Sets & Steps
Math Practice & Worked Solutions

Precalculus

Model Selection, Regression & Validation | 7-Topic Precalculus Bundle

7-topic bundle | 672 problems | Four activity formats

Included topics

The following pages list all 7 included resources in the suggested order, with a link to each product. Each resource retains its complete preview.

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.

56 PDFs and 7 READMEs; 554 buyer PDF pages across the 7 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

Precalculus

Included topics

7-topic bundle | 672 problems | Four activity formats

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01 **Building and Selecting Function Models**

View individual product and its full preview

02 **Model Domains and Validity**

View individual product and its full preview

03 **Interpreting and Comparing Function Models**

View individual product and its full preview

04 **Residuals and Model Validation**

View individual product and its full preview

05 **Exponential Regression**

View individual product and its full preview

06 **Comparing Regression Models**

View individual product and its full preview

07 **Linearizing Exponential Data**

View individual product and its full preview

7 included resources | Complete resource previews follow this guide.

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Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Building and Selecting Function Models

Building and Selecting Function Models | APPC-U01-P19

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for conclusion, claim, yes or no, decision, compatible model and model description.

8 PDFs and a README; 56 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.

Published by Tusils LLC.

AP Precalculus

Building and Selecting Function Models

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 trapezoid has parallel bases x and $x + 4$ meters and height 6 meters. Select its area model. Bank label: _____	Which polynomial candidate has both tails falling? Bank label: _____
Admission costs \$12 plus \$4 for every hour, with no rate change. Does the fee require multiple operating branches? Bank label: _____	A square has side length s centimeters. Choose the candidate that models its area in square centimeters. Bank label: _____
Which formula has the two observed zeros? Candidate formulas: $(x + 2)(x - 5)$; $(x - 2)(x + 5)$; $x^2 + 10$. Observed: x-intercepts -2 and 5. Bank label: _____	A service charges \$15 once and \$9 for every month with no discounts. Is a piecewise model needed? Bank label: _____
A banner is x meters long and 7 meters wide. Which candidate represents area? Bank label: _____	Evaluate both models at the two requested inputs. Inputs: 1; 4. Models: $A(x) = 2x + 5$; $B(x) = x^2 + 1$. Bank label: _____

AP Precalculus

Building and Selecting Function Models

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.

For equally spaced inputs, the outputs are $11, 17, 23, 29$. Which supplied rule is supported, and what evidence is decisive? Candidate formulas: $3x + 11$; $x^2 + 11$; $\frac{11}{x+1}$.

Complete response required: model.

x	y
0	11
2	17
4	23
6	29

A parcel costs \$8 through $5kg$, then each kilogram beyond 5 adds \$3. Should the supplied model be one global line or a threshold piecewise rule?

The products xy are constant in the table. Select the supported candidate and state what the finite table does not prove. Candidate formulas: $\frac{24}{x}$; $24 - 3x$; $3x^2$.

Complete response required: model.

x	y
1	24
2	12
4	6
8	3

Inputs are not equally spaced. Which candidate exactly matches all four values, and why would raw first differences be misleading? Candidate formulas: $2 + 3x$; $2 + x^2$; $2 + x + x^2$.

Complete response required: model.

x	y
0	2
1	4
3	14
6	44

AP Precalculus

Building and Selecting Function Models

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: x = 2; $A(2) = 7$ and $B(2) = 12$.

A triangle has base $3xcm$ and perpendicular height $x + 2cm$. Select the area model.

Your response: _____

Incoming: Input B; its prediction gap 1.2 exceeds twice the 0.3 uncertainty.

A circular ring has inner radius r and outer radius $r + 2$. Select the area of material.

Your response: _____

Incoming: $\frac{x+2}{x+3}$.

Equal input steps give first differences $-5, -3, -1, 1$. Which supplied candidate is supported? Candidate formulas: $x^2 - 2x - 1$; $-x - 1$; $\frac{4}{x+3}$.

Complete response required: model.

x	y
−2	7
−1	2
0	−1
1	−2
2	−1

Your response: _____

Incoming: Piecewise rising segments separated by downward jumps at replacement times.

A1-by-1 square is removed from a rectangle measuring $x + 3$ by $x + 1$. Which expression models remaining area?

Your response: _____

AP Precalculus

Building and Selecting Function Models

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.

Given the explicit linear-family assumption, do the two distinct data points determine a unique candidate? Diagnose the student claim: Even within the stated linear family, the two distinct input-output points leave many different linear models. Use the exact supplied assumptions and data to provide a counterexample or decisive calculation and state the strongest justified conclusion.

Complete response required: model.

1	5
4	14

Exhibit two distinct polynomial models matching both data points. Diagnose the student claim: Only one polynomial can pass through these two data points. Use the exact supplied assumptions and data to provide a counterexample or decisive calculation and state the strongest justified conclusion.

Complete response required: two models.

0	2
1	5

Building and Selecting Function Models

Full Worked Solutions - excerpt

Worked example

Problem. A triangle has base $3xcm$ and perpendicular height $x + 2cm$. Select the area model.

Answer. $A(x) = 1.5x(x + 2)$.

Explanation and check.

Triangle area is one half the product of base and perpendicular height.

Worked example

Problem. A circular ring has inner radius r and outer radius $r + 2$. Select the area of material.

Answer. $\pi((r + 2)^2 - r^2)$.

Explanation and check.

Subtract the inner disk area from the outer disk area; both terms have square-length units.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Model Domains and Validity

Model Domains and Validity | APPC-U01-P20

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for assumption failure, boundary behavior, claim, status, feasibility and domains.

8 PDFs and a README; 47 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.

Published by Tusils LLC.

AP Precalculus

Model Domains and Validity

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.

State the mathematical, observed, and contextual domains. The contextual range is $x \geq 0$. Use the model $\frac{1}{x+1}$. Observations cover $[0, 2]$. Bank label: _____	Where is the mass prediction physically feasible? The setting is mass. The physical constraint is $M \geq 0$. Use the model $M(t) = 36\text{-}t^2$. Assume $t \geq 0$. Bank label: _____
Name the three domains. The setting is seats. Allowed inputs are integers 0 through 40. The formula is defined for all real n. Observations cover $10, 20, 30$. Bank label: _____	State formula, observed, and shift domains. The setting is hours. The formula is defined for all real. Observations cover $[2, 7]$. The work shift spans $[0, 8]$. Bank label: _____
Separate formula, observation, and device-supported inputs. The setting is time. The device operates with $0 \leq t \leq 12$. The formula is defined for all real. Observations cover $2 \leq t \leq 8$. Bank label: _____	When does the hourly-rate assumption stop? The setting is parking. The cap is \$14/day. The rate is \$2/hour. Bank label: _____
List formula, observed, and trip domains. The setting is distance. The formula is defined for all real time. Observations cover 1 to 3 hours. The trip lasts 0 to 5 hours. Bank label: _____	For $t \geq 0$, when is volume feasible? The setting is storage. The physical constraint is $0 \leq V \leq 70$. Use the model $V(t) = 70 - 4t$. Bank label: _____

AP Precalculus

Model Domains and Validity

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.

State the mathematical, observed, and physically allowed input domains. The contextual range is time 0 through 10. Use the model $p(t) = t^2 + 1$. Observations cover $0 \le t \le 6$.	For $t \ge 0$, when does the model satisfy the population constraint? The setting is population. The physical constraint is $P \ge 0$. Use the model $P(t) = 80 - 5t$.
Classify a model prediction at input 4 relative to the data window. The observed inputs are $0, 2, 5, 8$. The requested input is 4.	Explain why the fixed-rate model should stop at 12 kg. The setting is agriculture. Use the model yield rises 4 units per kg. The trigger is soil nutrient exhausted after 12 kg.
Distinguish the formula domain from the observed and contextual count domains. The setting is inventory. The contextual range is 0 to 20 items. Observed n values are $1, 2, 3, 4$. Use the model $C(n) = 7n + 4$.	Can each policy use the rule at $x = 2.5$? The setting is tickets. Policy A requires real $0 \le x \le 8$. Policy B requires integer $0 \le x \le 8$. The requested input is 2.5. Use the rule $R(x) = 12x$.

AP Precalculus

Model Domains and Validity

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: Day 55 is extrapolation beyond the observed days 20 to 50; the observations alone do not establish that the model remains valid there. For which nonnegative x is the output a valid probability? The setting is probability. Use the model $p(x) = 0.2 + 0.1x$. Assume $x \geq 0$. Your response: _____	**Incoming:** $t > 3$. State the three domains. The contextual range is $[0, 8]$. Use the model $\frac{2}{x-5}$. Observations cover $[0, 3]$. Your response: _____
Incoming: Rent rises by exactly \$25 each month from an initial \$900. What must remain constant for this inverse relation? The setting is geometry. Use the model length=60/width. Your response: _____	**Incoming:** It is interpolation by location but unsupported by the pre-change protocol beyond dose 10. State the three input domains. The setting is time. The contextual range is $t \geq 0$. Use the model t^3-t. Observations cover $[1, 4]$. Your response: _____
Incoming: All reals except 6; $[0, 4]$; $[0, 6)$ union $(6, 12]$. Does the model ever violate nonnegativity for $t \geq 0$? The setting is inventory. Use the model $I(t) = \frac{30}{t+2}$. Assume $t \geq 0$. Your response: _____	**Incoming:** All real inputs; $\{2, 4, 6\}$; $\{0, 2, 4, 6, 8, 10\}$. Separate formula, observed, and device domains. The setting is devices. Allowed inputs are integers 0 to 6. The formula is defined for real x. Observations cover $1, 2, 4$. Your response: _____

AP Precalculus

Model Domains and Validity

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.

Replace the causal claim with one supported by the model fit. Diagnose this claim: A fitted line proves that study hours cause scores. Identify the unsupported inference or missing condition, give a defensible replacement, and state the evidence or model change needed. The setting is education. A student claims: study hours cause score because a line fits.

Give a defensible replacement and a useful test. Diagnose this claim: Four observed years prove that the trend continues forever. Identify the unsupported inference or missing condition, give a defensible replacement, and state the evidence or model change needed. The setting is climate. A student claims: trend continues forever. The supplied data are: four years.

Rewrite the conclusion and identify needed evidence. Diagnose this claim: Data from weeks 1 through 6 prove that week 20 will be exactly 74.3. Identify the unsupported inference or missing condition, give a defensible replacement, and state the evidence or model change needed. The setting is health. A student claims: week 20 will be exactly 74.3. Observations cover weeks 1 to 6.

Correct the reporting claim. Diagnose this claim: Measurements rounded to the nearest 10 units support the exact prediction 247.381. Identify the unsupported inference or missing condition, give a defensible replacement, and state the evidence or model change needed. The setting is production. A student claims: prediction exactly 247.381. Measurements are rounded to the nearest 10 units.

Model Domains and Validity

Full Worked Solutions - excerpt

Worked example

Problem. State the conserved quantity and a test of the model. The setting is chemistry. Use the model $c(V) = \frac{24}{V}$.

Answer. Solute amount stays 24 units; check whether measured products Vc remain near 24 as volume changes.

Explanation and check.

Dilution creates inverse concentration only when solute is neither added nor lost.

Worked example

Problem. State the model's change assumption. The setting is rent. Use the model $R(m) = 900 + 25m$.

Answer. Rent rises by exactly $\$\,25$ each month from an initial $\$\,900$.

Explanation and check.

The slope is presumed constant over modeled months.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Interpreting and Comparing Function Models

Interpreting and Comparing Function Models | APPC-U01-P24

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for direction and changing-rate conclusion, growth conclusion, existence conclusion, rate and interpretation, rate and meaning and rate and sign meaning.

8 PDFs and a README; 85 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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AP Precalculus

Interpreting and Comparing Function Models

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.

Find the modeled tank volume after 4 hours and state its unit. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value.

Context: water storage.

Work on the domain $0 \le t \le 10$.

Evaluate at the input 4.

Measure the input in hours.

Use the model $V(t) = 480 + 35t - 2t^2$.

Measure the output in liters.

Bank label: _____

At what time does the graph predict exactly 20 customers in line? For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value.

Context: queue length.

the horizontal axis measures minutes; the vertical axis measures customers.

The curve relation is below $y = 20$ for $t < 18$ and above $y = 20$ for $t > 18$.

Work on the domain $0 \le t \le 30$.

The intersection is $(18, 20)$.

The scale is 2 minutes horizontally and 5 customers vertically.

The target is 20 customers.

Bank label: _____

Where is the modeled arch height positive? For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value.

Context: playground arch.

The constraint is $H(x) > 0$.

Work on the domain $0 \le x \le 12$.

Measure the input in feet.

Use the model $H(x) = -(x + 2)(x - 10)$.

Measure the output in feet.

Bank label: _____

Find the modeled factory output on day 3. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value.

Context: factory output.

Evaluate at the input 3.

Measure the input in days.

Use the model $Q(d) = 90 + 24d - 3d^2$.

Measure the output in units.

Bank label: _____

AP Precalculus

Interpreting and Comparing Function Models

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.

At what feasible times does the model predict 22 degrees Celsius?

Context: greenhouse temperature.

Work on the domain $0 \le h \le 6$.

Measure the input in hours after sunrise.

Use the model $T(h) = 18 + 5h - h^2$.

Measure the output in degrees Celsius.

The target is 22.

Determine the mileage ranges on which each service is cheaper, including the break-even distance.

Context: delivery pricing.

Work on the domain $0 \le d \le 25$.

Measure the input in miles.

The model A is $A(d) = 18 + 1.6d$.

The model B is $B(d) = 30 + 0.8d$.

Measure the output in dollars.

The criterion is lower cost.

Find where along the span the clearance is at least 9 meters.

Context: arch clearance.

The constraint is $H(x) \ge 9$.

Work on the domain $0 \le x \le 8$.

Measure the input in meters from left support.

Use the model $H(x) = 12 - 0.75(x - 4)^2$.

Measure the output in meters.

The threshold is 9.

Compute the model's average rate of change from day 2 to day 6 and interpret its sign.

Context: reservoir depth.

Measure the input in days.

The interval is $(2, 6)$.

The model assumption is The listed values come from one continuous depth model.

Measure the output in centimeters.

Context/domain: reservoir depth

Input (days)	Output (centimeters)
2	74
6	58

AP Precalculus

Interpreting and Comparing Function Models

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

Find the average download rate over the indicated interval. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Context: page downloads.

Measure the input in minutes.

The interval is $(2, 7)$.

Use the model $D(t) = 180 + 45t$.

Measure the output in downloads.

Your response: _____

Incoming: At t = 2 and $t = 6$ hours; the maximum is 48 milligrams per liter.

Use the supplied rounded model to predict temperature at 7 minutes. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Context: coffee cooling.

The coefficient note is 0.18 is rounded to two decimal places.

Evaluate at the input 7.

Measure the input in minutes.

Use the model $T(t) = 21 + \frac{68}{1+0.18t}$.

Measure the output in degrees Celsius.

The report precision is nearest tenth.

Your response: _____

Incoming: 25.5 kilograms and 7 containers.

At what allowed price does the model predict 132 rentals? Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Context: rental demand.

Work on the domain $8 \le p \le 14$.

Measure the input in dollars.

Use the model $D(p) = 180 - 12(p - 8)^2$.

Measure the output in rentals.

The target is 132.

Your response: _____

Incoming: $-5 \le x < 3$ valve turns.

Find when the modeled noise level satisfies the 65-decibel limit. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Context: warehouse noise.

The constraint is $N(t) \le 65$.

Work on the domain $0 \le t \le 10$.

Measure the input in hours.

Use the model $N(t) = 65 + (t - 2)(t - 5)(t - 8)$.

Measure the output in decibels.

Your response: _____

AP Precalculus

Interpreting and Comparing Function Models

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.

State when the modeled lake temperature is at least 18 degrees Celsius. Student work: $3 < m \leq 8$ months after January. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.

Context: lake temperature.

the horizontal axis measures months after January; the vertical axis measures degrees Celsius.

The crossings is $(3, 8)$.

The curve relation is below $y = 18$ before $m = 3$, on or above $y = 18$ from $m = 3$ through $m = 8$, below afterward.

Work on the domain $0 \leq m \leq 11$.

The endpoints is included.

The threshold is at least 18 degrees.

Interpreting and Comparing Function Models

Full Worked Solutions - excerpt

Worked example

Problem. Determine the feasible width that maximizes modeled area and give the maximum area.

Context: garden area.

Work on the domain $4 \le w \le 18$.

Measure the input in meters.

Use the model $A(w) = 48w - 2w^2$.

Measure the output in square meters.

Answer. w = 12 meters, with maximum area 288 square meters.

Explanation and check.

$A(w) = -2(w - 12)^2 + 288$, and the interior vertex lies in the allowed interval.

Worked example

Problem. Describe the long-run prediction of the model as impressions increase.

Context: advertising response.

Work on the domain $x \ge 0$.

Measure the input in thousands of impressions.

Use the model $R(x) = 72\frac{x}{x+18}$.

Measure the output in percent awareness.

Answer. Predicted awareness approaches 72 percent and does not exceed it under the model.

Explanation and check.

The numerator and denominator have the same degree, so the horizontal asymptote is $R = 72$ percent.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Residuals and Model Validation

Residuals and Model Validation | APPC-U01-P25

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for compliance and violations, acceptability, qualified adequacy, evidence claim, consistency judgment and correction and correction and meaning.

8 PDFs and a README; 105 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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AP Precalculus

Residuals and Model Validation

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.

Find the residual and interpret it.

Given: domain: concert revenue; payload: observed: 18400; predicted: 19000; unit: dollars

Bank label: _____

Does the timing model meet the requirement?

Given: domain: package timing; payload: requirement: each error magnitude no greater than 2 minutes; residuals: $-1, 2, -3, 1$; unit: minutes

Bank label: _____

Find the observed tree mass.

Given: domain: tree mass; payload: definition: residual=observed-predicted; predicted: 48.2; residual: -1.6; unit: kilograms

Bank label: _____

State the four residual-plot coordinates.

Given: domain: room temperature; payload: input unit: hours; inputs: $0, 2, 5, 8$; residual unit: degrees Celsius; residuals: $-1, 0, 2, -2$

Construct the requested table/graph using the given axes, units and domain.

inputs	residuals
0	-1
2	0
5	2
8	-2

Bank label: _____

AP Precalculus

Residuals and Model Validation

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.

Compare the models and explain why signed totals are misleading.

Given: domain: daily sales; payload: criterion: sum of absolute residuals; model A residuals: $6, -6, 5, -5$; model B residuals: $2, 2, -2, -2$; unit: items

Give the points for the residual plot against week and specify the reference line.

Given: domain: plant height; payload: height unit: centimeters; input spacing: unequal; rows: (observed: 4; predicted: 5; week: 0); (observed: 11; predicted: 10; week: 2); (observed: 23; predicted: 21; week: 5); (observed: 36; predicted: 39; week: 9)

Construct the requested table/graph using the given axes, units and domain.

observed	predicted	week
4	5	0
11	10	2
23	21	5
36	39	9

Choose the more reasonable predictive model and address the perfect training fit.

Given: domain: traffic volume; payload: structures: model P: degree-7 polynomial; model Q: quadratic; training absolute errors: model P: $0, 0, 0, 0$; model Q: $3, 2, 2, 3$; unit: vehicles per minute; validation absolute errors: model P: $28, 35, 41$; model Q: $5, 6, 4$

Recover the prediction and explain the negative residual.

Given: domain: reservoir depth; payload: definition: residual=observed-predicted; observed: 42.3; residual: -1.8; unit: meters

AP Precalculus

Residuals and Model Validation

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: Case A has 5% error and case B has 0.25%; the same 0.2-meter residual is much more consequential at the smaller scale.

Use the model to produce the residual-plot points.

Given: domain: warehouse demand; payload: columns: day, observed orders; model: $P(t) = 50 + 8t$; rows: $(0, 51)$; $(2, 64)$; $(5, 93)$; $(9, 119)$

Construct the requested table/graph using the given axes, units and domain.

day	observed orders
0	51
2	64
5	93
9	119

Your response: _____

Incoming: Inputs $1 - 6$ form a positive-negative-positive curve, indicating model-shape mismatch; input 7 adds a12-kilowatt outlier beyond tolerance.

Calculate the residual-plot points.

Given: domain: sound level; payload: columns: distance meters, observed decibels; model: $P(x) = 80 - 3x$; rows: $(1, 76)$; $(3, 72)$; $(6, 64)$; $(10, 47)$

Construct the requested table/graph using the given axes, units and domain.

distance meters	observed decibels
1	76
3	72
6	64
10	47

Your response: _____

Incoming: No. The positive residual +6 is an underprediction exceeding the five-unit limit; -7, $+4$, and -3 satisfy their direction-specific limits.

Does the model satisfy the temperature requirement?

Given: domain: food temperature; payload: requirement: each magnitude at most 1 degree; residuals: $-1.2, 0.8, 1.5, -0.4$; unit: degrees Celsius

Your response: _____

Incoming: Model B is more reasonable there; its errors stay within 3 decibels, while A's spread expands to 15 despite its smaller training errors.

List the residual-plot points against day.

Construct the requested table/graph using the given axes, units and domain.

day	observed centimeters	predicted centimeters
0	12	11
3	19	21
8	27	24
14	31	35

Your response: _____

AP Precalculus

Residuals and Model Validation

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.

Identify the logical gap and replace the claim with a defensible conclusion. Diagnose the extension from three exact historical fits to thirty future years, including the changed migration mechanism.

Given: domain: population forecast; payload: claim: The model fits three observed years exactly, so it will predict the next 30 years exactly.; evidence: future domain: 3 through 30; mechanism change: a migration policy begins in year 3; residuals: $0, 0, 0$; sample years: $0, 1, 2$

Residuals and Model Validation

Full Worked Solutions - excerpt

Worked example

Problem. Judge the model for each intended use.

Given: domain: map distance; payload: residual: 0.12; unit: kilometer; uses: hiking map limit: 0.25; survey limit: 0.02

Answer. The 0.12-kilometer error is acceptable for the hiking map but not the survey, whose tolerance is only 0.02 kilometer.

Explanation and check.

The same error is compared with different decision thresholds.

Worked example

Problem. Recover the prediction and explain the negative residual.

Given: domain: reservoir depth; payload: definition: residual=observed-predicted; observed: 42.3; residual: -1.8; unit: meters

Answer. 44.1 meters; the prediction is 1.8 meters above the observation.

Explanation and check.

predicted=observed-residual= $42.3 - (-1.8) = 44.1$, consistent with overprediction.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Exponential Regression

Exponential Regression | APPC-U02-P09

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for metrics and verdict, classification and verdict, metric and verdict, evidence statement, robustness conclusion and validity and weighting implication.

8 PDFs and a README; 88 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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AP Precalculus

Exponential Regression

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.

Format and interpret the regression using the reporting rule without rounding b before converting it to a percent.

Given: domain: months; payload: convention: raw-output least squares; report rule: coefficient a to nearest tenth and percent change to nearest tenth percent; technology result: a: 7.408; b: 0.9631

Bank label: _____

Write the original-scale model represented by the fitted excess.

Given: domain: hours; payload: baseline: 6; fitted excess: $e = 45(0.65)^t$; relation: $e = y - 6$

Bank label: _____

Interpret the base of this fitted colony model.

Given: domain: days; payload: convention: raw-output least squares; output unit: colonies; technology result: $N(t) = 18.4(1.065)^t$

Bank label: _____

The negative response is a displacement below zero, and technology fit its positive magnitude. Restore the signed model.

Given: domain: seconds; payload: baseline: 0; definition: $m = -y$; magnitude regression: $m(t) = 12.0(0.823)^t$; table: $(0, -12.0)$; $(2, -8.1)$; $(4, -5.5)$

Context/domain: seconds

0	−12.0
2	−8.1
4	−5.5

Bank label: _____

AP Precalculus

Exponential Regression

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.

May all three rows be entered directly into a log-output exponential regression for $y = ab^t$? Explain before fitting.

Context/domain: minutes

0	8.2
2	4.1
4	0.0

AP Precalculus

Exponential Regression

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 Convert the two-hour regression factor to an equivalent hourly percent increase. Given: domain: 2-hour blocks; payload: input definition: n counts two-hour blocks; technology result: $Q(n) = 9.3(1.44)^n$ Your response: _____	**Incoming:** The relative residual magnitudes are at most about 1.2%, but their signs alternate at consecutive days 0 through 7 before another positive residual at day 8. Percentage errors are small; the ordered oscillation is a pattern, so small magnitude alone does not establish an adequate pattern-free model. Compare the week-12 residuals after rounding only the amplitude. Given: domain: weeks; payload: observation: x: 12; y: 27.4; predictions: retained: 26.98; rounded: 27.05; residual definition: observed-predicted; retained model: $y = 51.86(0.947)^x$; rounded model: $y = 52(0.947)^x$ Your response: _____
Incoming: The student's 0.011 is a log-scale residual. The required original-scale residual is $39.0 - 38.12 = 0.88$. Find both residuals at the origin. Given: domain: months; payload: input: 0; observed: 20.6; retained model: $y = 20.54(0.92)^x$; rounded model: $y = 21(0.92)^x$ Your response: _____	**Incoming:** Dividing hours by 24 gives $0, 1, 3, 5$ days, so the conversion is consistent. The fitted base is a factor per day, not per hour. A regression models the excess above a known level of 250. Restore the original response and state its long-run level. Given: domain: days; payload: baseline: 250; definition: $e = y - 250$; fitted excess: $e(t) = 84.5(0.91)^t$ Your response: _____

AP Precalculus

Exponential Regression

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.

The numerical regression inputs are years since 2018, although the source table lists calendar years. Is the fit invalid, and how should a be interpreted? A student says recoding calendar years invalidates the fit and a predicts calendar year zero. Diagnose both claims.

The last measured value equals the known baseline. Diagnose the proposed baseline-corrected log regression and give two defensible next steps without silently altering the row. A student enters $\log(0)$ for the baseline-equal reading. Diagnose the operation and explain two defensible next steps.

Context/domain: hours

0	31
2	19
5	12

Exponential Regression

Full Worked Solutions - excerpt

Worked example

Problem. The residual magnitudes are modest, but every sign is positive. Interpret this evidence.

Answer. The model underpredicts every observation, showing a one-sided level bias rather than centered residuals. Its calibration should be reconsidered.

Explanation and check.

Observed-minus-predicted is positive whenever prediction is low.

Worked example

Problem. A chamber warms toward 72 degrees Fahrenheit from below. Regression was performed on the positive shortfall $d(t) = 72 - y(t)$, producing $d(t) = 18.6(0.81)^t$. Restore a model for y and describe its approach.

Answer. $y(t) = 72 - 18.6(0.81)^t$; it increases toward 72 from below.

Explanation and check.

The fitted magnitude is the amount below equilibrium, so subtract it from 72; the decaying shortfall makes y rise.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Comparing Regression Models

Comparing Regression Models | APPC-U02-P10

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for exponential base and predictions, maximum losses and model, why selection is premature, predictions and plausibility, qualified candidates and costs and feasibility.

8 PDFs and a README; 100 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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AP Precalculus

Comparing Regression Models

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.

Evaluate both candidate models at hour 3. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. The exponential is $E(t) = 5(1.3)^t$. Evaluate at input 3. The quadratic is $Q(t) = 5 + t^2$.

Bank label: _____

Compute original-scale SSE for both candidates. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. For the exponential model, the predicted outputs in input order are 9.5, 14.5, 19. Use the inputs 0, 2, 4, in that order. For the linear model, the predicted outputs in input order are 11, 14, 18. The observed outputs, in input order, are 10, 14, 19.

Bank label: _____

Select the simplest exact family and state its rate. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value.

Given domain/context: years

0	50
2	44
4	38
6	32

Bank label: _____

Select the most discriminating feasible observation. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. The feasible months are 1, 3. The gaps are month10.1; month30.8; month52.4. The measurement resolution is 0.5.

Bank label: _____

AP Precalculus

Comparing Regression Models

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.

Evaluate both fitted models at month 4. The exponential is $E(t) = 8.0(1.24)^t$. Use least squares on original output scale. The linear is $L(t) = 8.2 + 3.1t$. Evaluate at input 4.	Choose the cheaper forecast under the stated asymmetric loss. The actual value is 100. Use this loss rule: underprediction costs \$5 per unit; overprediction costs \$1 per unit. The model predictions are exponential 106; linear 96.
Which feasible input is most useful for distinguishing the models? The feasible inputs are $0, 1, 5$. Use measurement precision nearest unit. Use these candidate models: exponential $E(t) = 10(1.2)^t$; linear $L(t) = 10 + 2t$.	The models are close during years $0 - 3$. Compare their year-20 predictions and qualify the inference. The exponential is $E(t) = 50(1.08)^t$. Evaluate the future input 20. The linear is $L(t) = 50 + 5t$. The observations cover the input interval $0, 3$.

AP Precalculus

Comparing Regression Models

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 4, $L = 260$ and $E \approx 243.10$. At 25, $L = 575$ and $E \approx 677.27$. Their ordering reverses, so local superiority is horizon-specific.

Compare hour-3 outputs. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The exponential is $E = 12(1.3)^t$. Evaluate at input 3. The linear is $L = 12 + 5t$.

Your response: _____

Incoming: Exponential, $y = 64(0.75)^t$, because each output is three-fourths of the preceding output.

Choose the lower-cost forecast. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The actual value is 80. Use this loss rule: shortage $6 per unit; surplus $2 per unit. The model predictions are exponential 85; linear 76.

Your response: _____

Incoming: Linear; its points scatter around zero, whereas quadratic residuals trend upward from overprediction to underprediction.

Choose the best feasible week for distinguishing the candidates. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The last feasible week is 5. The model predictions are week220.1, 20.4; week532.0, 34.3; week850.2, 57.9. The measurement resolution is 1.

Your response: _____

Incoming: Linear reaches 30 at $t = 15$. Exponential reaches 30 when $0.95^t = 0.25$, so $t \approx 27.03$. Both are extrapolations far beyond the data.

Select the exact family and write its rule. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Given domain/context: days

0	64
1	48
2	36
3	27

Your response: _____

AP Precalculus

Comparing Regression Models

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.

Apply the production loss to choose a model. Student work: Quadratic underpredicts by 3 and costs 20; exponential overpredicts by 4 and costs 4. Choose quadratic because its unsigned error, 3, is smaller. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. The actual value is 60. The model predictions are exponential 64; quadratic 57. Use underprediction beyond 2 units costs 20; otherwise absolute error.

Choose a staffing model using the interval-specific loss. Student work: exponential costs $1 + 30 + 2 = 33$. Quadratic costs $2 + 1 + 1 = 4$, so choose quadratic; its avoidance of critical noon underprediction is decisive. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. The actual value is $20, 35, 28$. The critical input interval is $11, 14$. The hours are $8, 12, 16$. For the linear model, the predicted outputs in input order are $19, 32, 30$. For the quadratic model, the predicted outputs in input order are $22, 36, 27$. Use inside critical interval, each understaffed unit costs 10; all other errors cost 1 per unit.

Which observation best tests the quadratic-turn claim? Student work: Day 10, because it lies after the proposed vertex and directly tests reversal; day 7 is before the turn where all three can still rise. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. Observations are available at inputs $7, 9$. For the exponential model, the prediction is continues rising faster. For the linear model, the prediction is continues rising at day 9. For the quadratic model, the prediction is peaks at day 8 then falls. The measurement resolution is sufficient at both.

Compare both candidates by absolute and percent error at the row. Student work: Linear error is 4 units or 4%; linear error is 3 units or 3%. Exponential is closer by both measures at this observation. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. For the exponential model, the prediction is 103. Evaluate at input 8. For the linear model, the prediction is 96. The observed outputs, in input order, are 100.

Comparing Regression Models

Full Worked Solutions - excerpt

Worked example

Problem. Compare hour-3 outputs. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The exponential is $E = 12(1.3)^t$. Evaluate at input 3. The linear is $L = 12 + 5t$.

Answer. $L(3) = 27$ and $E(3) = 26.364$.

Explanation and check.

Substitute 3 into each candidate.

Worked example

Problem. Compare the day-6 fitted values. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The exponential is $E = 18(0.86)^t$. Evaluate at input 6. The linear is $L = 18 - 2t$.

Answer. $L(6) = 6$ and $E(6) \approx 7.28$.

Explanation and check.

Evaluate each rule at the same elapsed day.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Linearizing Exponential Data

Linearizing Exponential Data | APPC-U02-P25

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for corrected line, least integer threshold, ratio and observed value, slope evolution, tail behavior and values and explanation.

8 PDFs and a README; 73 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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AP Precalculus

Linearizing Exponential Data

Name: _____ **Date:** _____ **Class:** _____

Answer each question and record the matching bank letter. Give exact values. Give the whole requested response, including any reasoning the question asks for.

Linearize the decay model in base 3. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. Use $y = 9(\frac{1}{3})^x$. Use the transformation $Y = \log_3(y)$.

Bank label: _____

Read the original output at the marked height $x = 2$. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. Use these axis scales: scale logarithmic y; linear x; x input; y original y on base-10 logarithmic scale. The marked point has $x2$; y label 100. The labeled levels are $1, 10, 100, 1000$.

Bank label: _____

Use the fitted table to predict the original output at $x = 4$. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value.

Context/domain: data

x	fitted Y=ln(y)
0	0
2	1
4	2

Bank label: _____

Place the decay observations on a base-2 transformed table. For the answer bank, record the complete response required by the original task; use the given context to distinguish responses that share a numerical value. Use logarithm base 2. The raw observations are $(0, 8), (1, 4)$, and $(2, 2)$; only these observations are asserted. Construct the transformed output column yourself.

Context/domain: data

x	raw y
0	8
1	4
2	2

Bank label: _____

AP Precalculus

Linearizing Exponential Data

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. Give the whole requested response, including any reasoning the question asks for.

Diagnose the parameter error and state the correct factor. The given line is $Y = 1 + 0.3x$. A student claims: The raw growth factor is 0.3. Use the transformation $Y = \log_{10}(y)$.

Write the transformed line and identify its intercept and slope. Use $y = 4(2^x)$. Use the transformation $Y = \log_2(y)$.

Correct the student's reading of the plotted point. Use these axis scales: scale linear-linear transformed plot; x input; $yY = \log_2(y)$. The point are $3, 5$. A student reads $y = 5$.

Express the semi-log line exactly and interpret the two coefficients. Use $y = 5(100^x)$. Use the transformation $Y = \log_{10}(y)$.

Compare the initial values and one-input growth factors. Use these axis scales: scale linear-linear transformed plot; x input unit; $yY = \log_{10}(y)$. The lines are (model P; rule $Y = 1 + 0.4x$), (model Q; rule $Y = 2 + 0.4x$).

Map all three raw observations to the base-4 plot.

Context/domain: data

0	2
1	8
3	128

AP Precalculus

Linearizing Exponential Data

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

Recover the positive raw y-value represented by $Y = -2$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use these axis scales: scale linear in Y; x input; yY =$\log_{10}(y)$. The point are $-1, -2$.

Your response: _____

Incoming: Y-values $\log_2(16)$=4, $\log_2(20)$, $\log_2(28)$; their increments are unequal.

Predict y at $x = 2$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The fitted relation is $Y = 1 + 0.5x$ where Y =$\log_{10}(y)$. Evaluate at input 2. The observations cover x in $0, 4$.

Your response: _____

Incoming: x = 1 and common $y = 27$

State the original output at the plotted point $(3, 5)$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use these axis scales: scale linear in Y; x stage; yY =$\log_2(y)$. The point are $3, 5$.

Your response: _____

Incoming: Y = 4.5 and $y = 16\sqrt{2}$

Convert the fitted height at $x = 1$ to original units. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The fitted relation is $Y = 3$-x where Y =$\log_2(y)$. Evaluate at input 1. The observations cover x in $0, 3$.

Your response: _____

Incoming: The slope is initially negative but approaches 0 as Y approaches $\log_3(9)$=2.

What multiplicative change is encoded by moving one labeled vertical interval from 1 to 10? Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Your response: _____

Incoming: y = $100(\frac{1}{\sqrt{5}})^x$

Translate the half-unit rise into a ratio of original outputs. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use these axis scales: scale linear in Y; x input; yY =$\log_4(y)$. The vertical displacement is 0.5.

Your response: _____

AP Precalculus

Linearizing Exponential Data

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.

Judge the student's claim that equal-looking log increments prove $y = 10(1.5^x)$ exactly. Student work/claim: The displayed fitted equation is an exact identity for every input, including values outside the observed data window. Locate the unsupported exact-fit/extrapolation step, then state the properly qualified model and justify the qualification from the displayed data.

Context/domain: data

x	raw y	Y=log_base(y)
0	10.0	1.0
1	15.1	1.179
2	22.4	1.35
3	34.0	1.531

Construct every admissible transformed row and diagnose the remaining observation. Student work: $(0, 1.079)$ and $(3, 2.079)$ are admissible; $x = 1$ can be plotted because $y = 0$ Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens.

Context/domain: data

x	raw y	Y=log_base(y)
0	12	1.079
1	0	_____
3	120	2.079

Linearizing Exponential Data

Full Worked Solutions - excerpt

Worked example

Problem. Write the transformed line and identify its intercept and slope. Use $y = 4(2^x)$. Use the transformation $Y = \log_2(y)$.

Answer. Y = $2 + x$; intercept 2 and slope 1

Explanation and check.

$\log_2(4) = 2$ and $\log_2(2) = 1$, so logarithms turn the product into $2 + x$.

Worked example

Problem. What multiplicative change is encoded by moving one labeled vertical interval from 1 to 10? Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Answer. a factor of 10

Explanation and check.

Consecutive decade levels differ by a ratio of 10 even though their numerical differences are not constant.