Lines and Curves: What Changes?

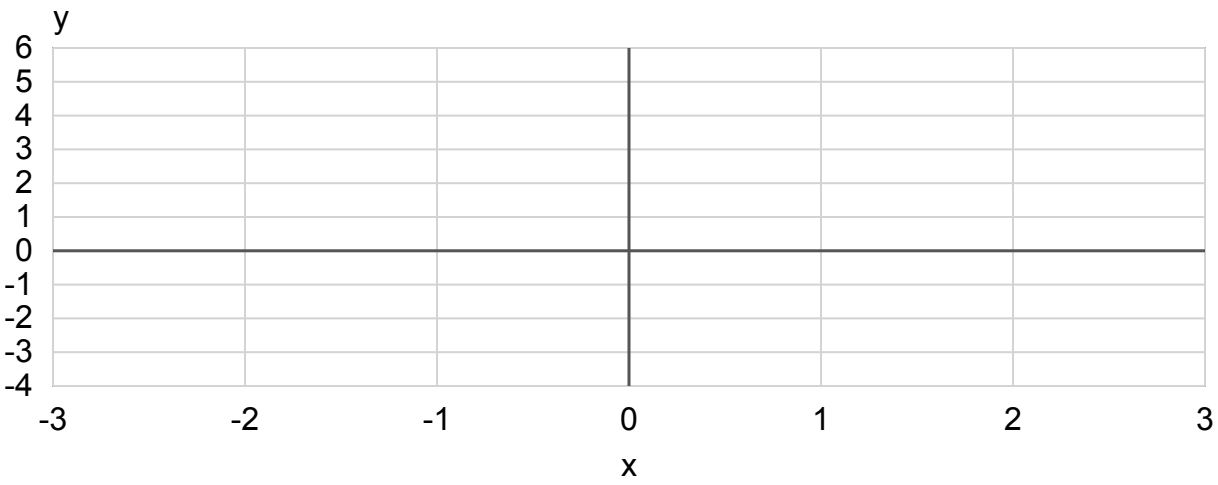
Graph a linear function and a nonlinear function, then explain slope and intercept

Name: _____ Date: _____

Part A - A Function That Makes a Line

1. Complete the table for the function y = 2x + 1. Then plot all five ordered pairs on the grid. Use a ruler to draw one straight line through the points. Extend the line across the grid.

x	y = 2x + 1
-2	
-1	
0	
1	
2	



Check: As x increases by 1, look for the same change in y each time.

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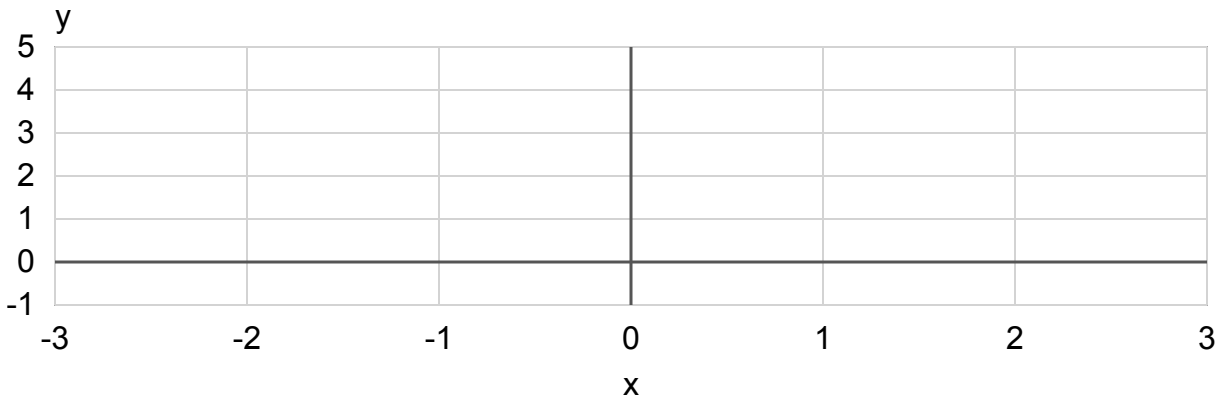
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Part B - A Function That Makes a Curve

2. Complete the table for $y = x^2$. Plot all five ordered pairs. Draw a smooth curve through the points. Do not connect the points with straight line segments.

x	**$y = x^2$**
-2	
-1	
0	
1	
2	



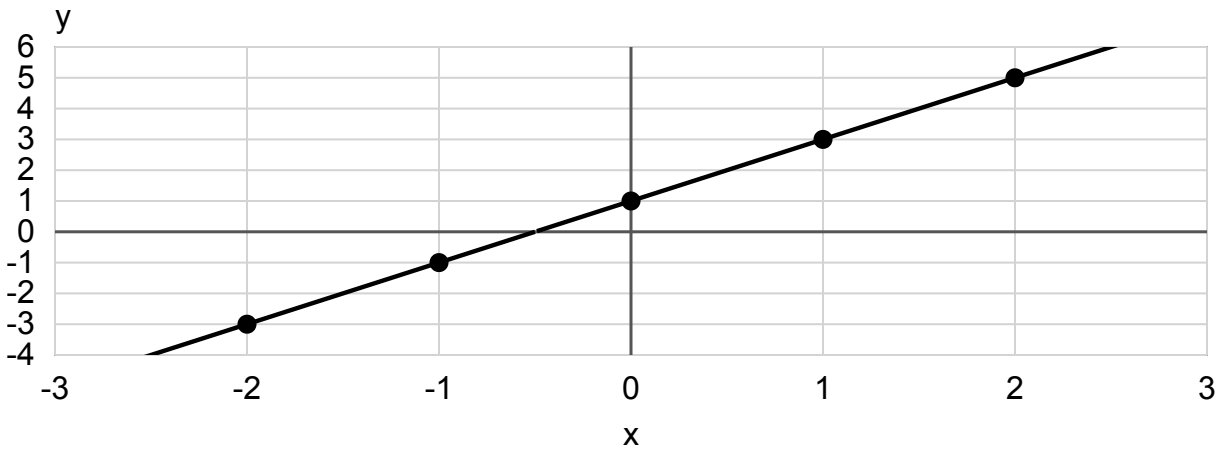
3. Compare the changes in y as x increases by 1. Why is $y = 2x + 1$ linear, but $y = x^2$ nonlinear? Then explain what m = 2 and b = 1 mean in $y = 2x + 1$.

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Answer Key and Teaching Notes - Part A

1. Table: when x = -2, -1, 0, 1, 2, the y-values are -3, -1, 1, 3, 5. Plot (-2,-3), (-1,-1), (0,1), (1,3), and (2,5). A correct graph is one straight line through these points.



Materials: Print and supply all student pages, keeping teacher-key pages separate. Supply pencils, rulers, and erasers. The worksheet supplies the grids and equations; no calculator is needed.

Exact setup: Give each student both task pages and a ruler. Ask students to complete Part A before Part B. Keep the key unavailable during work time. Display neither completed graph.

Teaching script: Say, “For each x-value, substitute into the equation to find y. A point is written (x, y). On the first grid, use a ruler after you plot the points. On the second grid, you will decide whether a ruler still makes sense.” Say, “A function can be linear only when its graph is a straight line.”

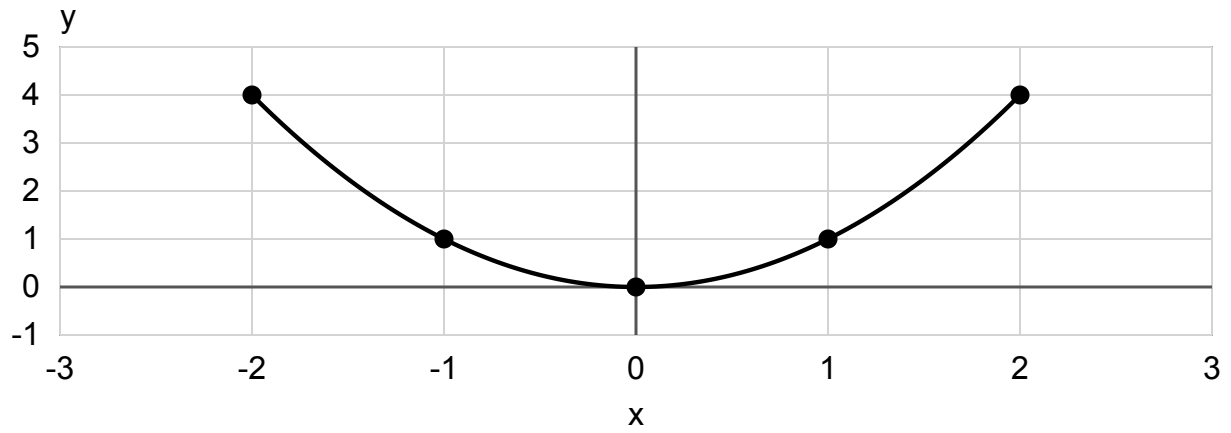
Observation method: Circulate while students work. For Part A, check that each student calculates five y-values, places x before y when plotting, and uses a straight line. Mark each criterion as secure, developing, or needs support. Ask one student, “What happens to y when x increases by 1?”

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Answer Key and Teaching Notes - Part B

2. Table: when x = -2, -1, 0, 1, 2, the y-values are 4, 1, 0, 1, 4. Plot (-2,4), (-1,1), (0,0), (1,1), and (2,4). A correct graph is a smooth U-shaped curve, not a straight line.



3. Sample response: For y = 2x + 1, y increases by 2 whenever x increases by 1. Its change is constant, so its graph is a straight line and the function is linear. For $y = x^2$, the consecutive changes in y are -3, -1, +1, and +3. The change is not constant, so the graph curves and the function is nonlinear. In y = 2x + 1, m = 2 means y changes by 2 for every increase of 1 in x. b = 1 means y is 1 when x is 0; the line crosses the y-axis at (0,1).

Scoring guide: Item 2: 1 point for all table values, 1 point for correctly plotted points, 1 point for a smooth curve. Item 3: 1 point for comparing constant versus nonconstant change, 1 point for identifying linear versus nonlinear with a reason, 1 point for correct meanings of both m and b. Accept equivalent clear language.

Follow-up prompt: If a student calls $y = x^2$ linear because it is an equation, ask, “Does the graph stay straight, and does y change by the same amount each step?”