.

Answer Key

6. **Graph A — Represents a function.** The S-shaped curve passes the Vertical Line Test. Any vertical line drawn anywhere on the graph intersects the curve at exactly one point. No *x*-value is paired with more than one *y*-value.

Graph B — Does NOT represent a function. The sideways parabola fails the Vertical Line Test. A vertical line drawn through the center of the graph intersects the curve in two places — one point on the upper arm and one point on the lower arm. The same *x*-value is paired with two different *y*-values.

7. input (also accepted: *x*-value, domain value)

8. a) Yes, this is a function. The *x*-values are 1, 2, 3, 4 — each appears exactly once. Every number of items purchased is paired with one and only one total cost.

b) Input: the number of items purchased. Output: the total cost in dollars.

c) If the relation were not a function, it would mean that buying the same number of items could result in two different total costs — which would be inconsistent and unreliable pricing at the store.

9. **No, this is NOT a function.** The student Alex appears twice as an input — once mapped to a score of 88 and once mapped to a score of 81. In the context of the grade book, this means Alex has two different quiz scores recorded for the same quiz, which is contradictory. A student cannot simultaneously earn two different scores on the same assessment.

10. **b) Graphs A and D**

- Graph A (diagonal line): passes the Vertical Line Test — each *x*-value has one *y*-value. ✓ Function.
- Graph B (circle): fails the Vertical Line Test — a vertical line through the center hits two points. ✕ Not a function.
- Graph C (vertical line at $x = 2$): every point on the line shares the same *x*-value paired with infinitely many *y*-values. ✕ Not a function.
- Graph D (horizontal line): every *x*-value maps to exactly one *y*-value. ✓ Function.

11. **Maya is incorrect.** The ordered pair $(3, 7)$ appears twice, but both repetitions pair the same input (3) with the same output (7). This is simply a repeated ordered pair — the input 3 is still only associated with one output value. The function rule is not violated. **This relation IS a function.** Maya confused "a repeated ordered pair" with "an input mapping to two different outputs."

12. **a)** Yes, this table represents a function. Each Member ID (1001, 1002, 1003, 1004, 1005) appears exactly once as an input. No Member ID is paired with two different monthly fees. Every input has exactly one output.

b) No, this does not violate the function rule. The rule only states that each input must have one output. Multiple inputs sharing the same output ($29.99) is completely acceptable. The restriction goes in one direction only: one output per input, not one input per output.

13. **a)** The vending machine models a function because each button (input) always delivers exactly one specific item (output). Pressing A3 always gives pretzels — never two different items. Every input has one and only one output.

b) The machine would no longer represent a function if pressing the same button could randomly deliver two different items. For example, if pressing A3 sometimes gave pretzels and sometimes gave chips, then one input would map to two different outputs — violating the function rule.

14. **Alex and Sam are both correct; Jordan is incorrect.** Alex is right that equal outputs do not disqualify a relation from being a function. Sam correctly identified the actual function rule: each input $(-1, 0, 1, 2)$ appears exactly once. Jordan made an error by claiming that outputs must be unique — the function definition places no restriction on repeated output values.

15. **a)** The graph represents a function. Any vertical line drawn across the graph intersects the curve at exactly one point. No value of time corresponds to two different distances.

b) Input: time in hours. Output: the car's distance from home in miles.

c) If the graph failed the Vertical Line Test, it would mean that at some specific moment in time, the car was simultaneously at two different distances from home — which is physically impossible. A car can only be in one location at any given moment.