

Precalculus
Equivalent Forms & Rational Algebra | 3-Topic Precalculus
Bundle

3-topic bundle | 288 problems | Four activity formats

- 01

Equivalent Polynomial Forms
View individual product and its full preview
- 02

Rational Expression Operations and Restrictions
View individual product and its full preview
- 03

Polynomial Division and Slant Asymptotes
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; 199 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.

AP Precalculus
Equivalent Polynomial Forms

Equivalent Polynomial Forms | APPC-U01-P13

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 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 $x^2 + 6x + 7$.

AP Precalculus
Rational Expression Operations and Restrictions

Rational Expression Operations and Restrictions | APPC-U01-P14

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for recommended representation with preserved domain, function equality and exact agreement domain, verified original ratio and exact exclusion set, correct rewrite, exclusion, and test-input evidence, simplified rule plus every original exclusion and single ratio, reduced rule, and sourced exclusions.

8 PDFs and a README; 55 buyer pages.

AP Precalculus

Rational Expression Operations and Restrictions

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.

Rewrite $R(x) = \frac{(x+2)(x-6)(2x+3)}{(x+2)(x-6)(x-2)}$ in reduced form and state its original domain. Cancel only common nonzero factors; do not restore an input merely because it disappears from the denominator. _____ Bank label: _____	Choose the more useful of the two supplied forms to determine the horizontal asymptote and the nonzero remainder in a quotient-remainder form. A (single ratio): $\frac{-3(x+2)+1}{x+2}$; B (supplied quotient-remainder): $-3 + \frac{1}{x+2}$. State the feature, explain why that form exposes it, and retain every original excluded input. _____ Bank label: _____
Rewrite $R(x) = 6(x+1)\frac{x-5}{(x+1)(x-5)}$ in reduced form and state its original domain. Cancel only common nonzero factors; do not restore an input merely because it disappears from the denominator. _____ Bank label: _____	Determine all real k for which $\frac{x+k}{x-7}$ and $\frac{x+2}{x-7}$ define identical functions. First compare the algebraic identity, then check zero denominators and whether the domains coincide. _____ Bank label: _____
Rewrite $R(x) = 5(x+7)\frac{x+1}{(x+7)(x+1)}$ in reduced form and state its original domain. Cancel only common nonzero factors; do not restore an input merely because it disappears from the denominator. _____ Bank label: _____	Determine all real k for which $\frac{(x+2)(x+k)}{(x+2)(x-3)}$ and $\frac{x+k}{x-3}$ define identical functions. First compare the algebraic identity, then check zero denominators and whether the domains coincide. _____ Bank label: _____
Rewrite $R(x) = 4(x-2)\frac{x-8}{(x-2)(x-8)}$ in reduced form and state its original domain. Cancel only common nonzero factors; do not restore an input merely because it disappears from the denominator. _____ Bank label: _____	Choose the more useful of the two supplied forms to determine the horizontal asymptote and the nonzero remainder in a quotient-remainder form. A (single ratio): $\frac{3(x+5)+3}{x+5}$; B (supplied quotient-remainder): $3 + \frac{3}{x+5}$. State the feature, explain why that form exposes it, and retain every original excluded input. _____ Bank label: _____

AP Precalculus

Rational Expression Operations and Restrictions

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.

Construct an original rational ratio that reduces to $x - 1$ but has requested original exclusions $\{x = -1\}$. The reduced rule already excludes none; do not add redundant common factors or unintended restrictions. 	Rewrite $\left(\frac{x+7}{x+4}\right) \div \left(\frac{x-3}{x}\right)$ as one rational expression and state the domain. Track every component denominator before simplifying; for division, also exclude inputs where the divisor equals zero.
Rewrite $R(x) = \frac{(x+8)x(2x-3)}{(x+8)x(x+2)}$ in reduced form and state its original domain. Cancel only common nonzero factors; do not restore an input merely because it disappears from the denominator. 	Given $f(x) = \frac{(x+6)(2x-3)}{(x+6)(x+1)}$ with excluded inputs $-6, -1$, and $g(x) = \frac{2x-3}{x+1}$ with $x \neq -6, -1$ with excluded inputs $-6, -1$. Decide whether they are identical functions and state exactly where their values agree. A matching simplified formula is not sufficient without matching domains.
Construct an original rational ratio that reduces to $x - 2$ but has requested original exclusions $\{x = -7\}$. The reduced rule already excludes none; do not add redundant common factors or unintended restrictions. 	Rewrite $\left(\frac{x+5}{x+2}\right)\left(\frac{x+2}{x-2}\right)$ as one rational expression and state the domain. Track every component denominator before simplifying; for division, also exclude inputs where the divisor equals zero.

AP Precalculus

Rational Expression Operations
and Restrictions

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 Rewrite $\left(\frac{x-2}{x-5}\right) \div \left(\frac{x-12}{x-9}\right)$ as one rational expression and state the domain. Track every component denominator before simplifying; for division, also exclude inputs where the divisor equals zero. Your response: _____	Incoming: The single ratio is $\frac{(x-2)(x-9)}{(x-5)(x-12)}$, reducing to $\frac{(x-2)(x-9)}{(x-5)(x-12)}$, with all real x except $x = 5, x = 9, x = 12$. Determine all real k for which $\frac{x+k}{x+2}$ and $\frac{x}{x+2}$ define identical functions. First compare the algebraic identity, then check zero denominators and whether the domains coincide. Your response: _____
Incoming: $k = 0$. Rewrite $\left(\frac{x+10}{x+7}\right) \div \left(\frac{x}{x+3}\right)$ as one rational expression and state the domain. Track every component denominator before simplifying; for division, also exclude inputs where the divisor equals zero. Your response: _____	Incoming: The single ratio is $\frac{(x+10)(x+3)}{(x+7)x}$, reducing to $\frac{(x+10)(x+3)}{(x+7)x}$, with all real x except $x = -7, x = -3, x = 0$. Construct an original rational ratio that reduces to $\frac{3x-2}{x+6}$ but has requested original exclusions $\{x = -6, x = -2\}$. The reduced rule already excludes $\{x = -6\}$; do not add redundant common factors or unintended restrictions. Your response: _____
Incoming: One valid predecessor is $\frac{(x+2)(3x-2)}{(x+2)(x+6)}$, with all real x except $x = -6, x = -2$. Rewrite $\left(\frac{x+3}{x}\right) + \left(\frac{4}{x}\right)$ as one rational expression and state the domain. Track every component denominator before simplifying; for division, also exclude inputs where the divisor equals zero. Your response: _____	Incoming: The single ratio is $\frac{x+7}{x}$, reducing to $\frac{x+7}{x}$, with all real x except $x = 0$. Choose the more useful of the two supplied forms to determine the horizontal asymptote and the nonzero remainder in a quotient-remainder form. A (single ratio): $\frac{-2(x-6)+4}{x-6}$; B (supplied quotient-remainder): $-2 + \frac{4}{x-6}$. State the feature, explain why that form exposes it, and retain every original excluded input. Your response: _____

AP Precalculus

Rational Expression Operations and Restrictions

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 rewrites $(x - 3) \frac{x+2}{x-3}$ as $x + 2$ for every real x . Identify the first invalid inference. State the corrected rule and its original domain, then test the designated input when it is allowed.

Designated test input: $x = 3$.

A student rewrites $\frac{x-1}{x-4}$ as $-\frac{1}{-4}$. Identify the first invalid inference. State the corrected rule and its original domain, then test the designated input when it is allowed.

Designated test input: $x = 1$.

A student rewrites $(x + 3) \frac{x+2}{x+3}$ as $x + 2$ for every real x . Identify the first invalid inference. State the corrected rule and its original domain, then test the designated input when it is allowed.

Designated test input: $x = -3$.

A student rewrites $\frac{4-x}{x-4}$ as 1. Identify the first invalid inference. State the corrected rule and its original domain, then test the designated input when it is allowed.

Designated test input: $x = 5$.

Rational Expression Operations and Restrictions

Full Worked Solutions - excerpt

Worked example

Problem. Rewrite $(\frac{x+3}{x}) + (\frac{4}{x})$ as one rational expression and state the domain. Track every component denominator before simplifying; for division, also exclude inputs where the divisor equals zero.

Answer. The single ratio is $\frac{x+7}{x}$, reducing to $\frac{x+7}{x}$, with all real x except $x = 0$.

Explanation and check.

Combining the operation gives $\frac{x+7}{x}$. The common denominator supplies the sole restriction. Therefore the complete exclusion set is 0.

Worked example

Problem. Rewrite $(\frac{x-9}{x-12}) + (\frac{6}{x-12})$ as one rational expression and state the domain. Track every component denominator before simplifying; for division, also exclude inputs where the divisor equals zero.

Answer. The single ratio is $\frac{x-3}{x-12}$, reducing to $\frac{x-3}{x-12}$, with all real x except $x = 12$.

Explanation and check.

Combining the operation gives $\frac{x-3}{x-12}$. The common denominator supplies the sole restriction. Therefore the complete exclusion set is 12.

AP Precalculus
Polynomial Division and Slant Asymptotes

Polynomial Division and Slant Asymptotes | APPC-U01-P15

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
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Topic focus

Across 96 tasks this topic asks for quotient line, remainder correction, and exclusion, quotient, remainder, and reconstructed identity, quotient and degree-valid remainder, validity verdict with both requirements, first invalid step and corrected continuation and missing polynomial or inconsistency proof.

8 PDFs and a README; 66 buyer pages.

AP Precalculus

Polynomial Division and
Slant Asymptotes

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.

Divide $12x^4 + 48x^3 + 3x^2 + 9x - 14$ by $3x + 12$. Insert zero placeholders for any missing powers, report q and r, and verify $p = dq + r$. _____ Bank label: _____	Determine the parameter value(s) so division of $k + x^2 + x$ by $x + 8$ has required remainder 0. Use the supplied exact constraint table and verify $p = dq + r$. Complete response required: complete parameters with verified remainder. <table border="1"><thead><tr><th>input</th><th>p_k(input)</th><th>required remainder</th></tr></thead><tbody><tr><td>-8</td><td>$56 + k$</td><td>0</td></tr></tbody></table> _____ Bank label: _____	input	p_k(input)	required remainder	-8	$56 + k$	0
input	p_k(input)	required remainder					
-8	$56 + k$	0					
Divide $2x^3 - 4x^2 + 2$ by $2x - 2$. Insert zero placeholders for any missing powers, report q and r, and verify $p = dq + r$. _____ Bank label: _____	In the identity $p(x) = d(x)q(x) + r(x)$, $d(x) = x^2 + 3x + 8$, $q(x) = x - 1$, $r(x) = 1 - x$ are given. Determine the dividend $p(x)$. Then verify the identity and the strict condition $\deg r < \deg d$. _____ Bank label: _____						

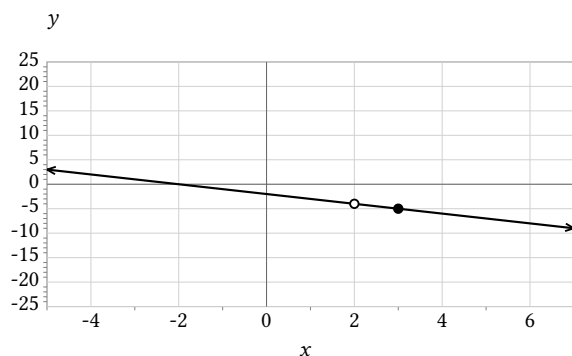
AP Precalculus

Polynomial Division and Slant Asymptotes

Name: _____ Date: _____ Class: _____

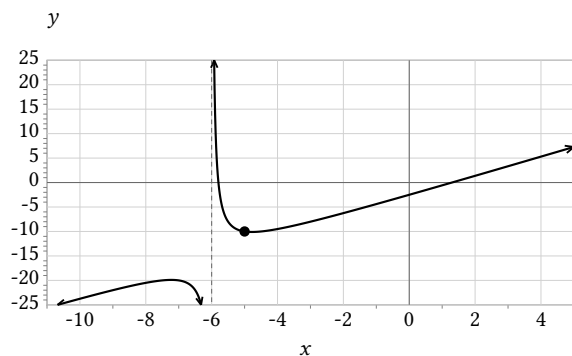
Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. Give the whole requested response, including any reasoning the question asks for.

Divide the numerator in $\frac{4-x^2}{x-2}$ by its denominator. Write the quotient-remainder form, derive the slant line, and explain why the correction tends to 0 while preserving $x = 2$ as excluded.



Divide $9x^4 + 9x^3 - 9x^2 - 3x + 7$ by $3x + 3$. Insert zero placeholders for any missing powers, report q and r , and verify $p = dq + r$.

Divide the numerator in $\frac{2x^2+9x-15}{x+6}$ by its denominator. Write the quotient-remainder form, derive the slant line, and explain why the correction tends to 0 while preserving $x = -6$ as excluded.



A student division of $3x^3 + 3x^2 + 6x$ by $3x$ first fails because the divisor leading coefficient was ignored when choosing the next quotient term. Explain the repair, finish the division, and verify the result.

AP Precalculus

Polynomial Division and Slant Asymptotes

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 is dividing $2x^3 - x^2 + 2x - 2$ by $2x - 1$. Diagnose this specific student statement: The quotient coefficient list $[1, 1]$ represents $x^2 + 1$. Correct the line or coefficient list, complete the division, and verify the quotient and remainder.

A student is dividing $x^3 - x - 1$ by $x - 1$. Diagnose this specific student statement: After subtracting $x^3 - x^2$ from $x^3 + 0x^2 - x - 1$, the remainder is $-x^2 - x - 1$. Correct the line or coefficient list, complete the division, and verify the quotient and remainder.

A student is dividing $x^3 - 3x^2 + 2x - 2$ by $x - 2$. Diagnose this specific student statement: Subtracting $x^3 - 2x^2$ from the dividend gives $-5x^2 + 2x - 2$. Correct the line or coefficient list, complete the division, and verify the quotient and remainder.

A student is dividing $2x^3 + 4$ by $2x + 2$. Diagnose this specific student statement: The descending coefficient list of $2x^3 + 4$ is $[2, 4]$. Correct the line or coefficient list, complete the division, and verify the quotient and remainder.

Polynomial Division and Slant Asymptotes

Full Worked Solutions - excerpt

Worked example

Problem. Divide $x^2 - 7x - 18$ by $x - 9$. Insert zero placeholders for any missing powers, report q and r , and verify $p = dq + r$.

Answer. $q(x) = x + 2, r(x) = 0$.

Explanation and check.

Successive leading-term cancellation gives $q = x + 2$ and $r = 0$. Re-expansion verifies $x^2 - 7x - 18 = (x - 9)(x + 2)$; the zero remainder makes the division exact.

Worked example

Problem. Divide $x^3 - x^2 + 16x - 32$ by $x^2 + x + 17$. Continue only while the current remainder degree is at least 2, then justify the stopping point.

Answer. $q(x) = x - 2, r(x) = x + 2$.

Explanation and check.

Multiplication gives $(x^2 + x + 17)(x - 2)$ and subtraction leaves $x + 2$. Its degree 1 is below 2, so the division is complete.