Compare Two Linear Functions

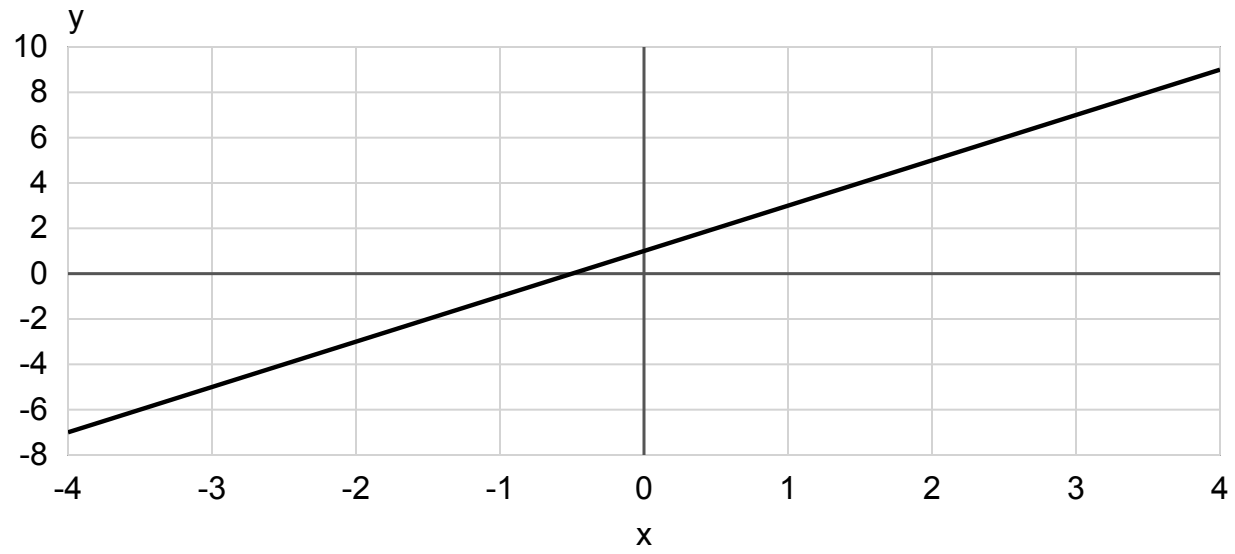
Find and compare rate of change and initial value from a graph and a table.

Name: _____ Date: _____

Part 1 - Read the representations

Original classroom data: Function R and Function S are linear for every value of x. Function R is shown on the graph. Function S is shown in the table.

Function R



Function S

x	y
-2	7
0	3
3	-3

1. From the graph, what are Function R's rate of change and initial value?

2. Use two rows of Function S's table. What is its rate of change? What is its initial value?

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Part 2 - Compare and justify

3. Complete the comparison table. Give evidence from the graph or table.

Property	Function R	Function S	Evidence
Rate of change			
Initial value			

4. Find the output of each function when x = 2. Which function has the greater output?

5. Do the functions ever have the same output? Write an equation, solve it, and state the point where they meet.

6. A student says, “Function R is greater than Function S for every x.” Is the statement true? Explain when R is greater, using your answer to question 5.

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Answer key and teaching notes

Materials: Print and supply all student pages, keeping teacher-key pages separate; pencil; optional straightedge. No calculator is needed.

Setup: Give each student the student pages in order. Say that the displayed graph and table are original classroom data and that the sentence “both functions are linear for every value of x” is an instruction they may use. Students should not infer a global rule from only three table entries without that stated assumption.

Teaching script: “Today you will compare the same two properties in two representations. Rate of change tells how y changes when x increases by 1. Initial value is the y-value when x is 0. The graph and table describe linear functions for all x, so a constant rate found from the table continues beyond the listed rows. Show evidence for each comparison.”

Observe: As students work, look for (1) a rise of 2 for a run of 1 on R, (2) a change of -4 in y for a change of 2 in x on S, and (3) use of the intersection to describe which function is greater. Ask: “What stated fact lets you extend the table pattern?” Record whether each student identifies both properties and supports a comparison with data.

1. R has rate of change 2 and initial value 1. The graph crosses the y-axis at 1; for each 1 unit right, it rises 2. Thus R: $y = 2x + 1$.

2. S has rate of change -2 and initial value 3. For example, from $x = -2$ to $x = 0$, y changes 7 to 3: $(3 - 7)/(0 - (-2)) = -4/2 = -2$. The row $x = 0$ gives initial value 3. Thus S: $y = -2x + 3$. The linear assumption justifies this rule for all x.

3. R: rate 2; S: rate -2. Evidence may cite graph rise/run and table calculation. R: initial value 1; S: initial value 3. Evidence may cite R's y-intercept and S's $x = 0$ row.

4. $R(2) = 2(2) + 1 = 5$. $S(2) = -2(2) + 3 = -1$. R has the greater output.

5. $2x + 1 = -2x + 3$; $4x = 2$; $x = 1/2$. Then $y = 2$. The functions meet at $(1/2, 2)$.

6. No. At $x = 1/2$ they are equal. R is greater when $x > 1/2$; S is greater when $x < 1/2$. A complete response connects this to R's larger rate of change, 2 compared with -2.