Function Connections

Compare rates and starting values in tables, graphs and equations.

8.5 · Proportionality. The student applies mathematical process standards to use proportional and non- proportional relationships to develop foundational concepts of functions. The student is expected to: represent linear proportional situations with tables, graphs, and equations in the form of y = kx; represent linear non-proportional situations with tables, graphs, and equations in the form of y = mx + b, where b ≠ 0; contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation; use a trend line that approximates the linear relationship between bivariate sets of data to make predictions; solve problems involving direct variation; distinguish between proportional and non-proportional situations using tables, graphs, and equations in the form y = kx or y = mx + b, where b ≠ 0; identify functions using sets of ordered pairs, tables, mappings, and graphs; identify examples of proportional and non-proportional functions that arise from mathematical and real-world problems; and write an equation in the form y = mx + b to model a linear relationship between two quantities using verbal, numerical, tabular, and graphical representations.

Name _____ Date _____

Connect the representations

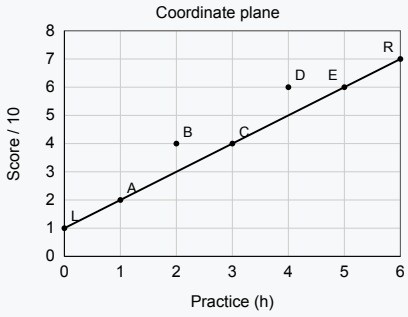
A function assigns exactly one output to each allowed input. A linear function y = mx + b has constant rate m and initial value b. A proportional relationship y = kx is linear with b = 0. Functions can also be nonlinear; going through (0,0) alone does not prove proportionality.

Worked example

Points A-E show practice hours x and quiz scores y out of 10. The line through L(0,1) and R(6,7) approximates the pattern. Find its equation and explain its rate.

1. Slope = (7 - 1)/(6 - 0) = 1; intercept = 1, so the trend line is y = x + 1.
2. The model predicts 1 more point per additional practice hour. Its intercept is a prediction at zero hours, not an observed score.

Approximately linear data; model y = x + 1. Individual scores may lie above or below the line.



Use tables, equations, graphs and contexts as evidence. On each construction grid, mark three correct points and draw the straight segment only over the stated interval. Show calculations and explain your classifications.

1. Practice

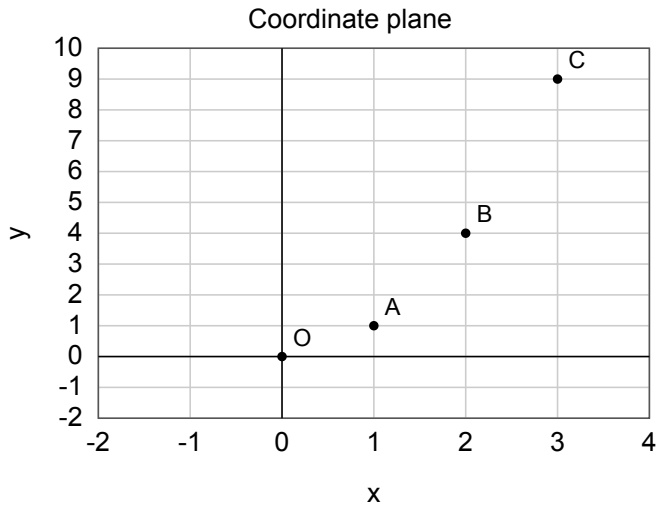
Table A lists a linear relationship. Find its rate, equation and value at x = 5. Is it a function? Is it proportional? Give evidence for each classification.

Table A

x	y
0	0
1	3
2	6
3	9

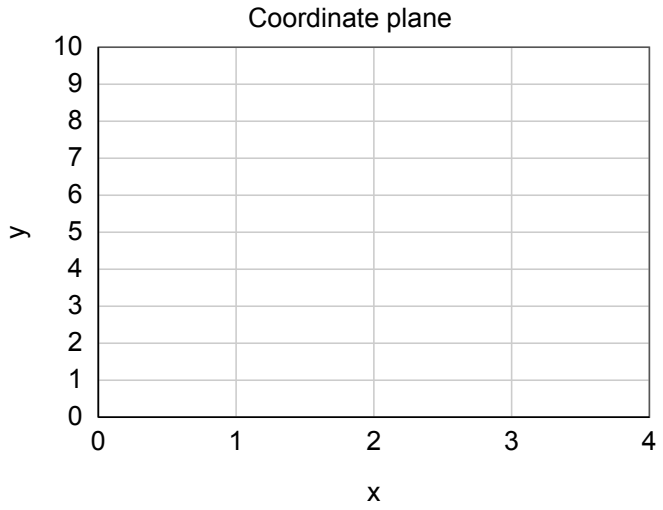
2. Practice

The plotted pairs follow y = x². Do they suggest a linear or nonlinear pattern? Compare rises for successive one-unit runs. Explain why passing through (0,0) does not prove proportionality.



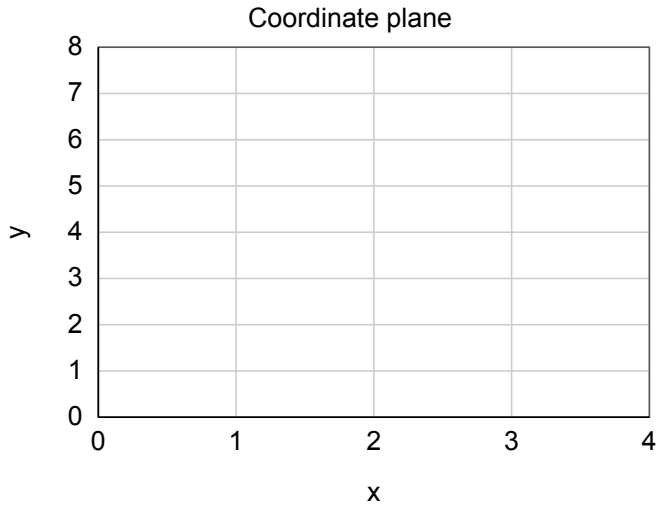
3. Practice

Graph y = 2x for 0 ≤ x ≤ 4, marking at least three points. Describe its rate, initial value, and proportionality. Compare with the line y = 2x + 2.



4. Practice

Graph y = x + 3 for 0 ≤ x ≤ 4, marking at least three points. State the rate and initial value. Is it proportional? Explain how the graph shows your answer.



5. Apply

Two bicycle rentals charge by hour. Plan A: $3 per hour, no fee. Plan B: $2 per hour plus $4. Write both equations, identify the proportional plan, and find when they cost the same. Compare costs at 2 and 6 hours.

6. Apply

The ordered pairs are (1,4), (2,7), (1,5). Can they define y as a function of x? Explain, then change one pair to make a function while keeping three different pairs.

7. Challenge

Use the worked trend line y = x + 1 to predict a score at 6 practice hours. Why is this an estimate? Compare its plotted data pattern with Task 2. Would one straight line fit both patterns equally well?

What to accept

Accept equivalent correct reasoning. Check plotted marks as well as written answers. Numbered solutions match the student tasks.

1. Practice

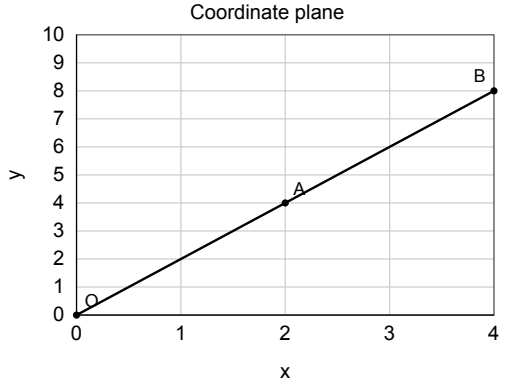
Rate 3; y = 3x; y(5) = 15. It is a function: each input has one output. It is proportional: y is 3 times x and it includes (0,0).

2. Practice

Nonlinear. From (0,0), (1,1), (2,4), (3,9), rises are 1, 3, 5 for runs of 1. The rate and ratios y/x are not constant, despite the point (0,0).

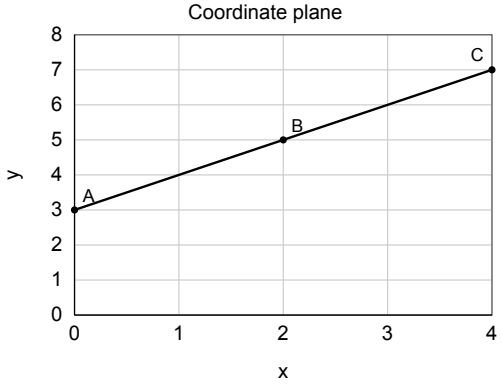
3. Practice

Points (0,0), (2,4), (4,8); rate 2 and initial value 0, so it is proportional. It has the same slope as the line y = 2x + 2 but every y-value is 2 lower.



4. Practice

Points (0,3), (2,5), (4,7); rate 1, initial value 3. It is a linear function but not proportional because the line does not pass through (0,0).



5. Apply

A: y = 3x, proportional.

B: y = 2x + 4, not proportional. Equal at x = 4, cost $12. At 2 h: A $6, B $8; at 6 h: A $18, B $16.

6. Apply

No: input 1 has two outputs, 4 and 5.

One possible repair is (1,4), (2,7), (3,5). Each input then has exactly one output.

7. Challenge

Predicted score 7 out of 10. Scores vary around the trend line; 6 hours is beyond the observed 1-5 hours, so this is an uncertain extrapolation. A-E show an approximately straight pattern. Task 2 curves upward as its rate increases; one straight line is a poorer model for that pattern.