Reading a Graph: The Behaviors

Five things to read off any graph, formula or not: intercepts, increasing or decreasing, positive or negative, maximum and minimum, and end behavior. Say where with an inequality, and say what it means in the story.

1 THE VOCABULARY

Words we use

x-intercept — where the graph crosses the x-axis: the output is 0. In a story: lands, empties, breaks even.

y-intercept — where it crosses the y-axis: the input is 0, the starting value.

Increasing, decreasing — climbing or falling as you read left to right. Say where: increasing when $3 < x < 15$.

Positive, negative — above or below the x-axis. A different question from climbing or falling.

Maximum, minimum — the highest and lowest points: give x and y. Can be at an end.

End behavior — the far ends: keeps climbing, keeps falling, levels off. Then: as x goes to infinity, y goes to ...

- Watch out for these.
- Mixing up increasing with positive. Increasing is direction (climbing). Positive is place (above the axis). A graph can climb while below the axis.
- Reading right to left. Always read a graph like a sentence, left to right.
- Giving only the y of a maximum. Give where it happens (x) and how high (y).
- Missing a maximum or minimum at an end of the graph.
- Saying where with a single number. Where is a stretch: use an inequality.

2 THE METHOD

The five-step checklist

1. INTERCEPTS x-intercepts: where y = 0. y-intercept: where x = 0, the start. Say the story meaning of each.
2. INCREASING OR DECREASING read left to right. Climbing: increasing when a < x < b. Falling: decreasing when ...
3. POSITIVE OR NEGATIVE above the x-axis: positive when ... Below: negative when ... Say what below zero means in the story.
4. MAXIMUM AND MINIMUM highest point (x, y) and lowest point (x, y), if there is one.
5. END BEHAVIOR plainly: as x keeps going right, the graph keeps climbing. Named: as x goes to infinity, y goes to infinity.

WHY NO FORMULA IS NEEDED

Every one of the five is a question about the picture: where it crosses, which way it goes, which side of the axis it is on, its top and bottom, its ends. A temperature record has no formula and you can still answer all five.

3 THE CHECKLIST, ALL THE WAY THROUGH

The tossed ball: height (feet) against time (seconds)

x-intercepts: x = 1 and x = 5	the output is 0: at ground level. The ball comes up out of the hole at 1 s and falls back in at 5 s
y-intercept: (0, −5)	the input is 0: at the start, the ball is 5 feet below ground
increasing when x < 3, decreasing when x > 3	read left to right: rising for 3 seconds, then falling
positive when 1 < x < 5; negative when x < 1 or x > 5	above ground between the intercepts, in the hole outside them
maximum (3, 4); no minimum	highest point: 4 feet up at 3 seconds. Both ends keep going down, so no lowest point
as x goes to infinity, y goes to negative infinity	end behavior, said first as: as x keeps going right, the graph keeps falling

CHECK YOURSELF

Between x = 3 and x = 5 the ball is falling (decreasing) but still above ground (positive). If your answers for those two steps are the same stretch every time, look again.

SAY IT OUT LOUD

Intercepts, climbing or falling, above or below, highest and lowest, and the far ends. Read left to right, say where with an inequality, say what it means.

Unit 2, Lesson 4 in one line: run the five-step checklist on any graph, say where with an inequality, and remember that climbing is not the same as being above the axis.