Sets & Steps
Math Practice & Worked Solutions

Precalculus

Building Polynomial & Rational Models | 3-Topic Precalculus Bundle

3-topic bundle | 288 problems | Four activity formats

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01 Polynomial Modeling from Data

View individual product and its full preview

02 Rational Function Word Problems

View individual product and its full preview

03 Finding Parameters in Function Models

View individual product and its full 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.

24 PDFs and 3 READMEs; 180 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

AP Precalculus

Polynomial Modeling from Data

Polynomial Modeling from Data | APPC-U01-P21

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for regression model, uniqueness conclusion, family of models, attendance model, demand model and factored model.

8 PDFs and a README; 67 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

Polynomial Modeling from 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.

Record the calculator's quadratic model using approximate language. 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 setting is manufacturing. The supplied hypothetical fitted model is $q(x) = 1.05x^2 - 0.19x + 2.01$. The inputs have one unit spacing. The outputs are nearest tenth. Treat the supplied fitted expression as a hypothetical model to interpret; it is not specified as the unconstrained least-squares fit to every displayed row.

Given domain/context: manufacturing

inputs	outputs
0	2.0
1	2.9
2	6.2
3	10.8

Bank label: _____

Translate the arch prototype to the stated peak and give its operating domain. 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 setting is bridge arch. Work on the interval $0 \le t \le 8$. Use the prototype $-x^2$. The vertex is $(4, 10)$.

Bank label: _____

Write the area polynomial and its positive-side restriction. 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 setting is rectangular sign. The diagram dimensions are length $x + 3$ width $x - 1$. The length is $x + 3$. The width is $x - 1$.

Bank label: _____

Write a continuous two-stage charge model. 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 setting is battery test. For the first stage, use charge remains 100 through hour 1. For the second stage, then loses $4(t - 1)^2$ through hour 5.

Bank label: _____

AP Precalculus

Polynomial Modeling from 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.

Build a height model using the turning point and measurement, and state its time domain. The setting is fountain. The maximum occurs at the point $(3, 20)$. The graph passes through $(1, 12)$. Restrict time to $0 \le t \le 6$.

Translate the labeled net into a polynomial volume model and its positive-length domain. The setting is packaging. Remove squares of side x at four corners. The diagram dimensions are base $20 - 2x$ by $14 - 2x$ height x. The base measures $20 - 2x$ by $14 - 2x$. The height is x. The sheet measures 20 by 14.

State the quadratic regression model and whether it passes through every measurement exactly. The setting is calibration. The supplied hypothetical fitted model is $y = 1.02x^2 + 0.01x + 0.04$. The inputs have one unit spacing. The outputs are nearest tenth. Treat the supplied fitted expression as a hypothetical model to interpret; it is not specified as the unconstrained least-squares fit to every displayed row.

Given domain/context: calibration

inputs	outputs
-2	4.1
-1	1.2
0	0.0
1	1.1
2	4.2

Write a two-stage model with an unambiguous rule at the transition. The setting is production. Restrict the input to $0 \le t \le 5$. For the first stage, use output grows as $4t$ before $t = 3$. For the second stage, after $t = 3$ add $(t - 3)^2$ to the accumulated 12.

AP Precalculus

Polynomial Modeling from 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.

Incoming: $S(x) = 2(\frac{x-1}{2})^3 - 2$, equivalently $\frac{(x-1)^3}{4} - 2$.

Use the single-turn trend to report an approximate polynomial model. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The setting is traffic noise. The inputs have one hour spacing. The outputs are nearest tenth. The supplied hypothetical fitted model is $n(t) = -1.03t^2 + 5.08t + 7.99$. Treat the supplied fitted expression as a hypothetical model to interpret; it is not specified as the unconstrained least-squares fit to every displayed row.

Given domain/context: traffic noise

inputs	outputs
0	8.0
1	12.1
2	14.2
3	13.9
4	11.8

Your response: _____

Incoming: $v(x)$ is approximately $0.98x^4 + 0.04x^2 + 1.06$ over the sampled inputs.

Use factored form to build the profit model. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The setting is profit. A measured point is $(1, 16)$. The zeros are -3 and 5.

Your response: _____

Incoming: $M(t) = 4t$ for $0 \le t < 3$, and $M(t) = 15 + 2(t-3)^2$ for $3 \le t \le 6$.

Construct the triangle area polynomial and impose positive dimensions. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The setting is triangular garden. The diagram dimensions are base x height $18 - 2x$. The base measures x. The height is $18 - 2x$.

Your response: _____

START

Apply the described translations to the cubic prototype. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The setting is response index. Use the operating domain $-4 \le x \le 2$. Use the prototype x^3. Translate the prototype 2 units left and 1 unit down.

Your response: _____

AP Precalculus

Polynomial Modeling from 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.

Construct an area polynomial from the dependent legs and restrict x physically. Student work: A(x)=(1/2)x(12-x), with 0<=x<12. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. The setting is triangular display. The diagram dimensions are horizontal leg x vertical leg 12-x. The horizontal leg has length x. The vertical leg has length 12-x. The two legs form a right angle.

Write a continuous fee model and assign $h = 2$ to the later rule. Student work: $C(h) = 5 + 3h$ for $0 \le h < 2$, and $C(h) = 11 + 2(h-2)^2$ for $2 \le h < 5$. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. The setting is parking fee. Restrict the input to $0 \le h \le 5$. For the first stage, use $5 + 3h$ through $h = 2$. For the second stage, begin at 11 and add $2(h-2)^2$.

Polynomial Modeling from Data

Full Worked Solutions - excerpt

Worked example

Problem. Use factored form to build the profit model. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. The setting is profit. A measured point is $(1, 16)$. The zeros are -3 and 5.

Answer. $P(x) = -(x + 3)(x - 5)$.

Explanation and check.

At $x = 1$ the two factors multiply to negative sixteen, so a scale of negative one gives the measured profit.

Worked example

Problem. Find k and write the continuous piecewise model. The setting is signal. The first branch is $3t + 2$ for $t < 4$. The model must be continuous at $t = 4$. The second branch is $(t - 4)^2 + k$ for $t \geq 4$.

Answer. k = 14; use $3t + 2$ for $t < 4$ and $(t - 4)^2 + 14$ for $t \geq 4$.

Explanation and check.

Both pieces must have boundary value 14, which directly fixes the second piece's offset.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Rational Function Word Problems

Rational Function Word Problems | APPC-U01-P22

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for intensity model, model and invariant, model, concentrate fraction, concentration and domain and concentration model.

8 PDFs and a README; 54 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

Rational Function Word Problems

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.

Express width in terms of a nonnegative design input x. 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: rectangle. Area: 99. Dimensions: Length: $x + 2$; Width: w. Bank label: _____	Model the juice fraction after adding only water. 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: juice. Initial juice: 8. Initial volume: 20. Water added: x liters. Bank label: _____
Construct average printing cost per ticket. 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: tickets. Per ticket: 2. Quantity: positive tickets n. Setup: 500. Bank label: _____	Model frequency from the fixed speed relation. 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: waves. Relationship: fixed wave speed. Input: wavelength lambda>0. Speed: 340. Bank label: _____
Express height for a nonnegative parameter x. 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: triangle. Area: 54. Dimensions: Base: $x + 3$; Height: h. Bank label: _____	Model concentration after adding pure water. 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: cleaner. Initial solute: 15. Initial volume: 60. Water added: x. Bank label: _____
Express the second side as a function of positive x. 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: rectangle. Area: 144. Dimensions: Other side: y; Side: x. Bank label: _____	Express height as a function of positive base. 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: parallelogram. Area: 88. Dimensions: Base: b; Height: h. Bank label: _____

AP Precalculus

Rational Function Word Problems

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.

Track salt and total liquid separately to build the concentration. Context: saline. Added concentration: 0.2. Added volume: x liters. Initial salt: 6. Initial volume: 30.	Construct cost per poster and state the admissible inputs. Context: printing. Fixed cost: 240. Quantity: n positive posters. Variable cost: 3.
Model the completion time when both constant-rate pumps work together. Context: pumps. Relationship: parallel workers. Pump a time: 6. Pump b time: $b > 0$ hours.	Audit the proposed blue concentration using units and feasible range. Context: paint. Blue: 4. Proposed: $\frac{10}{4}$. Total: 10.
Construct average cost and identify which term prevents a finite horizontal baseline. Context: manufacturing. Quantity: $q > 0$. Total cost: $C(q) = 500 + 4q + 0.02q^2$.	Express height in terms of radius for the fixed-volume cylinder. Context: cylinder. Dimensions: Height: h; Radius: r. Volume: 200.

AP Precalculus

Rational Function Word Problems

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

Build the simplest zero-baseline saturating ratio. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Context: advertising. Half limit input: 5. Limit: 80.

Your response: _____

Incoming: $A(n) = \frac{2500}{n} + 30$ for integers $1 \le n \le 90$; the average remains above 30.

Model concentration after dilution. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Context: soap. Initial volume: 44. Soap: 11. Water: x liters.

Your response: _____

Incoming: $L(d) = \frac{288}{d^2}$ for $d > 0$.

Construct cost per badge. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Context: badges. Fixed: 360. Per badge: 1.5. Quantity: positive whole n.

Your response: _____

Incoming: $h(x) = \frac{180}{(x-3)(x+1)}$ for $x > 3$.

Express length for $x \ge 0$. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Context: rectangle. Area: 168. Width: $x + 4$.

Your response: _____

Incoming: $h(x) = \frac{84}{x-1}$ for $x > 1$.

Model the equal amount per participant. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Context: shared budget. Participants: positive whole n. Total: 750.

Your response: _____

Incoming: $I(d) = \frac{576}{d^2}$ for $3 \le d \le 18$.

Construct a zero-start learning model with the specified half-saturation input. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Context: learning. Half limit practice: 8. Limit: 100.

Your response: _____

AP Precalculus

Rational Function Word Problems

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.

Express length as a function of positive width. Student work: $L(w) = \frac{72}{w}$ for $w \geq 0$. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. Context: rectangle. Area: 72. Dimensions: Length: L; Width: w.

Model travel time from the fixed-distance invariant. Student work: $T(v) = \frac{180}{v}$ for $v \geq 0$. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. Context: travel. Distance: 180. Input: speed $v > 0$.

Identify the conservation mistake in the constant proposal. Identify the precise error or unsupported step in the stated claim or method, then give the corrected conclusion and justify it from the supplied information. Context: dye. Initial dye: 5. Initial volume: 25. Proposed: $\frac{5}{25}$. Water added: x.

Rational Function Word Problems

Full Worked Solutions - excerpt

Worked example

Problem. Track salt and total liquid separately to build the concentration. Context: saline. Added concentration: 0.2. Added volume: x liters. Initial salt: 6. Initial volume: 30.

Answer. $C(x) = \frac{6+0.2x}{30+x}$ for $x \geq 0$.

Explanation and check.

Added solution contributes both $0.2x$ salt and x total liters.

Worked example

Problem. Model concentration after dilution. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Context: soap. Initial volume: 44. Soap: 11. Water: x liters.

Answer. $C(x) = \frac{11}{44+x}$ for $x \geq 0$.

Explanation and check.

Water increases only the total volume.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Finding Parameters in Function Models

Finding Parameters in Function Models | APPC-U01-P23

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for existence, free family, freedom, parameter, parameters and check and parameters.

8 PDFs and a README; 59 buyer pages.

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AP Precalculus

Finding Parameters in 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 k using the allowed input. 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 the function $f(x) = \frac{k}{x}$. The graph passes through $(4, 7)$.

Bank label: _____

Read the shifts and calibrate the scale. 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 the function $a(x - h)^2 + k$. The graph passes through $(0, 5)$. The vertex is $(-1, 2)$.

Bank label: _____

State the input-output feature encoded by 7 and 12. 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 the model $y = a(x - 7)^2 + 12$.

Bank label: _____

Use the two observations to recover the slope and intercept. 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: motion

0	4
3	19

Bank label: _____

AP Precalculus

Finding Parameters in 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.

Are a and b identifiable? Use the function $f(x) = ax + b$.

Complete response required: freedom.

1	4
1	4

Give units for a, b, and c. height is measured in meters. Use the model $h(t) = at^2 + bt + c$. time is measured in seconds.

Audit the fitted denominator. The calibration input is 2. A student claims $b = 2$. Use the function $\frac{a}{x-b}$.

Interpret $100, 500$, and a. Use the model $C(q) = a(q - 100)^2 + 500$.

Explain the effect of the small slope difference at $x = 100$. Both models have intercept 1. Evaluate at input 100. Their slopes are $(2.0, 2.03)$.

Find the first observation the claimed fit violates. A student claims $(2, 1)$. Use the function $ax + b$.

Given domain/context: linear fit

0	1
1	3
2	6

AP Precalculus

Finding Parameters in 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

Calibrate k at the allowed input. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use the function $\frac{k}{x-1}$. The graph passes through $(4, 6)$.

Your response: _____

Incoming: a has liters per hour cubed, $t0$ has hours, and $R0$ has liters per hour.

Determine a and c. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use the function $ax^2 + c$.

Given domain/context: quadratic

0	3
2	15

Your response: _____

Incoming: a = 2 and $b = 2$.

Decide uniqueness and recover k. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use the function $10\frac{x}{x+k}$. The graph passes through $(2, 5)$.

Your response: _____

Incoming: a = 3 and $b = 1$; the third row is consistent but adds no freedom.

Recover the limiting level and inverse offset from the two features. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use the function $a + \frac{b}{x+1}$. The horizontal limiting value is 4. The output at input zero is 10.

Your response: _____

Incoming: k is pressure-volume in kilopascal-liters.

Recover slope and baseline from the two measurements. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task.

Given domain/context: linear

0	−2
4	10

Your response: _____

Incoming: a = 3 and $b = -2$.

Decide whether k is identifiable and solve it. Use the complete final response to identify the next Match & Move card; show the reasoning required by the original task. Use the function $\frac{k}{x+2}$. The graph passes through $(1, 7)$.

Your response: _____

AP Precalculus

Finding Parameters in 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.

What do 6 and 18 represent? Student work: At reference time $t = 6$, the modeled temperature is 17. Identify the precise mathematical error or omitted condition, then complete the original task and verify the correction from the supplied givens. Use the model $T(t) = m(t - 6) + 18$.

Correct the claimed slope. Identify the precise error or unsupported step in the stated claim or method, then give the corrected conclusion and justify it from the supplied information. A student claims $a = 2$. Use the function $ax + 2$. The graph passes through $(3, 11)$.

Finding Parameters in Function Models

Full Worked Solutions - excerpt

Worked example

Problem. Audit the fitted denominator. The calibration input is 2. A student claims $b = 2$. Use the function $\frac{a}{x-b}$.

Answer. The fit is invalid because x = 2 is undefined when $b = 2$.

Explanation and check.

A calibration equation cannot be cleared at a forbidden input.

Worked example

Problem. Interpret $100, 500$, and a. Use the model $C(q) = a(q - 100)^2 + 500$.

Answer. The reference quantity is 100, cost there is 500, and a controls curvature away from that quantity.

Explanation and check.

Shifted form attaches parameters to the vertex rather than input zero.