Matching Qualitative Graphs to Story Scenarios

Complete worked example / separate answer key

A cyclist starts at the bottom of a hill, rides uphill for 5 minutes, rests at the top for 2 minutes, then rides downhill for 4 minutes. Sketch the qualitative graph of distance from the start versus time and describe its segments.

Answer: The graph has three segments in order: rise for 5 minutes, plateau for 2 minutes, fall for 4 minutes. If the uphill speed is slower than the downhill speed, the rise is gentler than the fall; if speeds are not stated, any reasonable relative steepness is acceptable under the convention. The plateau is horizontal at the top level. Total time is 11 minutes. Check: three phases match three segments, and the plateau occurs between rise and fall.

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Original tasks 1, 2 / complete keys

Task 1

Story: A candle is lit and burns steadily for 6 minutes, stays at the same height for 1 minute because the flame is shielded, then burns steadily again for 3 minutes. Describe the segment sequence of the qualitative graph of candle height versus time.

Answer: Fall, plateau, fall.

Reason: Burning steadily decreases height, so the first segment falls. Shielding stops the change, giving a plateau. Burning again decreases height, giving a second fall. The order is fall, plateau, fall.

Check: Count story phases: burn, pause, burn = 3 phases. Count segments in the answer: fall, plateau, fall = 3 segments in matching order. Total time 6 + 1 + 3 = 10 minutes is consistent with three time intervals.

Task 2

Story: A runner jogs at a steady speed for 4 minutes, sprints faster for 2 minutes, then walks slowly for 5 minutes. The graph shows speed versus time. Describe the segment sequence and relative steepness.

Answer: Plateau, rise, plateau, fall, plateau. The first plateau is steady jogging speed; the rise shows speeding up to sprint; the second plateau is steady sprinting speed; the fall shows slowing to walking; the final plateau is steady walking speed. Relative steepness of the rise and fall is not specified.

Reason: Jogging at a steady speed means speed is constant, so the first segment is a plateau. Speeding up to sprint increases speed, so the next segment rises. Sprinting at a steady faster speed is another constant speed, so it is a second plateau at a higher level. Slowing to walk decreases speed, so the next segment falls. Walking at a steady slow speed is a final plateau at a lower level. The story does not state how quickly the runner changes speed, so no relative steepness should be required. The sequence is plateau, rise, plateau, fall, plateau.

Check: List phases: steady jog, speed up to sprint, steady sprint, slow to walk, steady walk = 5 phases. The answer has 5 segments in matching order: plateau, rise, plateau, fall, plateau. Check that the first and second plateaus are flat, with the second higher than the first, and that the final plateau is flat and lower than the sprint plateau. Do not require a specific steepness for the rise or fall, since the story does not state how quickly the runner changes speed. Total time 4 + 2 + 5 = 11 minutes matches the three stated durations across five phases.

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Original tasks 3, 4 / complete keys

Task 3

Story: A water tank starts half full. It fills for 3 minutes, stays full for 2 minutes, then drains for 4 minutes until empty. The graph shows water level versus time. Describe the segment sequence and the starting level.

Answer: Rise, plateau, fall; the graph starts at a positive level, not at zero.

Reason: Filling increases the level, so the first segment rises from a positive starting height. Staying full gives a plateau at the top. Draining decreases the level to zero, so the final segment falls to the baseline. The starting level is positive because the tank is half full.

Check: Three phases give three segments. The plateau is between rise and fall. The final level is zero, so the last segment ends at the baseline. Total time 3 + 2 + 4 = 9 minutes matches three intervals.

Task 4

Story: A hiker climbs for 2 minutes, rests for 3 minutes, climbs faster for 1 minute, then descends for 4 minutes. The graph shows elevation versus time. Describe the segment sequence and identify which rise is steeper.

Answer: Rise, plateau, steeper rise, fall. The third segment is the steeper rise.

Reason: Climbing increases elevation, so the first segment rises. Resting gives a plateau. Climbing faster gives a second rise that is steeper than the first. Descending decreases elevation, so the last segment falls. The sequence is rise, plateau, steeper rise, fall.

Check: Four phases give four segments. The plateau is second, and the steeper rise is third. Total time 2 + 3 + 1 + 4 = 10 minutes matches four intervals. Check that the final segment falls and ends lower than the highest point.

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Task 1, Task 2, Task 3, Task 4 / Answer key: segment sequences and reasoning

Text-only key for genuinely qualitative tasks. Each answer is explained by segment sequence; relative steepness is noted only when the story states it.

Exercise 1: Fall, plateau, fall. Burning steadily decreases height, so the first segment falls. Shielding stops the change, giving a plateau. Burning again decreases height, giving a second fall. Check: 3 phases = 3 segments in matching order; total time 6 + 1 + 3 = 10 minutes.

Exercise 2: Plateau, rise, plateau, fall, plateau. The first plateau is steady jogging speed; the rise shows speeding up to sprint; the second plateau is steady sprinting speed; the fall shows slowing to walking; the final plateau is steady walking speed. Relative steepness of the rise and fall is not specified. Check: 5 phases = 5 segments in matching order; second plateau higher than first; final plateau lower than sprint plateau; total time 4 + 2 + 5 = 11 minutes.

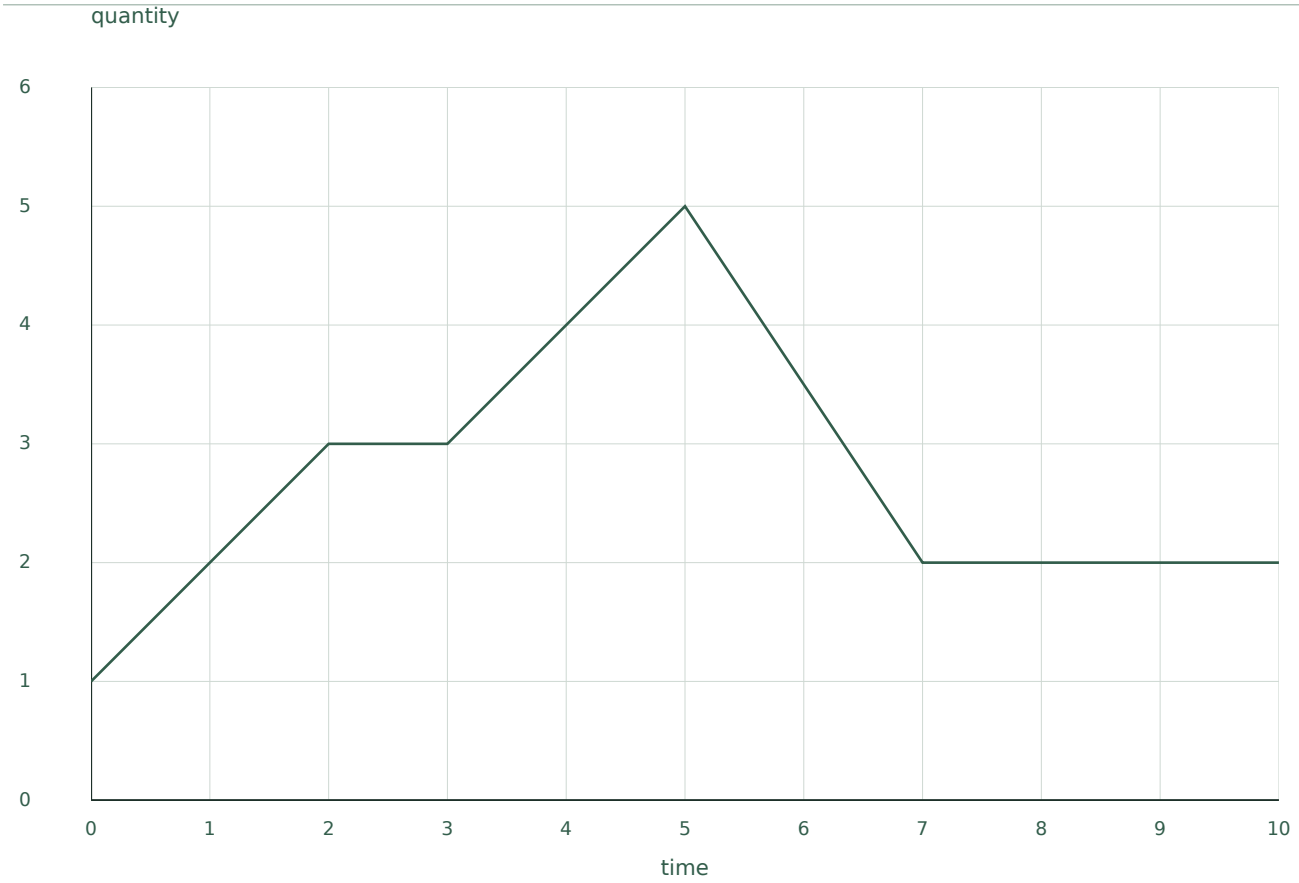
Exercise 3: Rise, plateau, fall; the graph starts at a positive level, not at zero. Filling increases the level, so the first segment rises from a positive starting height. Staying full gives a plateau at the top. Draining decreases the level to zero, so the final segment falls to the baseline. Check: 3 phases = 3 segments; plateau between rise and fall; final level zero; total time 3 + 2 + 4 = 9 minutes.

Exercise 4: Rise, plateau, steeper rise, fall. The third segment is the steeper rise. Climbing increases elevation, so the first segment rises. Resting gives a plateau. Climbing faster gives a second rise steeper than the first. Descending decreases elevation, so the last segment falls. Check: 4 phases = 4 segments; plateau second; steeper rise third; total time 2 + 3 + 1 + 4 = 10 minutes; final segment falls and ends lower than the highest point.

Rubric: (1) Graph divided into segments at every change of direction. (2) Each segment labeled rise, fall, or plateau. (3) Sequence matches the order of events in the story. (4) Relative steepness used only when the story gives comparative speed or rate information. (5) Starting and ending behavior consistent with the story. (6) Sketch follows the baseline-midline convention and is clear enough to read. (7) Valid alternative sketches with the same segment sequence areaccepted

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Worked example / Convention diagram: baseline, midline, rise, fall, plateau



Segments in order: rise (0-2), plateau (2-3), fall (3-5), plateau (5-7), fall (7-10). Baseline at y=0; midline at y=3.

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Source rubric / reflection

- [ ] Graph is divided into segments at every change of direction.
- [ ] Each segment is labeled rise, fall, or plateau.
- [ ] The sequence of segments matches the order of events in the story.
- [ ] Relative steepness is used only when the story gives comparative speed or rate information.
- [ ] Starting and ending behavior are consistent with the story.
- [ ] Sketch follows the baseline-midline convention and is clear enough to read.
- [ ] Valid alternative sketches with the same segment sequence are accepted when the story does not specify relative steepness.

Reflection: What did you check, what did you change, and what will you try next?