

Precalculus
Polynomial Structure, Symmetry & Forms | 3-Topic Precalculus Bundle

3-topic bundle | 288 problems | Four activity formats

- 01

Polynomial Degree, Zeros, and End Behavior
View individual product and its full preview
- 02

Function Symmetry, Finite Differences, and End Behavior
View individual product and its full preview
- 03

Equivalent Polynomial Forms
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; 260 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.

AP Precalculus

Polynomial Degree, Zeros, and End Behavior

Polynomial Degree, Zeros, and End Behavior | APPC-COMB-U01-P04-P06

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
03	Match & Move	24 cards
04	Error Analysis & Strategy	24 tasks
05	Quick Answer Key	96 answers
06	Full Worked Solutions	96 solutions
07	Teacher / Parent Use Guide	included
08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for left/right signs and oriented behavior, dominant term and both tails by case, decision with structural reason, qualified local relative-size conclusion, justified eventual comparison and qualified zero-set and equality conclusion.

8 PDFs and a README; 88 buyer pages.

AP Precalculus

Polynomial Degree, Zeros, and End Behavior

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.

For $P(x) = 4x^3 - 4x^3 + 7 - 7$, determine the actual degree, leading term, and leading coefficient. Simplify only as much as needed and handle any constant or zero exception.

On the stated domain, the rule is $f(x) = x^4 + \frac{3}{x}$. Does it define a polynomial function? Simplify if useful and justify from coefficient, exponent, and domain structure.

Bank label: _____

Bank label: _____

For $f(x) = -x^6 + 5x^5 + 18$ and $g(x) = -x^6 - 17$, compare the requested difference after leading cancellation. Distinguish signed tail direction from eventual absolute magnitude and inspect cancellation when relevant.



For $P_p(x) = (p - 1)x^4 - 2x^3 + 17$, describe both tails for $p > 1$, $p < 1$, and $p = 1$. Recompute degree at cancellation rather than assigning a zero leading coefficient.

Bank label: _____

Bank label: _____

AP Precalculus

Polynomial Degree, Zeros, and End Behavior

Name: _____ Date: _____ Class: _____

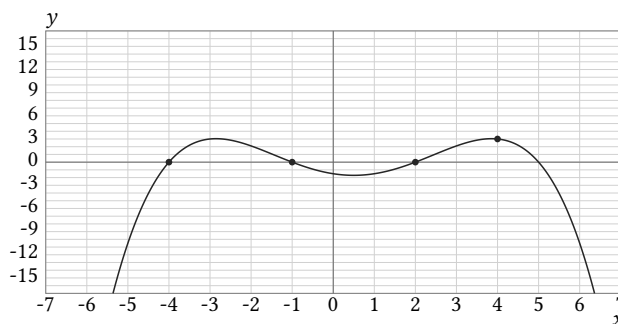
Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. Give the whole requested response, including any reasoning the question asks for.

For the polynomial $f(x) = x^6 + 2x^5 + 18$, describe both end behaviors. State the x -direction and output direction for each tail, and justify from the leading structure.

On the stated domain, the rule is $f(x) = \sqrt{2}x^1 - 2x + 11$. Does it define a polynomial function? Simplify if useful and justify from coefficient, exponent, and domain structure.

For $P(x) = (4x^3 + 1)(3x + 1)(-x + 1)$, determine the actual degree, leading term, and leading coefficient. Simplify only as much as needed and handle any constant or zero exception.

A continuous polynomial graph uses one unit per tick and includes exact visible points $(-4, 0)$, $(-1, 0)$, $(2, 0)$, $(4, 3)$. Its certified arrows state $y \rightarrow -\infty$ as $x \rightarrow -\infty$ and $y \rightarrow -\infty$ as $x \rightarrow +\infty$. Infer the necessary degree parity and leading-coefficient sign. Does this identify a unique degree?



AP Precalculus

Polynomial Degree, Zeros, and End Behavior

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.

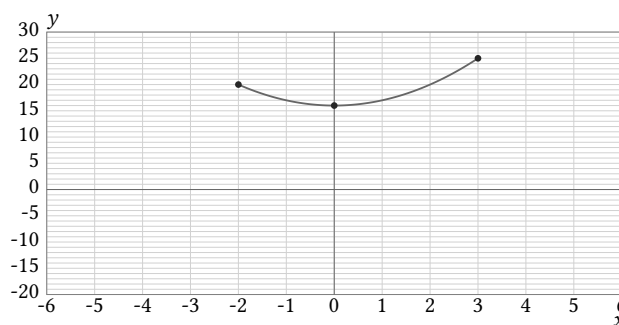
START

For $P(x) = 5x^5 - 5x^5 - 2x^3 + 11$, determine the actual degree, leading term, and leading coefficient. Simplify only as much as needed and handle any constant or zero exception.

Your response: _____

Incoming: Degree 3; leading term $-2x^3$; leading coefficient -2 .

An exact polynomial graph uses rule $x^2 + 16$, one unit per tick, domain $[-2, 3]$, supplied feature points $(-2, 20)$, $(0, 16)$, $(3, 25)$, and certified behavior: no full-domain tails are asserted. Determine which absolute extrema are justified on the stated domain; distinguish local from global evidence.



Your response: _____

AP Precalculus**Polynomial Degree, Zeros,
and End Behavior****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 one polynomial of minimum allowed degree at least 2, with even degree, positive leading coefficient, and constant term 1. Give a formula and verify both tails. A student writes only the final conclusion and omits the substitution, algebra, domain check, or justification required by the prompt. Diagnose the incomplete reasoning and supply the missing work.

Polynomial Degree, Zeros, and End Behavior

Full Worked Solutions - excerpt

Worked example

Problem. For $P(x) = 5x^5 - 5x^5 - 2x^3 + 11$, determine the actual degree, leading term, and leading coefficient. Simplify only as much as needed and handle any constant or zero exception.

Answer. Degree 3; leading term $-2x^3$; leading coefficient -2 .

Explanation and check.

After the needed combining or leading-factor multiplication, the highest surviving power is 3 with coefficient -2 .

Worked example

Problem. For $P(x) = 4x^3 - 4x^3 + 7 - 7$, determine the actual degree, leading term, and leading coefficient. Simplify only as much as needed and handle any constant or zero exception.

Answer. The result is the zero polynomial, whose ordinary degree and leading coefficient are undefined.

Explanation and check.

All terms cancel. The zero polynomial has no highest nonzero power, so it has no ordinary degree or leading coefficient.

AP Precalculus
Function Symmetry, Finite Differences, and End Behavior

Function Symmetry, Finite Differences, and End Behavior | APPC-COMB-U01-P07-P09

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for classification with identity check, classification with mapped-point evidence, unit-bearing conditional model comparison, scaled difference and unchanged degree, two tail sides and crossing qualifier and forced values or exact conflict.

8 PDFs and a README; 94 buyer pages.

AP Precalculus

Function Symmetry, Finite Differences, and End Behavior

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.

Find all real k for which $f_k(x) = kx^3 + 17x$ is even. Collect like powers and set every coefficient of the incompatible parity to zero; report whether the result is unique, free, or inconsistent.

Bank label: _____

Classify $f(x) = -x^2 + 3$ as even, odd, both, or neither. Compute and simplify $f(-x)$; do not use the parity of the highest degree alone.

Bank label: _____

A polynomial is declared even. Its exact partial table gives $f(0) = 6$. Recover every forced entry and diagnose any conflict, enforcing the paired-input law and the odd-function origin condition.

Complete response required: forced values or exact conflict.

x	$f(x)$
0	6

Bank label: _____

Construct an odd polynomial with $f(0) = 1$. If impossible, prove the contradiction from the symmetry identity.

Bank label: _____

AP Precalculus

Function Symmetry, Finite Differences, and End Behavior

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.

Classify $f(x) = 0$ as even, odd, both, or neither. Compute and simplify $f(-x)$; do not use the parity of the highest degree alone. _____ _____	Classify $f(x) = 3x^9 - 5x$ as even, odd, both, or neither. Compute and simplify $f(-x)$; do not use the parity of the highest degree alone. _____ _____
A polynomial is declared odd and satisfies $f(1) = 5$. Infer both $f(-1)$ and $f(0)$, including the forced graph feature at the origin. _____ _____	Construct an odd polynomial of degree at most 5 with $f(1) = 1$ and $f(2) = 8$. Give one formula and verify both values. _____ _____
Find all real k for which $f_k(x) = kx^4 + 4x^2$ is even. Collect like powers and set every coefficient of the incompatible parity to zero; report whether the result is unique, free, or inconsistent. _____ _____	Construct an even polynomial of degree at most 4 with $f(0) = 1$ and $f(1) = 3$. Give one formula and verify symmetry. _____ _____

AP Precalculus

Function Symmetry, Finite Differences, and End Behavior

Name: _____ Date: _____ Class: _____

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

Incoming: The data are inconsistent with a declared odd function: $f(-1)$ must equal -5 , not 6 .

Find all real k for which $f_k(x) = (k - 5)x^3 + 6x^2$ is even. Collect like powers and set every coefficient of the incompatible parity to zero; report whether the result is unique, free, or inconsistent.

Your response: _____

Incoming: Yes. The inputs are equally spaced (the step need not be 1), so ordinary successive differences may be compared.

A polynomial is declared even. Its exact partial table gives $f(3) = 10$, $f(-3) = 11$, $f(0) = 1$. Recover every forced entry and diagnose any conflict, enforcing the paired-input law and the odd-function origin condition.

Complete response required: forced values or exact conflict.

x	$f(x)$
3	10
-3	11
0	1

Your response: _____

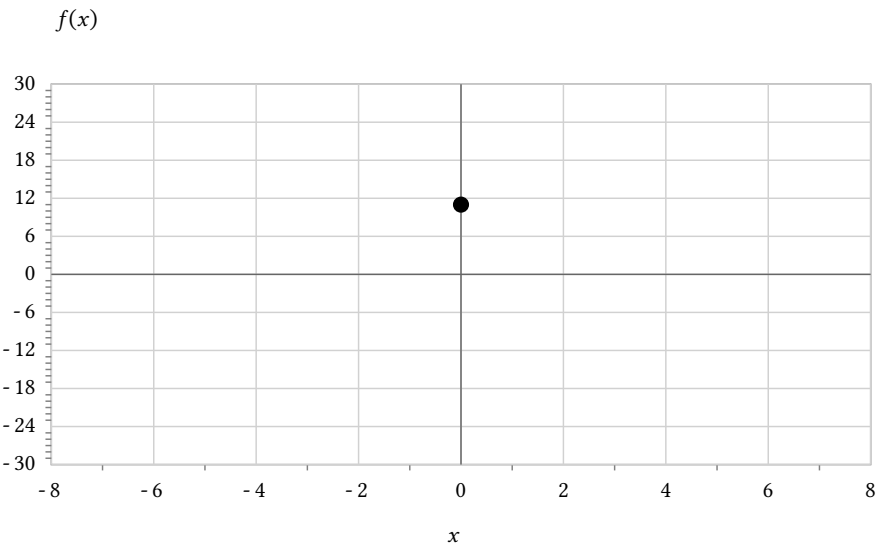
AP Precalculus

Function Symmetry, Finite Differences, and End Behavior

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.

A polynomial is declared odd. Its exact partial graph gives $f(0) = 11$. Recover every forced entry and diagnose any conflict, enforcing the paired-input law and the odd-function origin condition. A student reads only one visible feature of the graph and states the conclusion without checking scale, domain, endpoints, or marked exclusions. Diagnose the incomplete reasoning and give the corrected justification.



0		11	
Viewing window		Minimum	Maximum
x		-8	8
y		-30	30
x		$f(x)$	
0		11	

Function Symmetry, Finite Differences, and End Behavior

Full Worked Solutions - excerpt

Worked example

Problem. Construct an even polynomial with $f(1) = 3$ and $f(-1) = 4$. If impossible, identify the exact paired-value conflict.

Answer. Impossible: even symmetry requires $f(-1) = f(1) = 3$, not 4.

Explanation and check.

Apply the symmetry identity directly to the prescribed values; the contradiction prevents any polynomial from satisfying all conditions.

Worked example

Problem. Construct an odd polynomial with $f(0) = 1$. If impossible, prove the contradiction from the symmetry identity.

Answer. Impossible: odd symmetry forces $f(0) = 0$, contradicting $f(0) = 1$.

Explanation and check.

Apply the symmetry identity directly to the prescribed values; the contradiction prevents any polynomial from satisfying all conditions.

AP Precalculus
Equivalent Polynomial Forms

Equivalent Polynomial Forms | APPC-U01-P13

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for form choice and exact revealed feature, consistent candidate with decisive evidence, first error, corrected identity, and lost graph feature, complete exact polynomial and requested coefficient, factored form plus newly visible feature and feature meaning with units and domain check.

8 PDFs and a README; 78 buyer pages.

AP Precalculus

Equivalent Polynomial Forms

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.

An answer may be used more than once.

Factor $P(x) = 2x^2 - 16x + 32$ to reveal useful structure. Explain the feature made visible by the factorization rather than merely listing roots. _____ Bank label: _____	Rewrite $f(x) = 2x^2 + 1$ in vertex form. On the stated domain $-2 \leq x \leq 3$, determine the minimum value and where it occurs; justify the bound using square nonnegativity and check whether the vertex is feasible. _____ Bank label: _____
Factor $P(x) = 2x^2 + 18x$ to reveal useful structure. Explain the feature made visible by the factorization rather than merely listing roots. _____ Bank label: _____	Rewrite $f(x) = x^2 + 8x + 13$ in vertex form. On the stated domain all real x, determine the minimum value and where it occurs; justify the bound using square nonnegativity and check whether the vertex is feasible. _____ Bank label: _____
Factor $P(x) = 3x^2 - 42x + 147$ to reveal useful structure. Explain the feature made visible by the factorization rather than merely listing roots. _____ Bank label: _____	Rewrite $f(x) = 3x^2 + 12x + 11$ in vertex form. On the stated domain $-1 \leq x \leq 2$, determine the minimum value and where it occurs; justify the bound using square nonnegativity and check whether the vertex is feasible. _____ Bank label: _____
Factor $P(x) = 3x^2 - 18x$ to reveal useful structure. Explain the feature made visible by the factorization rather than merely listing roots. _____ Bank label: _____	Two equivalent descriptions of the same polynomial are vertex: $(x + 1)^2 + 2$; standard: $x^2 + 2x + 3$. Which named form most directly answers the request for vertex? State the feature it reveals and explain why equivalence alone does not make both forms equally efficient. _____ Bank label: _____

AP Precalculus

Equivalent Polynomial Forms

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.

Rewrite $f(x) = 2x^2 - 12x + 17$ in vertex form. On the stated domain $1 \leq x \leq 6$, determine the minimum value and where it occurs; justify the bound using square nonnegativity and check whether the vertex is feasible.

Factor $P(x) = 2x^2 + 32x + 128$ to reveal useful structure. Explain the feature made visible by the factorization rather than merely listing roots.

Use the supplied complete Pascal table to expand $(4x - 4)^5$ and explain how signs and nonunit factors enter each coefficient.

Context/domain: precalculus

j	C(n,j)	power of x	power of constant term	resulting coefficient
0	1	5	0	1024
1	5	4	1	-5120
2	10	3	2	10240
3	10	2	3	-10240
4	5	1	4	5120
5	1	0	5	-1024

Determine all real parameter values that make the two forms $a(x - 3)^2 + k$ and $x^2 - 6x + 8$ identical for every x . Match only decisive coefficients first, then verify every coefficient.

AP Precalculus

Equivalent Polynomial Forms

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

Two equivalent descriptions of the same polynomial are factored: $2(x-2)(x-5)$; standard: $2x^2 - 14x + 20$. Which named form most directly answers the request for initial output $f(0)$? State the feature it reveals and explain why equivalence alone does not make both forms equally efficient.

Your response: _____

Incoming: The roots $t = 0$ and $t = 9$ mean the object is at height 0 feet at launch and landing; both are feasible endpoints.

Use the supplied complete Pascal table to expand $(x+1)^2$ and explain how signs and nonunit factors enter each coefficient.

Context/domain: precalculus

j	C(n,j)	power of x	power of constant term	resulting coefficient
0	1	2	0	1
1	2	1	1	2
2	1	0	2	1

Your response: _____

Incoming: Use the factored form; it directly reveals $x = -1$ and $x = 2$.

Factor $P(x) = x^2$ to reveal useful structure. Explain the feature made visible by the factorization rather than merely listing roots.

Your response: _____

Incoming: $(x-1)^3 = x^3 - 3x^2 + 3x - 1$.

Two equivalent descriptions of the same polynomial are vertex: $3(x+2)^2 - 1$; standard: $3x^2 + 12x + 11$. Which named form most directly answers the request for quadratic extremum and where it occurs? State the feature it reveals and explain why equivalence alone does not make both forms equally efficient.

Your response: _____

AP Precalculus

Equivalent Polynomial Forms

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.

A student claims $3(x - 2)^2 - 1$ is identically equal to $x^2 - 4x + 3$. Locate the algebraic error, write the corrected identity, and name one graph feature or value changed by the false rewrite. Diagnose the missing factor of 3 in expansion; compare the values at $x = 0$. Give the corrected identity and explain why the claimed expressions are not equivalent.

A student claims $3x^2 + 2$ is identically equal to $x^2 + 2$. Locate the algebraic error, write the corrected identity, and name one graph feature or value changed by the false rewrite. Diagnose the omitted coefficient 3; compare the values at $x = 1$. Give the corrected identity and explain why the claimed expressions are not equivalent.

A student claims $(x + 2)^2$ is identically equal to $x^2 + 4$. Locate the algebraic error, write the corrected identity, and name one graph feature or value changed by the false rewrite. Diagnose the omitted cross term; compare both vertices and the values at $x = 1$. Give the corrected identity and explain why the claimed expressions are not equivalent.

A student claims $(x + 5)^2$ is identically equal to $x^2 + 25$. Locate the algebraic error, write the corrected identity, and name one graph feature or value changed by the false rewrite. Diagnose the omitted cross term; compare the values at $x = 1$. Give the corrected identity and explain why the claimed expressions are not equivalent.

Equivalent Polynomial Forms

Full Worked Solutions - excerpt

Worked example

Problem. Factor $P(x) = x^2$ to reveal useful structure. Explain the feature made visible by the factorization rather than merely listing roots.

Answer. $P(x) = xx = x^2$; the repeated factor shows a double zero at $x = 0$.

Explanation and check.

The factorization $xx = x^2$ is an identity. The repeated factor shows a double zero at $x = 0$.

Worked example

Problem. Determine all real parameter values that make the two forms $a(x + 3)^2 + k$ and $x^2 + 6x + 7$ identical for every x . Match only decisive coefficients first, then verify every coefficient.

Answer. $a = 1, k = -2$.

Explanation and check.

Coefficient matching yields the unique pair $a = 1, k = -2$, and substitution reproduces $x^2 + 6x + 7$.