

GRADE 8 · FUNCTIONS · ANSWER KEY

READING A GRAPH QUALITATIVELY

Today's goal: I can describe qualitatively the functional relationship between two quantities by analysing a graph, including where the function is increasing or decreasing, linear or non-linear and sketch a graph that exhibits the qualitative features of a function that has been described verbally.



How to use this key. Problem numbers match the student sheets. Each answer shows the steps and the slip Mr DJ sees most, so a wrong answer tells you what to reteach. Pepper levels: **Mild** warm-up, **Medium** stretch, **Spicy** challenge, **Extra Spicy** big brain.

Practice

9 problems

Use: In-class practice after the deck. Item 5 puts the map-reading error in a setting where a landscape is impossible — a bath cannot be tilted — which makes the misreading visible to the child rather than only to you. Item 8 separates “flat” from “no data”, which nothing else on the sheet reaches. **Timing:** 15–20 min · pairs · items 5 and 7 on the board · sketches on plain paper, no grid.

- 1 covering distance faster 2 a straight line going down, then a horizontal line 3 a curve rising and getting steeper
- 4 for example filling a bath until the taps are turned off, a phone charging to 100%, or a car accelerating to its top speed
- 5 it filled, then was left full, then was emptied 6 increasing
- 7 a falling graph's values go DOWN; a graph rising more slowly still has values going UP, just by less each time
- 8 no — the temperature simply did not change
- 9 because steadily means the same amount of change in each equal step, which is a constant rate, and a constant rate draws a straight line

1 **MILD** A steeper section
covering distance faster

1. More distance in the same time.
2. Steepness is the rate.

Watch for: Said “going uphill”.

2 **MEDIUM** Sketch: falls steadily then constant
a straight line going down, then a horizontal line

1. Steadily means constant rate, so straight.
2. Constant means flat.

Watch for: Curved the fall, or drew it going back up.

3 **MEDIUM** Sketch: rises faster and faster
a curve rising and getting steeper

1. Rising throughout.
2. Getting steeper, so a curve that bends upwards.

Watch for: Drew a straight line, which is rising at a **CONSTANT** rate rather than a growing one.

4 **MEDIUM** A rise-then-flatten situation
for example filling a bath until the taps are turned off, a phone charging to 100%, or a car accelerating to its top speed

1. Something that grows and then stops growing.
2. Charging to full is the cleanest.

Watch for: Described something that rises and then **FALLS**, which is a different shape. Or gave a situation with no natural ceiling, where flattening has no reason.

5 **SPICY** The bath

it filled, then was left full, then was emptied

1. Rising: water going in.
2. Flat: the amount is not changing — taps off, plug in.
3. Falling to zero: draining out.
4. The graph shows the AMOUNT, not the movement of the water.

Watch for: Said the bath was tilted or the water was level. Same map-reading error as the journey, in a setting where a landscape makes no sense at all — which is why this item is first.

6 **SPICY** Increasing but flattening

increasing

1. The value goes up the whole way, so it is increasing.
2. The RATE is decreasing — it slows down.
3. Two different things: the value rises, the rate falls.

Watch for: Answered decreasing. Naming which quantity is falling — the rate, not the value — is what resolves it.

7 **SPICY** Falling against rising more slowly

a falling graph's values go DOWN; a graph rising more slowly still has values going UP, just by less each time

1. Falling: y is smaller than it was.
2. Rising more slowly: y is still bigger than it was, by a smaller amount.
3. One crosses back down, the other never does.
4. On a distance-time graph the difference is turning round versus slowing down.

Watch for: Treated them as the same. This is the confusion of the whole skill and the journey/bath items are its concrete forms.

8 **SPICY** The flat temperature

no — the temperature simply did not change

1. Flat means the value stayed the same, which is a perfectly ordinary thing for a temperature to do.
2. A broken thermometer is a story about the instrument, not something the graph shows.
3. Flat means no change. It does not mean no reading.

Watch for: Said the thermometer broke, or that nothing was recorded. Flat is DATA, not absence of data, and this is worth separating explicitly.

9 **EXTRA SPICY** Why steadily means straight

because steadily means the same amount of change in each equal step, which is a constant rate, and a constant rate draws a straight line

1. Steadily = the same each time.
2. The same change per step is a constant rate.
3. A constant rate is a straight line — that is what linear means.
4. A curve would mean the change itself is changing.

Watch for: Said “because it looks neater”. This links straight back to the “Linear and non-linear” lesson: constant rate means linear.

Homework

8 problems

Use: Homework after the practice sheet, closing Grade 8 Functions. Item 8 is the best item in the skill: two graphs sharing a start, an end and a duration have the SAME average speed and describe different journeys — so the shape carries information the endpoints cannot, which is the entire case for reading graphs qualitatively. **Timing:** 20–25 min · independent · plain paper for the sketches · items 6, 7 and 8 first when marking.

1 she had not set off yet — no distance covered

2 a straight rising line, then a horizontal line

3 a curve dropping steeply then levelling out

4 increasing, and not linear

5 travelled away quickly, stopped for a while, then returned all the way to the start

6 because walking on level ground still covers distance, so the graph would still rise

7 because the question asks about the shape — increasing, decreasing, steepening, flattening — and none of that depends on the numbers

8 both cover the same distance in the same time, so their average speed is equal — but the straight one held a steady speed while the bending one started slower and sped up

1 **MILD** Flat for the first hour

she had not set off yet — no distance covered

1. Time passing, distance unchanged.

Watch for: Said she was walking on the flat.

2 **MEDIUM** Rises steadily then stops rising

a straight rising line, then a horizontal line

1. Steadily → straight. Stops rising → flat, not falling.

Watch for: Drew the second part going down. Stopping rising is not falling.

3 **MEDIUM** Falls quickly then slowly

a curve dropping steeply then levelling out

1. Falling throughout, with the steepness shrinking.

Watch for: Drew it turning back upwards at the end.

4 **SPICY** Up by 10, 4, 1

increasing, and not linear

1. Every step is up, so increasing.

2. The steps shrink, so the rate falls and it is not linear.

Watch for: Answered decreasing.

5 **SPICY** Rise, flat, fall to zero

travelled away quickly, stopped for a while, then returned all the way to the start

1. Steep rise: moving away fast.

2. Flat: stopped.

3. Falling to zero: the distance from home is shrinking, so coming back — and reaching zero means all the way home.

Watch for: Said the last part was going downhill. Falling on a distance-from-home graph means returning, and reaching zero is the detail that makes it unambiguous.

6 **SPICY** Why flat cannot mean flat ground

because walking on level ground still covers distance, so the graph would still rise

1. The vertical axis is distance, not height.

2. Level ground still adds distance, so the line would keep climbing.

3. Only standing still leaves the distance unchanged.

4. The graph shows how far, not what the ground was like.

Watch for: Said “because the graph is not a hill” without explaining. The argument that level ground WOULD still rise is what makes it airtight.

7 **SPICY** Why no scale

because the question asks about the shape — increasing, decreasing, steepening, flattening — and none of that depends on the numbers

1. Qualitative means the description, not the values.
2. A scale invites you to argue with your own points instead of showing the shape.
3. The features are the answer.

Watch for: Said “because it is only a sketch”, which sounds like being allowed to be careless. It is not carelessness; it is that the numbers are not what is being asked for.

8 **EXTRA SPICY** Straight against bending upwards

both cover the same distance in the same time, so their average speed is equal — but the straight one held a steady speed while the bending one started slower and sped up

1. Same start, same end, same total time and distance.
2. So the AVERAGE speed is identical.
3. Straight: constant speed throughout.
4. Bending upwards: slower at first, faster later.
5. Same average, different journeys — which is why the shape carries information the endpoints do not.

Watch for: Said one was faster. They have the same average speed, and this is the best item on the sheet: two graphs can agree on every number you might read off and describe genuinely different journeys.

Exit Ticket

4 problems

Use: End of the qualitative-reading lesson and the last of Grade 8 Functions. 5–8 min, independent. Items 2 and 3 are one diagnostic: a child who describes hills is reading the graph as a map, which is intelligent and wrong, and the correction has to come from the axes rather than from being told. **Timing:** 5–8 min · independent · no calculators, no rulers needed.

1 a horizontal section, then a straight rising section, then a steeply falling section

2 she travelled quickly, then stopped, then travelled again more slowly

3 flat means stopped, not level ground

4 increasing, and not linear

1 **MEDIUM** Sketch the description

a horizontal section, then a straight rising section, then a steeply falling section

1. Flat first: no change.
2. Then a straight line upwards — steadily means constant, so straight.
3. Then steeply down.
4. No scale and no numbers are needed. Steadily means straight, quickly means steep.

Watch for: Added a scale and specific points and then contradicted them; or drew the rise as a curve, when “steadily” means a constant rate and therefore straight.

2 **SPICY** Describe the journey

she travelled quickly, then stopped, then travelled again more slowly

1. Steep rise: covering distance fast.
2. Flat: time is passing and the distance is not changing, so she has STOPPED.
3. Less steep rise: moving again, but slower than before.
4. Nothing goes down, so she never turns back.

Watch for: Described a landscape — up a hill, along the flat, up another hill. That is reading the graph as a picture of the route, which is a coherent misreading and the target of this whole skill.

3



SPICY

Correct Kai

flat means stopped, not level ground

1. Look at the axes: time across, distance up.
2. On the flat part, time is still passing but the distance is not increasing.
3. If the distance is not increasing, she is not moving.
4. Level ground would still cover distance, so the line would still rise — just less steeply.
5. A graph is not a map of the route.

Watch for: Agreed with him, or said “flat means stopped” without explaining. The reason has to come from the AXES, because that is the move that transfers to every other graph.

4



EXTRA SPICY

Rising by 6, 3, 1

increasing, and not linear

1. Every step goes UP, so the value is increasing throughout.
2. But the amounts shrink: 6, then 3, then 1.
3. Changing steepness means it is not linear.
4. So it is increasing at a decreasing RATE — slowing down, never going back.

Watch for: Answered “decreasing” because the increases shrink. This is the second core confusion: the rate is falling while the value is rising, and only the value decides increasing or decreasing.

Lesson slides

teaching notes & timing

Slide	Time	What to do
1	0:00	Say it plainly: this lesson has no arithmetic. Children who have only ever read values off graphs find that unsettling rather than easy.
2	1:00	THE slide. Offer the hill reading yourself — “up a hill, along the flat, up another hill” — because it is what half the class is thinking, and it is an intelligent misreading rather than carelessness.
3	2:30	Fix it by reading the axes aloud. Time across, distance up. Then flat can only mean time passing with no distance gained.
4	4:00	Steepness as speed, with the two legs computed. Both are rising; one is faster.
5	5:30	Flattening against decreasing. This is the second big confusion and it is worth the time: slowing down is not going back.
6	7:00	Linear or not, from steepness alone. Quick — it is the “Linear and non-linear” lesson read off a picture.
7	8:00	Sketching from words, and say explicitly that no numbers are wanted. Children add a scale out of habit and then argue with their own points.
9	9:00	One sketch to try, then the exit ticket. Whiteboards: everyone tries Mild, then climbs. These are #1, #2, #5 on the practice sheet.
10		Fingers up: 3 = got it, 2 = almost, 1 = not yet. Pull the 1s for a quick reteach while everyone else starts the practice sheet.
11		Launch the practice sheet. Exit ticket in the last 5–8 minutes.