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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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: _____

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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.

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

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

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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.

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 $2(h-2)^2$.

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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.