LESSON MAKER PRO

Rate or Not?

Use changes in output to spot linear functions.

GRADE 8 · 8.AT.C.8

8.AT.C.8 "Identify whether a function is linear or non-linear given equations, graphs, or input-output pairs, and provide a justification using reasoning about the constant rate of change and its relationship to proportional reasoning."

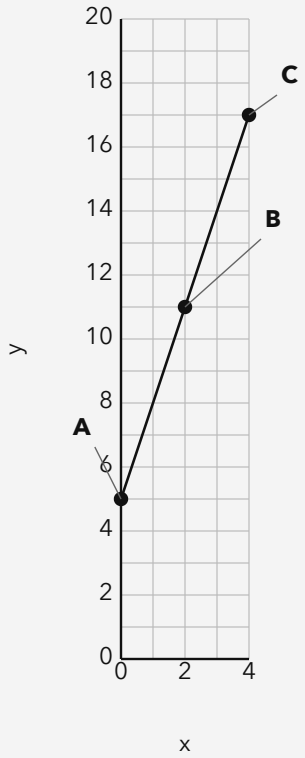
NAME _____ DATE _____

THE BIG IDEA

A function is linear when the change in output divided by the change in input is always the same. A linear function is proportional only when its graph passes through (0, 0).

WORKED EXAMPLE

Use the graph to decide whether the function is linear and whether it is proportional. Show how you know.

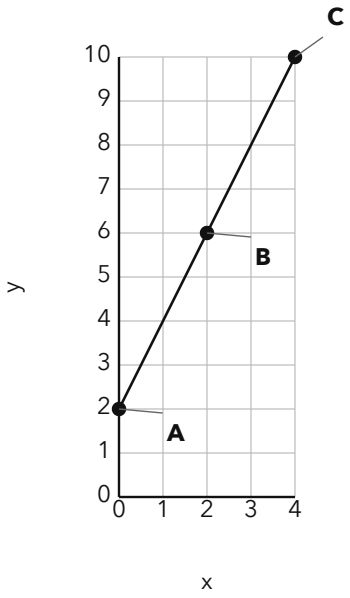


1. From A to B, the rate of change is (11 - 5)/(2 - 0) = 3.
2. From B to C, the rate of change is (17 - 11)/(4 - 2) = 3.
3. The rate stays the same, but the graph does not pass through (0, 0).

Answer: Linear, but not proportional.

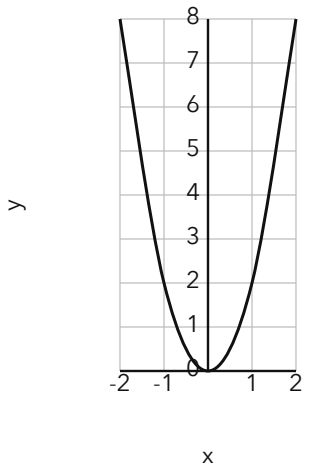
PRACTICE 6 problems

1 Is the graphed function linear or non-linear? Is it proportional? Justify both answers.



ANSWER _____

2 Is the graphed function linear or non-linear? Compare changes in y for each 1-unit increase in x.



ANSWER _____

3 Is y = -2x linear or non-linear? Is it proportional? Justify your answers.

ANSWER _____

4 Is $y = x^2 - 4$ linear or non-linear? Use outputs for x = 0, 1, and 2 to justify your answer.

ANSWER _____

5 Is the function in the table linear or non-linear? Is it proportional? Justify your answers.

INPUT AND OUTPUT

x	y
1	6
3	10
5	14
7	18

ANSWER _____

6 Is the function in the table linear or non-linear? Compare rates of change.

INPUT AND OUTPUT

x	y
1	2
2	4
4	8
6	18

ANSWER _____

APPLY IT Show your work

1 An arcade charges $6 to enter and $4 for each game you play. Let x be the number of games and y be the total cost in dollars. Is the cost a linear function of x? Is it proportional to x? Explain.

WORK SPACE

ANSWER _____

2 A student's video has 60 views after 1 hour, 120 views after 2 hours, and 240 views after 3 hours. Based on these three input-output pairs, is the number of views a linear function of hours? Explain.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student says this table is non-linear because the outputs rise by different amounts. Is the student correct? Compare the rates of change between each pair of consecutive rows. Then decide whether the function is proportional.

INPUT AND OUTPUT

x	y
1	10
3	18
6	30
10	46

WORK SPACE AND ANSWER

ANSWER KEY

Rate or Not?

GRADE 8 · 8.AT.C.8

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Is the graphed function linear or non-linear? Is it proportional? Justify both answers.	**Linear, but not proportional. The rate is (6 - 2)/2 = 2 and (10 - 6)/2 = 2, but the graph does not pass through (0, 0).**
2	Is the graphed function linear or non-linear? Compare changes in y for each 1-unit increase in x.	**Non-linear. As x increases by 1, y changes by -6, -2, 2, and 6, so the rate is not constant.**
3	Is y = -2x linear or non-linear? Is it proportional? Justify your answers.	**Linear and proportional. The rate is always -2, and y = 0 when x = 0.**
4	Is $y = x^2 - 4$ linear or non-linear? Use outputs for x = 0, 1, and 2 to justify your answer.	**Non-linear. The outputs are -4, -3, and 0; for equal increases in x, the changes in y are 1 and 3.**
5	Is the function in the table linear or non-linear? Is it proportional? Justify your answers.	**Linear, but not proportional. Each increase of 2 in x adds 4 to y, so the rate is 2. The rule y = 2x + 4 does not give y = 0 when x = 0.**
6	Is the function in the table linear or non-linear? Compare rates of change.	**Non-linear. The rates between consecutive rows are 2/1 = 2, 4/2 = 2, and 10/2 = 5.**

PART 2 · APPLY IT

1. **Linear, but not proportional. The cost rises by $4 per game, but it is $6 when x = 0.** Write y = 4x + 6. The rate of change is constant at 4, and the starting cost is not 0.
2. **Non-linear. Views increase by 60 from hour 1 to hour 2, then by 120 from hour 2 to hour 3.** Both time intervals are 1 hour, but their changes in views differ. The rate of change is not constant.

CHALLENGE

No. The rates are 8/2 = 4, 12/3 = 4, and 16/4 = 4, so the function is linear. It is not proportional: the rule y = 4x + 6 gives y = 6 when x = 0.

Accept any correct justification using equal output changes for equal input changes or a constant change-in-output to change-in-input ratio. For proportionality, accept a correct zero-input test or a graph-through-the-origin explanation.