

Lines With Lift

Represent a nonzero start and a constant rate.

GRADE 8 • TEKS 8.5.B

8.5.B "represent linear non-proportional situations with tables, graphs, and equations in the form of $y = mx + b$, where $b \neq 0$;"

NAME _____

DATE _____

Connect the representations

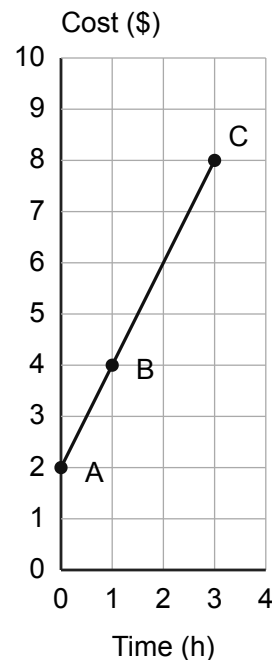
A linear non-proportional situation has $y = mx + b$ with $b \neq 0$. The slope m is change in output divided by change in input; b is the output at zero. Tables, graphs and equations must describe the same values and context.

Worked example

A machine rental costs \$2 to start plus \$2 per hour. Represent total cost y for x hours, $0 \leq x \leq 3$.

The starting cost is $b = 2$ dollars. The hourly rate is $m = 2$ dollars/hour. Use $y = 2x + 2$ to make table values, then plot and connect them over the allowed hours.

$y = 2x + 2$; table pairs (0,2), (1,4), (3,8). The graph starts at (0,2), not the origin.



Use the stated variables, units and graph intervals. Plot only when asked. Label points clearly and use the response lines for equations, tables and explanations.

1. Practice

A storage tank holds 9 L and drains at 2 L/min. Write $y = mx + b$ for water remaining after x minutes. Give a table for $x = 0, 1, 2, 3$. Interpret m and b .

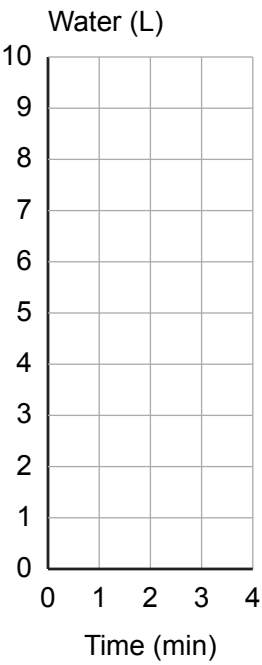
2. Practice

The table is linear. Find its rate, missing output and equation. Explain why it is non-proportional even though its rate is constant.

x	y
-1	1
0	
1	5
3	9

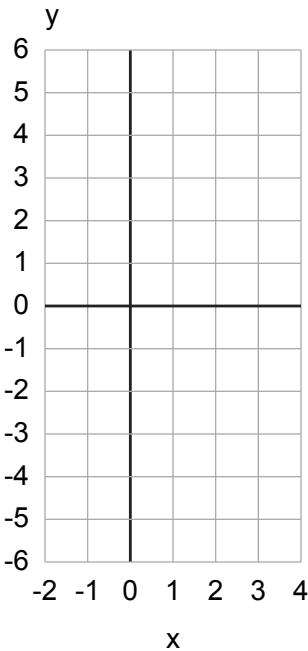
3. Practice

Graph the draining tank from Task 1 for $0 \leq x \leq 3$. Mark all four table points and connect. Why does this model stop before negative water amounts?



4. Practice

For $y = 2x - 3$, make a table at $x = -1, 0, 2, 4$. Plot those points and draw the segment over $-1 \leq x \leq 4$. Identify the starting value on the graph.



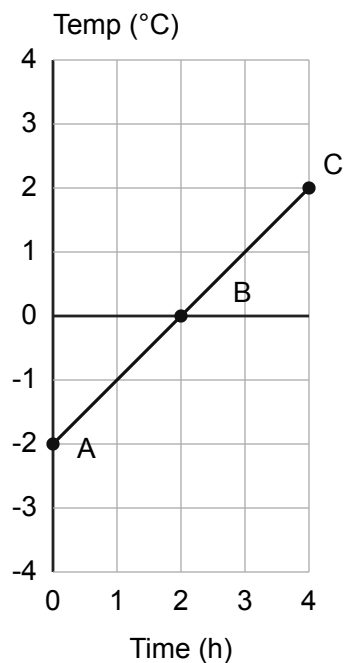
5. Apply

A print shop charges \$3 to set up plus \$1 per poster. Complete the table and write an equation. Give the point representing no posters and explain why zero posters still has a cost in this model.

Posters x	Cost y (\$)
0	
1	4
2	
4	

6. Apply

The displayed line models temperature y ($^{\circ}\text{C}$) at time x (hours). Read two points to find m and b , write the equation, and give a two-row table.

**7. Challenge**

A linear table includes (1,5), (3,11), (5,17). Find $y = mx + b$, extend your table to $x = 0$, and describe how the graph proves it is non-proportional.

Accept equivalent correct reasoning. Check plotted points and constructed representations as well as written answers. Numbered solutions match the student tasks.

Task 1

$y = -2x + 9$; table (0,9), (1,7), (2,5), (3,3). $m = -2$ L/min and $b = 9$ L.

Task 2

Rate 2; missing output 3; $y = 2x + 3$. Its output at $x = 0$ is 3, so it is not proportional.

Task 3

Plot (0,9), (1,7), (2,5), (3,3) and connect. Water cannot be negative; the draining model ends when the tank is empty at 4.5 minutes.

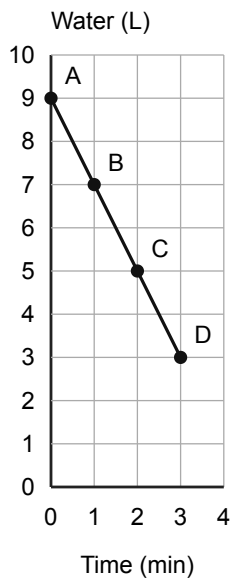
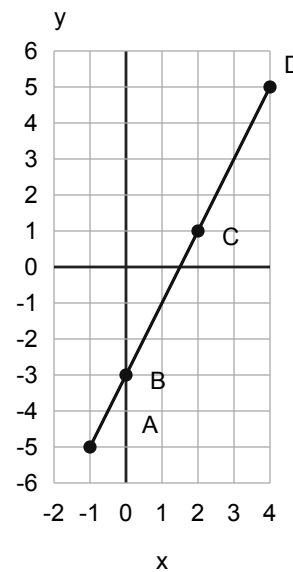
**Task 4**

Table (-1,-5), (0,-3), (2,1), (4,5); connect the points. The y-intercept is -3 at (0,-3), so the relationship is non-proportional.

**Task 5**

$y = x + 3$; missing costs 3, 5 and 7 dollars. The point (0,3) represents the setup fee, which is charged even when no posters are printed.

Task 6

$m = 1$; $b = -2$; $y = x - 2$. For example, table (0,-2), (4,2). Temperature rises 1°C per hour and starts at -2°C .

Task 7

$m = 6/2 = 3$; $b = 2$; $y = 3x + 2$. Add (0,2). The line crosses the y-axis at 2 rather than passing through the origin.