Accelerated 7 · Unit 5 · Assessment Guide

Linear Relationships

For the Parent or Teacher — What to look for

Unit 5 is the heart of grade 8: linear relationships in multiple representations (tables, graphs, equations, situations) and the move to systems of equations. Students also begin formal data analysis. Watch for fluency moving across representations and meaningful interpretation in context.

Problem 1 — Printer proportional

- (a) Yes, proportional — constant rate, passes through origin (0 pages in 0 seconds).
- (b) p = 0.4s OR s = 2.5p. Either is fine; check units.
- (c) k = 0.4 (pages per second) OR 2.5 (seconds per page). Meaning: rate of printing.
- Strong: chooses one direction and clearly states units. Weak: writes 4/10 without simplifying or saying which variable depends on which.

Problem 2 — Taxi linear (not proportional)

- Values: 4, 9, 16.50, 29. Equation: C = 4 + 2.50m.
- KEY: a relationship can be LINEAR but not PROPORTIONAL (here, because of the $4 fee, no proportionality — when m=0, C=$4 not $0).
- Many students will say it IS proportional. Diagnose by checking C/m: 9/2 = 4.5; 16.50/5 = 3.3 — not constant.

Problem 3 — Table analysis

- Differences in y per unit x: from x=0 to x=2 is +6 in y for +2 in x = slope 3. From 2 to 4: +6/+2 = 3. Constant rate of change -> linear. y = 3x + 5.
- NOT proportional because when x=0, y=5, not 0.
- Strong: explicitly notes the (0, 5) y-intercept rules out proportionality.

Problem 4 — Equation of a line

- Slope = (11-5)/(4-1) = 6/3 = 2. Use point: 5 = 2(1) + b -> b = 3. Equation: y = 2x + 3.
- Watch for arithmetic and sign errors; check by plugging in the other point.

Problem 5 — Line with slope -3/4, y-intercept 6

- (a) y = -(3/4)x + 6.
- (b) x-intercept: 0 = -(3/4)x + 6 -> x = 8.
- (c) The account STARTED with $6 (at year 0). Y-intercept = initial value.
- Strong contextual interpretation distinguishes y-intercept (initial state) from slope (rate of change).

Problem 6 — System y=2x+1 and y=-x+7

- Set equal: 2x + 1 = -x + 7 -> 3x = 6 -> x = 2, y = 5. Solution: (2, 5).
- Slopes: 2 and -1. Y-intercepts: 1 and 7.
- Strong: explicitly checks the solution in BOTH equations.

Problem 7 — Phone plans

- 0.05m = 10 + 0.02m -> 0.03m = 10 -> m ≈ 333.33 minutes.
- At ~333 minutes, both plans cost $16.67.

- Strong contextual interpretation: "below 333 min, Plan A is cheaper; above, Plan B is cheaper."

Problem 8 — Line of fit interpretation

- (a) y = 4(8) + 60 = 92.
- (b) For each extra hour of study, score increases by about 4 points.
- (c) Y-intercept 60 = predicted score for 0 hours. Plausible (some baseline knowledge) but not necessarily meaningful for everyone.
- (d) At 25 hours, predicted score is 160 — beyond the maximum possible. Extrapolation outside the data range is unreliable.
- THIS is the diagnostic question — does the student RESIST extrapolation? Best answers note that linear models don't extend beyond reasonable data range.

Problem 9 — Same slope, different intercepts

- Parallel lines never meet -> no solution.
- Strong: justifies by saying the lines have the same direction but different starting points, so they can't cross.
- Weak: tries to solve algebraically without recognizing the structural insight.

Problem 10 — Andre and Mai race

- (a) Andre: y = 20 + 4t. Mai: y = 6t.
- (b) 6t = 20 + 4t -> 2t = 20 -> t = 10 seconds; at 60 meters.
- (c) Y-intercept = starting position. Slope = speed.
- Watch: do they recognize the 20-meter head-start as the y-intercept? Common confusion: putting Andre's head-start as slope.

Problem 11 — Two cities, different correlations

- Strong answers offer plausible alternative explanations:
- City Y might already have abundant rainfall everywhere (no variation to detect signal).
- Other factors (soil, sunlight, temperature) might dominate in City Y.
- Range of precipitation values in City Y might be too narrow.
- This is a SCIENTIFIC REASONING question. Zero correlation doesn't mean no relationship — it means no LINEAR relationship in THAT data.

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