Sets & Steps
Math Practice & Worked Solutions

Algebra 1

Direct Variation & Linear Models | Algebra 1 | 3-Topic Bundle

3-topic bundle | 288 problems | Four activity formats

In every topic

Answer Bank Challenge	24 tasks
Grid Rounds	24 tasks
Match & Move	24 cards
Error Analysis & Strategy	24 tasks
Quick Answer Key and Full Worked Solutions	included
Teacher / Parent Use Guide and Terms of Use	included

Product previews

The following preview pages show the cover, all four activity formats, and worked examples for each included resource, in the listed order.

24 PDFs and 3 READMEs; 172 buyer PDF pages across the 3 products.

Preview pages are not included in the buyer page count. Check the list against resources you already own.

This is a fixed collection of the listed products. Purchase includes the existing individual resource files. To open a product's online preview, follow its title link and select View Preview.

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Sets & Steps
Math Practice & Worked Solutions

Algebra 1

Direct Variation

Direct Variation | A1-U05-P15

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for an exact rule, value, graph description, or justified verdict.

8 PDFs and a README; 72 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

Direct Variation

Name: ______________ **Date:** ______________ **Class:** ______________

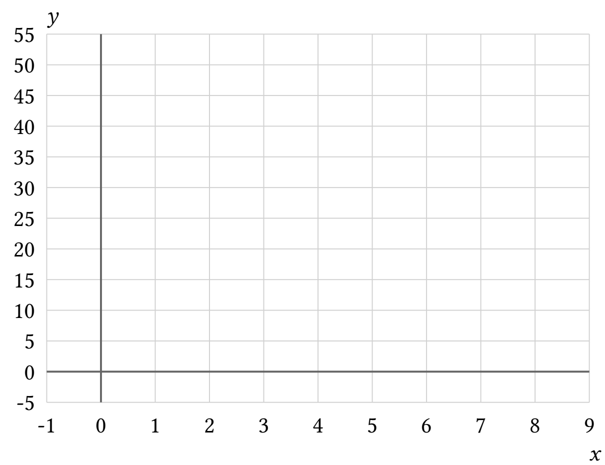
Answer each question and record the matching bank letter. Give exact values. A value without its unit is not a complete answer.

Scale the fractional proportional pair $(21, -14)$ to the target input $-\frac{9}{2}$. Give the exact target output.

Input x	Output y
21	-14

Bank label: ______

Construct the graph of $y = 6x$ on the domain $2 \le x < 8$. Use the exact sample inputs $2, 5, 7$ and state whether points should be connected.



Bank label: ______

A direct-variation constant is $\frac{17}{6}$ dollars per hour. In the new units, each output number is multiplied by 100 and each input number by 3600. Find the constant in cents per second and verify an equivalent pair.

Bank label: ______

The declared domain currently includes only input 0, with output 0. Can the constant of direct variation be recovered uniquely? State the full set of possible constants.

Bank label: ______

Algebra 1

Direct Variation

Name: ______________ **Date:** ______________ **Class:** ______________

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.

Determine whether this exact relation is a direct variation: the relation $6y + 3 = 12x$ Explain which required invariant is decisive.

A declared $y = kx$ relation contains the fractional pair $(8, 6)$. Compute the exact quotient and write the rule.

Input x	Output y
8	6

The fractional direct-variation pair $(14, -\frac{11}{2})$ is known. Recover the input that would produce $y = \frac{33}{8}$.

Input x	Output y
14	$-\frac{11}{2}$

Scale the fractional proportional pair $(\frac{11}{4}, -\frac{13}{6})$ to the target input $-\frac{9}{5}$. Give the exact target output.

Input x	Output y
$\frac{11}{4}$	$-\frac{13}{6}$

A graph marks the origin but gives no other point or slope. Can the constant of direct variation be recovered uniquely? State the full set of possible constants.

A declared $y = kx$ relation contains the fractional pair $(\frac{3}{2}, 9)$. Compute the exact quotient and write the rule.

Input x	Output y
$\frac{3}{2}$	9

Algebra 1

Direct Variation

Name: ______________ **Date:** ______________ **Class:** ______________

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: Plot $(0,0),(1,12),(\frac{3}{2},18)$. Connect the admissible points as the stated continuous domain requires. The origin is included and must be plotted.

Compare the two patterns: A has pairs $(5,-2),(15,-6),(25,-10)$. B has $(-2,5),(-6,15),(-10,25)$. Classify proportional versus additive structure and name the invariant used.

Your response: ______________

Incoming: both proportional, with reciprocal constants. A has $k=-\frac{2}{5}$ and B has $k=-\frac{5}{2}$; swapping coordinates changes k but not proportionality.

The direct variation contains $(12,0)$ with a nonzero input. Determine the only possible k and describe the rule.

Input x	Output y
12	0

Your response: ______________

Algebra 1

Direct Variation

Name: ______________ **Date:** ______________ **Class:** ______________

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.

Audit this direct-variation reasoning: From the pair $(4, 12)$, a student reports $k = \frac{x}{y} = \frac{1}{3}$ in $y = kx$. Identify the first invalid inference and correct it.

Audit this direct-variation reasoning: Two constraints demand $k = \frac{5}{3}$ and $k = \frac{10}{6}$; a student treats the fractions as different and rejects the model. Identify the first invalid inference and correct it.

Audit this direct-variation reasoning: A table includes $(0, 5), (2, 6), (4, 12)$. A student ignores the zero row because $\frac{y}{x}$ cannot be formed there. Identify the first invalid inference and correct it.

Audit this direct-variation reasoning: A student calls $y = 3x + 2$ a direct variation because its slope is constant. Identify the first invalid inference and correct it.

Direct Variation

Full Worked Solutions - excerpt

Worked example

Problem. Scale the fractional proportional pair $(21, -14)$ to the target input $-\frac{9}{2}$. Give the exact target output.

Input x	Output y
21	-14

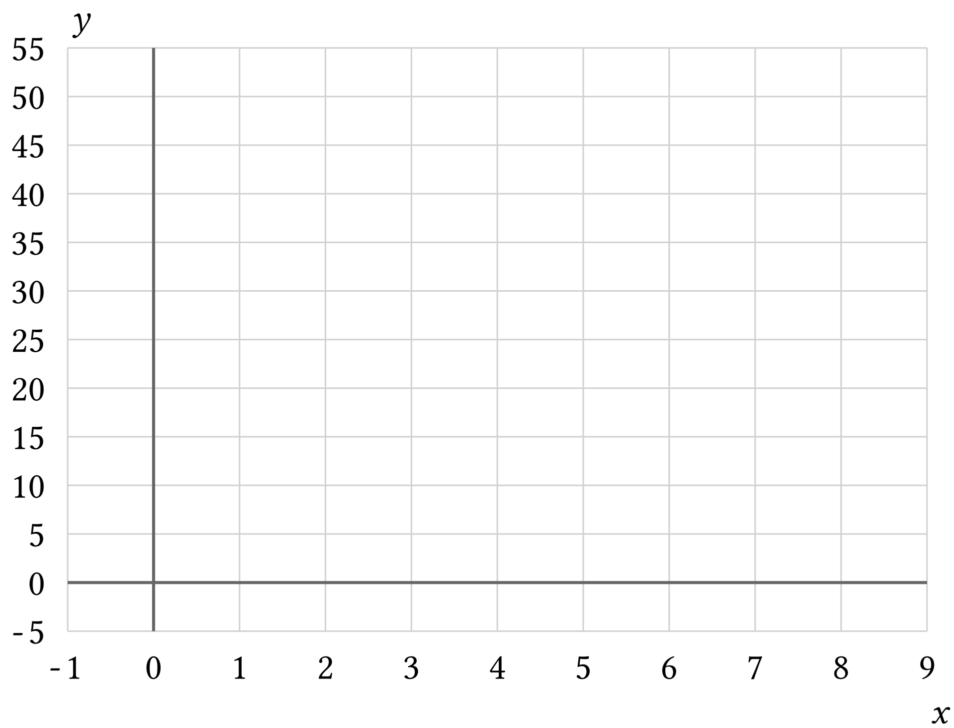
Answer. Using the known pair $(21, -14), y = 3$ at $x = -\frac{9}{2}$; $k = -\frac{2}{3}$.

Explanation and check.

The exact ratio is $-\frac{2}{3}$. Fraction multiplication gives $(-\frac{2}{3})(-\frac{9}{2}) = 3$.

Worked example

Problem. Construct the graph of $y = 6x$ on the domain $2 \leq x < 8$. Use the exact sample inputs $2, 5, 7$ and state whether points should be connected.



Answer. Plot $(2, 12), (5, 30), (7, 42)$. Use a continuous segment or ray only over the declared interval. The displayed domain excludes or does not sample 0, although the zero-offset rule is still proportional.

Explanation and check.

Each output is kx with $k = 6$. Use a continuous segment or ray only over the declared interval. The displayed domain excludes or does not sample 0, although the zero-offset rule is still proportional.

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.

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Algebra 1

Linear Models from Initial Value and Rate

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 $-6 \leq t \leq 0$, 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 $t \geq 7$, 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: ______

Algebra 1

Linear Models from Initial Value and Rate

Name: ______________ **Date:** ______________ **Class:** ______________

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.

Algebra 1

Linear Models from Initial Value and Rate

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

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: ____________

Algebra 1

Linear Models from Initial Value and Rate

Name: ______________________ **Date:** ______________________ **Class:** ______________________

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

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

Sets & Steps
Math Practice & Worked Solutions

Algebra 1

Evaluating Linear Models in Context

Evaluating Linear Models in Context | A1-U05-P17

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for an exact prediction with a context-qualified conclusion.

8 PDFs and a README; 50 buyer pages.

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Algebra 1

Evaluating Linear Models in Context

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.

A newly appended row has input 4 and output $\frac{47}{6}$. Test it against $Q(t) = -\frac{5}{2} + \frac{7}{3}t$ with absolute tolerance $\frac{1}{2}$, and say what an out-of-band result establishes. Bank label: _______	A supporting table covers inputs −8 through −1, and the rule's domain is $-10 \le t \le 3$. Locate $t = -5$ relative to the evidence and classify this within-span prediction. Bank label: _______
For the supplied rule $Q(t) = \frac{11}{3} + \frac{13}{7}t$, evaluate at $t = 14$ and compare with observed value 29. Use $\lvert\text{observed-predicted}\rvert \le \frac{2}{3}$ as the consistency rule. Bank label: _______	A supporting table covers inputs 0 through 18, and the rule's domain is $0 \le t \le 20$. Locate $t = 11$ relative to the evidence and classify this within-span prediction. Bank label: _______
The supplied model is $Q(t) = 18 + 7t$ on t in $\{0, 1, \ldots, 12\}$. At what t, measured in batches, does Q reach 60? Solve and verify that the predicted input is admissible. Bank label: _______	For the forecast $Q(t) = 18 + 5t$ at $t = 12$, the intercept changes by 7 and the rate changes by −1. Combine the two effects exactly and state the net prediction change. Bank label: _______
The supplied model is $Q(t) = 25 + 11t$ on t in $\{0, 1, \ldots, 10\}$. At what t, measured in days, does Q reach 102? Solve and verify that the predicted input is admissible. Bank label: _______	The supplied forecast is $Q(t) = \frac{9}{2} + \frac{7}{3}t$. At $t = 3$ it is being used under this condition: completed packages must be whole. Compute the output and decide whether the contextual interpretation is feasible; identify the decisive condition. Bank label: _______

Algebra 1

Evaluating Linear Models in Context

Name: ______________ **Date:** ______________ **Class:** ______________

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.

The supplied forecast is $Q(t) = -15 + 11t$. At $t = 12$ it is being used under this condition: domain is $2 \le t \le 9$ and capacity is 80. Compute the output and decide whether the contextual interpretation is feasible; identify the decisive condition.	Check observation $Q = -1$ at $t = 9$ against $Q(t) = 12 - \frac{3}{2}t$, allowing error of at most 1. Report the signed and absolute residual before judging agreement.
The established rule is $Q(t) = 320 - 18(t - 12)$, where Q measures stored energy in kilowatt-hours and t is days. Within $0 \le t \le 18$, predict $Q(5)$ and interpret the reference shift $t = 12$.	A decreasing model for reservoir depth is $Q(t) = 51 - 5t$. Its modeled domain is $0 \le t \le 9, Q$ is measured in feet, and t in days. Evaluate the admissible forecast at $t = \frac{13}{2}$ and state what the sign means.
A decreasing model for candle height is $Q(t) = 24 - 3t$. Its modeled domain is $0 \le t \le 8, Q$ is measured in centimeters, and t in hours. Evaluate the admissible forecast at $t = 5$ and state what the sign means.	The supplied forecast is $Q(t) = 72 - 9t$. At $t = 8$ it is being used under this condition: inventory must be nonnegative. Compute the output and decide whether the contextual interpretation is feasible; identify the decisive condition.

Algebra 1

Evaluating Linear Models in Context

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

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: The target $\frac{95}{18}$ is reached at $t = \frac{31}{7}$ seconds, an allowed input in $0 \le t \le 6$.

A newly appended row has input 12 and output 28. Test it against $Q(t) = 80 - 5t$ with absolute tolerance 2, and say what an out-of-band result establishes.

Your response: ____________

Incoming: The model predicts 20; residual observed-predicted is 8, whose absolute value is 8. That is outside the tolerance 2, so the observation is not consistent with the model at this tolerance. This comparison alone does not establish a cause.

Audit this forecast statement: A model for completed shipments reaches a target algebraically at $t = 4.6$, and the report claims the target occurs during shipment 4.6. Identify the first unjustified step and write a repaired, qualified conclusion.

Your response: ____________

Incoming: The prediction changes by 6, from 26 to 32. A positive value means an increase and a negative value a decrease.

The supplied model is $Q(t) = \frac{11}{6} + \frac{7}{9}t$ on $0 \le t \le 6$. At what t, measured in seconds, does Q reach $\frac{95}{18}$? Solve and verify that the predicted input is admissible.

Your response: ____________

Incoming: The target 132 is reached at $t = 7$ cycles, an allowed input in $0 \le t \le 15$.

The initial value in $Q(t) = -5 + 7t$ is recalibrated by 11 while the rate stays fixed. Quantify the prediction change at $t = 6$ and explain whether the horizon amplifies it.

Your response: ____________

Incoming: This is extrapolation: -5 lies outside the observed input interval $[-2, 6]$. It is inside the declared model domain, but the classification alone does not guarantee empirical accuracy; continued linear behavior is an assumption wherever direct observations are absent.

The supplied forecast is $Q(t) = 5 + \frac{3}{2}t$. At $t = 5$ it is being used under this condition: output counts people and must be whole. Compute the output and decide whether the contextual interpretation is feasible; identify the decisive condition.

Your response: ____________

Incoming: $Q(8) = 53$ dollars. It predicts balance relative to zero of 53 dollars at 8 payments.

The zero-rate rule $Q(t) = -7$ is used on $-4 \le t \le 9$. Identify all allowed t in seconds for which $Q(t) = 5$, or explain why none exist.

Your response: ____________

Algebra 1

Evaluating Linear Models in Context

Name: ______________ **Date:** ______________ **Class:** ______________

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.

Evidence in a table stops at the span $[0, 7]$, and the model itself is restricted to $0 \le t \le 12$. Assess the proposed forecast input 16 against both limits.

Audit this forecast statement: A rule gives distance in miles with t in hours. A student evaluates it correctly but reports the result as miles per hour. Identify the first unjustified step and write a repaired, qualified conclusion.

The first and last tabulated inputs are 9 and 27. For domain $0 \le t \le 35$, classify use of the rule exactly at $t = 27$ and distinguish an endpoint from beyond-range use.

A student states a conclusion from the visible representation without preserving all stated associations, constraints, or units. Diagnose the specific reasoning error, then complete the original task: Audit this forecast statement: A rate 2.46 is rounded to 2 before multiplying by 18, and the final forecast is reported to the nearest tenth. Identify the first unjustified step and write a repaired, qualified conclusion.

Evaluating Linear Models in Context

Full Worked Solutions - excerpt

Worked example

Problem. A newly appended row has input 4 and output $\frac{47}{6}$. Test it against $Q(t) = -\frac{5}{2} + \frac{7}{3}t$ with absolute tolerance $\frac{1}{2}$, and say what an out-of-band result establishes.

Answer. The model predicts $\frac{41}{6}$; residual observed-predicted is 1, whose absolute value is 1. That is outside the tolerance $\frac{1}{2}$, so the observation is not consistent with the model at this tolerance. This comparison alone does not establish a cause.

Explanation and check.

Prediction $\frac{41}{6}$ and observation $\frac{47}{6}$ have absolute gap 1, larger than allowed tolerance $\frac{1}{2}$.

Worked example

Problem. A supporting table covers inputs -8 through -1, and the rule's domain is $-10 \leq t \leq 3$. Locate $t = -5$ relative to the evidence and classify this within-span prediction.

Answer. This is interpolation: -5 lies strictly between observed inputs -8 and -1. It is inside the declared model domain, but the classification alone does not guarantee empirical accuracy; continued linear behavior is an assumption wherever direct observations are absent.

Explanation and check.

The requested input lies between -8 and -1, so the prediction uses the model within the observed span.