Sets & Steps

Math Practice & Worked Solutions

Algebra 1

Linear Models from Initial Value and Rate

Linear Models from Initial Value and Rate | A1-U05-P16

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for an exact affine rule, domain, interpretation, or corrected model.

8 PDFs and a README; 50 buyer pages.

The following pages use the same questions, given data, and notation as the final files. Question/card serial numbers and internal IDs are omitted in this preview only. Table values and matching responses are retained. Full answer keys are not included.

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Algebra 1

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Name: ____________ **Date:** ____________ **Class:** ____________

Answer each question and record the matching bank letter. Give exact values. A value without its unit is not a complete answer.

At use count $18,250$ grams remain and 15 grams are used per count. Construct an anchored linear model and then rewrite it to identify $Q(0)$. Do not treat the value at $t = 18$ as the intercept. Bank label: ______	At week 40, a fund is 1000 dollars and then changes -22 dollars per week. Construct an anchored linear model and then rewrite it to identify $Q(0)$. Do not treat the value at $t = 40$ as the intercept. Bank label: ______
A vertical coordinate starts at 3 units and changes by $-\frac{7}{3}$ units per step. Let t be the number of steps. Construct $Q(t)$ in units; identify the value at $t = 0$ and preserve the sign of the supplied rate. Bank label: ______	At $t = -8$ relative to calibration, a signal is 12 and rises $\frac{5}{2}$ per time unit. Construct an anchored linear model and then rewrite it to identify $Q(0)$. Do not treat the value at $t = -8$ as the intercept. Bank label: ______
An inventory starts at 100 and processes at most 8 whole orders. Use the supplied initial-rate rule $Q(t) = 100 - 12t$. State the valid domain for t in orders, combining input type with the process limit. Bank label: ______	For the contextual model $Q(t) = 4 - \frac{1}{3}t$ on domain $-6 \le t \le 0$, explain the intercept and slope in the original units and say whether $Q(0)$ is observed or extrapolated. Q is a historical offset and $t = 0$ is the end of the observation window. Bank label: ______
A process has initial value 9 miles and rate 45 miles per hour. Express its model using meters and input measured in seconds; output counts multiply by $\frac{201168}{125}$ and input counts by 3600. Bank label: ______	For the contextual model $Q(t) = 31 + 5t$ on domain $t \ge 7$, explain the intercept and slope in the original units and say whether $Q(0)$ is observed or extrapolated. Q is a quantity measured from a baseline date, but observations start seven periods later. Bank label: ______

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Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. A value without its unit is not a complete answer.

A temperature deviation rises from -10 to a cutoff of 8. Use the supplied initial-rate rule $Q(t) = -10 + \frac{9}{4}t$. State the valid domain for t in hours, combining input type with the process limit.	A signed elevation is -5 meters at time zero and falls 2 meters per kilometer traveled. Let t be the number of kilometers. Construct $Q(t)$ in meters; identify the value at $t = 0$ and preserve the sign of the supplied rate.
A process has initial value 2 liters and rate 6 liters per package. Express its model using liters and input measured in items; output counts multiply by 1 and input counts by 3.	A process has initial value $\frac{13}{6}$ gallons and rate $-\frac{17}{9}$ gallons per hour. Express its model using quarts and input measured in minutes; output counts multiply by 4 and input counts by 60.
A process has initial value 12 liters and rate 5 liters per hour. Express its model using milliliters and input measured in minutes; output counts multiply by 1000 and input counts by 60.	At $t = \frac{3}{2}$ days, a total is 9 and grows 4 units per day. Construct an anchored linear model and then rewrite it to identify $Q(0)$. Do not treat the value at $t = \frac{3}{2}$ as the intercept.

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Begin at START. Answer the card, then find the matching final answer at the top of another card. Use the recording sheet for your reasoning. Visit each card once and continue to FINISH.

Incoming: At t = 4, $A = 18$ and $B = 17$. Both initial value and rate change, so neither parameter alone explains the output gap.

For the contextual model $Q(t) = -5 - 4t$ on domain $-2 \le t \le 6$, explain the intercept and slope in the original units and say whether $Q(0)$ is observed or extrapolated. Q is position relative to a marker and $t = 0$ is a chosen clock reference.

Your response: ______________

Incoming: In $Q(t) = -5 - 4t$, -5 is observed at the chosen zero; -4 is the signed output change per one input unit. Context: Q is position relative to a marker and $t = 0$ is a chosen clock reference.

Models $A(t) = 18 - \frac{1}{2}t$ and $B(t) = 18 - \frac{3}{4}t$ have the same starting value. Explain how the changed rate affects later outputs and compare them at $t = 10$.

Your response: ______________

Incoming: In $Q(t) = 72 - 9t$, 72 is observed at the chosen zero; -9 is the signed output change per one input unit. Context: Q is percentage points remaining, not a multiplicative percent change.

Compare the redesigned affine models $A(t) = -10 + 7t$ and $B(t) = 5 + 3t$. Separate the start change from the rate change before checking $t = 4$.

Your response: ______________

Incoming: At t = 6, $A = 100$ and $B = 120$. Both initial value and rate change, so neither parameter alone explains the output gap.

For the contextual model $Q(t) = 500 + 20t$ on domain $0 \le t \le 6$, explain the intercept and slope in the original units and say whether $Q(0)$ is observed or extrapolated. Q includes a fixed setup contribution plus production over hours.

Your response: ______________

Incoming: At t = 7, $A = 44$ and $B = 65$. The models start together, and their rate difference changes the gap with t.

For the contextual model $Q(t) = 90$ on domain $0 \le t \le 12$, explain the intercept and slope in the original units and say whether $Q(0)$ is observed or extrapolated. Q is a fixed sensor reading and t is hours.

Your response: ______________

Incoming: $Q(t) = 0 + \frac{7}{3}(t - 12)$, equivalently $Q(t) = -28 + \frac{7}{3}t$; therefore $Q(0) = -28$.

A process has initial value 0 items and rate 300 items per hour. Express its model using items and input measured in minutes; output counts multiply by 1 and input counts by 60.

Your response: ______________

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Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

Choose an efficient method, explain why it fits the given representation, and then complete the task exactly. Compare the redesigned affine models $A(t) = 500 + 20t$ and $B(t) = 450 + 25t$. Separate the start change from the rate change before checking $t = 4$.

Choose an efficient method, explain why it fits the given representation, and then complete the task exactly. Both parameters differ in $A(t) = 8 + \frac{3}{2}t$ and $B(t) = 12 + \frac{1}{2}t$. Compare the exact rational starts and rates, then evaluate each at $t = 6$.

Models $A(t) = 10 + 3t$ and $B(t) = 16 + 3t$ share one rate. Isolate the effect of changing the initial value, then check the fixed gap at $t = 4$.

Models $A(t) = 6 + 12t$ and $B(t) = 9 + 12t$ share one rate. Isolate the effect of changing the initial value, then check the fixed gap at $t = \frac{5}{2}$.

Linear Models from Initial Value and Rate

Full Worked Solutions - excerpt

Worked example

Problem. At use count $18, 250$ grams remain and 15 grams are used per count. Construct an anchored linear model and then rewrite it to identify $Q(0)$. Do not treat the value at $t = 18$ as the intercept.

Answer. $Q(t) = 250 - 15(t - 18)$, equivalently $Q(t) = 520 - 15t$; therefore $Q(0) = 520$.

Explanation and check.

Start from the reference form using $(t - 18)$ and rate -15. Expanding gives the initial value

$$250 - (-15)(18) = 520$$

Worked example

Problem. At week 40, a fund is 1000 dollars and then changes -22 dollars per week. Construct an anchored linear model and then rewrite it to identify $Q(0)$. Do not treat the value at $t = 40$ as the intercept.

Answer. $Q(t) = 1000 - 22(t - 40)$, equivalently $Q(t) = 1880 - 22t$; therefore $Q(0) = 1880$.

Explanation and check.

Start from the reference form using $(t - 40)$ and rate -22. Expanding gives the initial value

$$1000 - (-22)(40) = 1880$$