Unit 3 · Linear and Functional Relationships Cheat Sheet

Unit 3 focus: functions, function rules, tables and graphs

1 KEY VOCABULARY

function	Each input has exactly one output.	$y = 3x + 1$
input / output	x goes in, y comes out.	$x = 2 \rightarrow y = 7$
rate of change	Change in y ÷ change in x (the slope).	\$12 per hour
initial value	The output when $x = 0$ (the y-intercept).	b in $y = mx + b$
linear	Constant rate of change; graph is a line.	$y = -2x + 5$

2 IS IT A FUNCTION?

- Table or ordered pairs: no input x repeats with a different output.
- $\{(1, 4), (2, 5), (1, 6)\}$ is **not** a function: $x = 1$ has two outputs.
- Graph: **vertical line test**. A vertical line may cross the graph at most once.
- Outputs may repeat: $\{(1, 3), (2, 3)\}$ is a function.

3 WRITING A FUNCTION RULE

Find the rate of change from a table, then the starting value.

Example: x: 0, 1, 2, 3 y: 5, 8, 11, 14
Rate: each step adds 3, so $m = 3$
Start: at $x = 0$, $y = 5$

Answer: $y = 3x + 5$

4 LINEAR OR NONLINEAR?

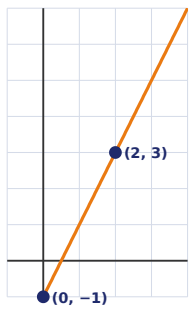
Linear	Nonlinear
constant rate of change	rate of change varies
graph is a straight line	graph curves or bends
$y = mx + b$	$y = x^2$, $y = 2^x$, $y = \frac{1}{x}$
y: 2, 5, 8, 11 (+3 each)	y: 1, 4, 9, 16 (+3, +5, +7)

5 SLOPE FROM TWO POINTS

$m = \frac{y_2 - y_1}{x_2 - x_1}$ = rise ÷ run.

Example: The line through $(0, -1)$ and $(2, 3)$
Slope: $\frac{3-(-1)}{2-0} = \frac{4}{2} = 2$
Intercept: $b = -1$

Answer: $y = 2x - 1$



6 QUICK REMINDERS & COMMON MISTAKES

✔ Do remember

- Subtract in the same order on top and bottom of the slope formula.
- The initial value is where the graph meets the y-axis.
- Units of the rate: y-units per x-unit.

✘ Common mistakes

- Run over rise: slope is rise over run
- Calling repeated outputs "not a function": only repeated inputs matter
- Assuming every table is linear: check the differences

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More practice: linear vs. nonlinear, rate of change, intervals and graphs in context

1 THREE WAYS TO SHOW A LINE

Form	$y = 4x - 2$
Equation	slope 4, y-intercept -2
Table	x: 0, 1, 2 → y: -2, 2, 6
Graph	start at $(0, -2)$, up 4, right 1
Words	start at -2 and add 4 each time

2 COMPARING FUNCTIONS

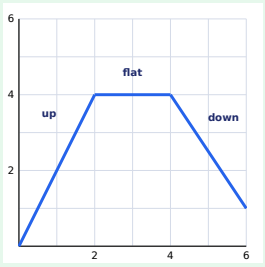
Compare rates (slopes) and initial values, even when the functions are shown in different ways.

Example: A: $y = 3x + 10$. B: table $(0, 4), (2, 12)$. Which grows faster?
Rate of B: $\frac{12-4}{2-0} = 4$
Compare: $4 > 3$

Answer: B grows faster; A starts higher

3 INCREASING AND DECREASING

Read the graph from **left to right**. **Increasing**: going up. **Decreasing**: going down. **Constant**: flat. A **maximum** is the highest point; a **minimum** is the lowest.
Here: increasing from $x = 0$ to 2, constant from 2 to 4, decreasing from 4 to 6; maximum value 4.



4 RATE OF CHANGE IN CONTEXT

The slope tells how much the output changes for each 1 unit of input. Include units.

Example: A plant is 6 cm tall and grows 1.5 cm per week: $h = 1.5w + 6$. Height after 8 weeks?
Substitute: $h = 1.5(8) + 6$

Answer: 18 cm (rate 1.5 cm/week, start 6 cm)

5 SKETCHING FROM A STORY

- Label the axes (time is usually x).
- Break the story into pieces: each piece is one segment.
- Steeper segment = faster change. Flat segment = no change.
- "Walks to school, waits at the bus stop, then rides the bus": slow rise, flat, steep rise.

6 CHECK YOURSELF

- Does each input have only one output?
- Is the rate of change constant (linear) or not?
- Did I read the graph from left to right?
- Did I state the rate and starting value with units?