Sets & Steps
Math Practice & Worked Solutions

Algebra 1

Linear, Quadratic, and Exponential Functions

Linear, Quadratic, and Exponential Functions | A1-U09-P15

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for correct transformed comparison, exact finite changes, rates, and justified comparison, finite evidence, assumption audit, and justified eventual conclusion, matching family rule and interval-aware evidence, quadratic curve and why sign alone fails and quadratic and exponential identifications.

8 PDFs and a README; 114 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

Linear, Quadratic, and Exponential Functions

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.

The input gaps in the exact table are unequal. The possible rules are $y = 2x + 1$, $y = x^2 + 1$, and $y = (2)^x$. Which rule generated the table, and what interval-aware evidence rules out using raw output changes alone? Normalize every change by its input gap. Match the complete original model comparison, all requested predictions or changes/rates and ties. For unequal steps, include the full normalized interval-rate evidence with the selected rule and family.

x	y
0	1
1	3
3	7
6	13

Input steps	1, 2, 3
Candidate rules	$y = 2x + 1$, $y = x^2 + 1$, $y = (2)^x$

Bank label: ______

The input gaps in the exact table are unequal. The possible rules are $y = 3x - 1$, $y = x^2$, and $y = (2)^x$. Which rule generated the table, and what interval-aware evidence rules out using raw output changes alone? Changing raw differences do not by themselves prove exponential behavior. Match the complete original model comparison, all requested predictions or changes/rates and ties. For unequal steps, include the full normalized interval-rate evidence with the selected rule and family.

x	y
0	0
1	1
3	9
4	16

Input steps	1, 2, 1
Candidate rules	$y = 3x - 1$, $y = x^2$, $y = (2)^x$

Bank label: ______

The input gaps in the exact table are unequal. The possible rules are $y = 4x - 1$, $y = x^2 + x + 1$, and $y = (2)^x$. Which rule generated the table, and what interval-aware evidence rules out using raw output changes alone? A gap of two should compound the per-unit factor twice. Match the complete original model comparison, all requested predictions or changes/rates and ties. For unequal steps, include the full normalized interval-rate evidence with the selected rule and family.

x	y
0	1
1	2
3	8
4	16

Input steps	1, 2, 1
Candidate rules	$y = 4x - 1$, $y = x^2 + x + 1$, $y = (2)^x$

Bank label: ______

The input gaps in the exact table are unequal. The possible rules are $y = -3x + 8$, $y = -x^2 + 2x + 8$, and $y = 8(\frac{1}{2})^x$. Which rule generated the table, and what interval-aware evidence rules out using raw output changes alone? Keep the signs in the interval rates. Match the complete original model comparison, all requested predictions or changes/rates and ties. For unequal steps, include the full normalized interval-rate evidence with the selected rule and family.

x	y
0	8
2	2
3	-1
6	-10

Input steps	2, 1, 3
Candidate rules	$y = -3x + 8$, $y = -x^2 + 2x + 8$, $y = 8(\frac{1}{2})^x$

Bank label: ______

Algebra 1

Linear, Quadratic, and Exponential Functions

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.

Classify the exact table generated on $x = 0, 1, 2, 3$ among linear, quadratic, exponential, or neither. Use first differences.

x	y
0	1
1	4
2	7
3	10

Equal input step	1

Classify the exact table generated on $x = 0, 1, 2, 3$ among linear, quadratic, exponential, or neither. A quadratic candidate must be considered.

x	y
0	0
1	1
2	4
3	9

Equal input step	1

Classify the exact table generated on $x = 0, 1, 2, 3$ among linear, quadratic, exponential, or neither. Compare ratios as well as differences.

x	y
0	2
1	4
2	8
3	16

Equal input step	1

Classify the exact table generated on $x = 0, 1, 2, 3, 4$ among linear, quadratic, exponential, or neither. Translation does not remove curvature.

x	y
0	3
1	4
2	9
3	18
4	31

Equal input step	1

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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.

START

On $x = 1$ to $x = 3$, which of the listed linear, quadratic, and exponential rules has the greatest net change? Report all three exact changes and justify the quadratic comparison. Evaluate endpoints exactly. Match the complete original model comparison, all requested predictions or changes/rates and ties. For unequal steps, include the full normalized interval-rate evidence with the selected rule and family.

Interval	1, 3
Rules	Linear: $y = 4x$ Quadratic: $y = 2x^2$ Exponential: $y = 2(2)^x$

Your response: ____________

Incoming: average rates: exponential: $\frac{211}{80}$; linear: 6; quadratic: 6; changes: exponential: $\frac{211}{16}$; linear: 30; quadratic: 30; descending change groups: linear and quadratic, exponential

Compute each model's average rate of change on $[-1, 5]$. Order the rates and explain why this finite comparison does not by itself settle eventual growth. Do not look only at the leading coefficient. Match the complete original model comparison, all requested predictions or changes/rates and ties. For unequal steps, include the full normalized interval-rate evidence with the selected rule and family.

Interval	-1, 5
Rules	Linear: $y = 4x - 2$ Quadratic: $y = 2x^2 - 7x + 1$ Exponential: $y = (2)^x$

Your response: ____________

Incoming: average rates: exponential: 6; linear: 5; quadratic: 6; changes: exponential: 12; linear: 10; quadratic: 12; descending change groups: quadratic and exponential, linear

Compare the signed changes of the three models from $x = -3$ through $x = 4$. Which increase, which decrease, and what does the quadratic change reveal? Show endpoint substitutions before ordering. Match the complete original model comparison, all requested predictions or changes/rates and ties. For unequal steps, include the full normalized interval-rate evidence with the selected rule and family.

Interval	-3, 4
Rules	Linear: $y = -\frac{3}{2}x + 5$ Quadratic: $y = -2x^2 + x + 5$ Exponential: $y = -(2)^x$

Your response: ____________

Incoming: average rates: exponential: $\frac{15}{4}$; linear: 4; quadratic: 4; changes: exponential: 15; linear: 16; quadratic: 16; descending change groups: linear and quadratic, exponential

Over the finite interval from $x = 0$ to $x = 3$, rank the changes in the three exact models from greatest to least. Then identify the changing-rate evidence specific to the quadratic model. Negative output levels do not determine the change order. Match the complete original model comparison, all requested predictions or changes/rates and ties. For unequal steps, include the full normalized interval-rate evidence with the selected rule and family.

Interval	0, 3
Rules	Linear: $y = 2x - 20$ Quadratic: $y = x^2 - 30$ Exponential: $y = -16(\frac{1}{2})^x$

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.

Use the exact table and the stated long-term growth theorem to compare the quadratic and exponential models. What is supported eventually, and what is supported only at the sampled inputs? Do not turn four rows into a proof for every larger input. Compare the finite sampled evidence with the conclusion justified by the original long-term theorem conditions. State which claim each supports and retain the original comparison domain.

x	quadratic	exponential
0	5	1
2	13	4
4	37	16
8	133	256

Quadratic rule	$y = 2x^2 + 5$
Exponential rule	$y = (2)^x$
Comparison domain	all nonnegative real x

Audit whether eventual exponential dominance applies to these two rules on $x \geq 0$. Check every sign and base assumption before using the theorem. Both leading factors and the exponential base satisfy the theorem. Compare the finite sampled evidence with the conclusion justified by the original long-term theorem conditions. State which claim each supports and retain the original comparison domain.

x	quadratic	exponential
0	2	3
3	20	$\frac{81}{8}$
6	56	$\frac{2187}{64}$
12	182	$\frac{1594323}{4096}$

Quadratic rule	$y = x^2 + 3x + 2$
Exponential rule	$y = 3(\frac{3}{2})^x$
Comparison domain	$x \geq 0$

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Full Worked Solutions - excerpt

Worked example

Problem. A student calls the table $1, 4, 9, 16$ exponential because the increments grow. Diagnose and repair the argument.

Given evidence	equal-step outputs $1, 4, 9, 16$
Student claim	The model is exponential because its increments grow.

Answer. correction: the data support a quadratic pattern; decisive check: first differences $3, 5, 7$ have constant second difference 2; error: growing increments are not the same as constant ratios

Explanation and check.

The first differences are $3, 5, 7$ and their differences are 2. Ratios are not constant, so quadratic—not exponential—is supported.

Worked example

Problem. Repair the claim that $E(x) = 20(\frac{1}{2})^x$ must eventually exceed $Q(x) = x^2$ merely because E is exponential.

Given evidence	$E(x) = 20(\frac{1}{2})^x$ and $Q(x) = x^2$
Student claim	Every exponential eventually exceeds every quadratic.

Answer. correction: this exponential tends toward zero and does not eventually dominate Q; decisive check: verify positive coefficient and base greater than one before applying the theorem; error: the exponential base is below one

Explanation and check.

The dominance theorem requires a growing positive exponential with base above 1. Here E decays, while Q grows.