Sets & Steps
Math Practice & Worked Solutions

Precalculus

Rational Graphs: Domains, Asymptotes & Holes | 3-Topic Precalculus Bundle

3-topic bundle | 288 problems | Four activity formats

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; 295 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

Rational Function Domains and Sign Charts

Rational Function Domains and Sign Charts | APPC-U01-P10

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for compatible graph with decisive feature, verified formula or impossibility proof, exact real domain, repaired solution with domain/sign reason, qualified exact zero conclusion and complete real parameter set.

8 PDFs and a README; 59 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

Rational Function Domains and Sign Charts

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.

Determine the real domain of the original rule $f(x) = \frac{x+40}{(x-6)^2(x-10)(x^2+23)}$. Factor the denominator as needed and preserve exclusions even if a factor cancels.

Bank label: ______

Find all real zeros and x-intercepts of $f(x) = \frac{(x+3)(x+1)(x-2)}{(x+1)(x-5)(x^2+15)}$. List numerator roots first, then enforce the original denominator restrictions.

Bank label: ______

The table rows (x, reported $f(x)$) are $(-9, 0.03), (-8, 0.00), (-7, -0.02)$. Additional exact information: $f(-8) = \frac{1}{500}$ exactly. Decide what zero claim is warranted, using the stated precision and definition status.

Required output: qualified exact zero conclusion

x	**reported** $f(x)$
-9	0.03
-8	0.00
-7	-0.02

Bank label: ______

Find all real zeros and x-intercepts of $f(x) = \frac{(x+9)(x+7)(x+4)}{(x+7)(x+1)(x^2+9)}$. List numerator roots first, then enforce the original denominator restrictions.

Bank label: ______

AP Precalculus

Rational Function Domains and Sign Charts

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.

Determine the real domain of the original rule $f(x) = \frac{(x+2)x}{(x+2)(x-4)}$. Factor the denominator as needed and preserve exclusions even if a factor cancels.	Construct one real rational function with zeros $\{-6, -3\}$, exclusions $\{0, 2\}$, and common factor $(x-2)$, or prove the conditions incompatible. No hole height is prescribed.
A student argues: "For $\frac{(x+3)x}{x} = 0$, cancel to $(x+3) = 0$ and include both $x = -3$ and $x = 0$ as zeros." Diagnose the exact error and repair the solution while preserving original-domain and sign conditions.	Determine the real domain of the original rule $f(x) = \frac{(x-14)}{(x-11)(x^2+27)}$. Factor the denominator as needed and preserve exclusions even if a factor cancels.
Solve $f(x) = \frac{0}{(x-11)(x-13)} \leq 0$. Use the original factored rule to build a sign chart and state every endpoint membership explicitly.	Construct one real rational function with zero set containing 5 and excluded set also containing 5, or prove the conditions incompatible. No hole height is prescribed.

AP Precalculus

Rational Function Domains and Sign Charts

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 Solve $f(x) = \frac{(x+8)}{(x+6)} > 0$. Use the original factored rule to build a sign chart and state every endpoint membership explicitly. Your response: ______________________	**Incoming:** Solution: $(-\infty, -8) \cup (-6, \infty)$. Find all real zeros and x-intercepts of $f(x) = \frac{(x+13)(x+11)}{(x+13)(x+11)(x^2+5)}$. List numerator roots first, then enforce the original denominator restrictions. Your response: ______________________
Incoming: Real zeros: none; there are no x-intercepts. Solve $f(x) = \frac{0}{(x+9)(x+7)} \leq 0$. Use the original factored rule to build a sign chart and state every endpoint membership explicitly. Your response: ______________________	**Incoming:** Solution: $(-\infty, -9) \cup (-9, -7) \cup (-7, \infty)$. Determine all real k such that $x = -5$ is a real zero of $f_k(x) = \frac{x-k}{x}$. Enforce numerator zero and original denominator nonzero simultaneously. Your response: ______________________
Incoming: k = −5. Solve $f(x) = \frac{(x+6)(x+4)}{(x+4)(x+1)} < 0$. Use the original factored rule to build a sign chart and state every endpoint membership explicitly. Your response: ______________________	**Incoming:** Solution: $(-6, -4) \cup (-4, -1)$. Solve $f(x) = \frac{(x+10)(x+8)}{(x+8)(x+5)} < 0$. Use the original factored rule to build a sign chart and state every endpoint membership explicitly. Your response: ______________________

AP Precalculus

Rational Function Domains and Sign Charts

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 argues: "For $\frac{x(x-3)}{x-3} = 0$, cancel to $x = 0$ and include both $x = 0$ and $x = 3$ as zeros." Diagnose the exact error and repair the solution while preserving original-domain and sign conditions. Identify the first invalid inference, give the corrected solution set, and justify it using the original equation.

A student argues: "For $\frac{(x-3)(x-6)}{x-6} = 0$, cancel to $(x-3) = 0$ and include both $x = 3$ and $x = 6$ as zeros." Diagnose the exact error and repair the solution while preserving original-domain and sign conditions. Identify the first invalid inference, give the corrected solution set, and justify it using the original equation.

A student argues: "For $\frac{x-1}{x-4} = 1$, cross-multiply and include $x = 4$ because both sides become 0." Diagnose the exact error and repair the solution while preserving original-domain and sign conditions. Identify the first invalid inference, give the corrected solution set, and justify it using the original equation.

Rational Function Domains and Sign Charts

Full Worked Solutions - excerpt

Worked example

Problem. Construct one real rational function with zero set containing 5 and excluded set also containing 5, or prove the conditions incompatible. No hole height is prescribed.

Answer. No such rational function exists.

Explanation and check.

Impossible: a rational zero must be in the domain, while $x = 5$ is required to be outside the domain.

Worked example

Problem. Determine all real k such that $x = 2$ is a real zero of $f_k(x) = \frac{x-k}{x-k}$. Enforce numerator zero and original denominator nonzero simultaneously.

Answer. No real value of k works.

Explanation and check.

The numerator condition at $x = 2$ forces $k = 2$, but then the denominator is also zero at $x = 2$. The only candidate is forbidden.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus

Vertical Asymptotes and One-Sided Behavior

Vertical Asymptotes and One-Sided Behavior | APPC-U01-P11

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for two signed one-sided limits, complete generic and exceptional classification, verified formula or impossibility proof, evidence-based pole decision, qualified local limit conclusion and exact pole set with residual orders.

8 PDFs and a README; 120 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

Vertical Asymptotes and One-Sided 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.

Determine every vertical asymptote of $f(x) = \frac{(x-2)^2(x-6)}{(x-2)^2(x-6)^2(x^2+19)}$. Collect common factors and compare multiplicities; do not call every original denominator zero a pole.

Bank label: ______

AP Precalculus

Vertical Asymptotes and One-Sided 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.

Determine every vertical asymptote of $f(x) = \frac{(x-11)^2(x-15)}{(x-11)^2(x-15)^2(x^2+28)}$. Collect common factors and compare multiplicities; do not call every original denominator zero a pole.

AP Precalculus

Vertical Asymptotes and One-Sided 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 $f(x) = \frac{3}{(x-1)(x^2+18)}$, analyze the two one-sided limits at $x = 1$. Use the residual denominator parity and the sign of the nonzero local cofactor.

Your response: ____________

AP Precalculus

Vertical Asymptotes and One-Sided 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.

An exact display uses $f(x) = \frac{1}{x-10}$ on window $[0, 4]$. A student claims: “No spike appears in the window $[0, 4]$, so the function has no vertical asymptote.” Diagnose the claim using residual denominator factors rather than visual height alone. Diagnose the no-spike claim by locating the actual pole relative to the displayed window.

Vertical Asymptotes and One-Sided Behavior

Full Worked Solutions - excerpt

Worked example

Problem. Construct a simple rational example satisfying one pole at $x = -6$ with left limit $+\infty$ and right limit $-\infty$, or prove it impossible. Verify pole order and every prescribed one-sided sign.

Answer. One example is $f(x) = -\frac{1}{x+6}$.

Explanation and check.

The denominator power 1 has the required parity and numerator sign -1; direct local sign analysis verifies both branches.

Worked example

Problem. Construct a simple rational example satisfying one pole at $x = 0$ with left limit $-\infty$ and right limit $+\infty$, or prove it impossible. Verify pole order and every prescribed one-sided sign.

Answer. One example is $f(x) = \frac{1}{x}$.

Explanation and check.

The denominator power 1 has the required parity and numerator sign 1; direct local sign analysis verifies both branches.

Sets & Steps
Math Practice & Worked Solutions

AP Precalculus
Holes in Rational Functions

Holes in Rational Functions | APPC-U01-P12

96 problems · Four activity formats

Topic focus

Across 96 tasks this topic asks for verified original ratio or impossibility proof, height membership conclusion with alternate-preimage check, corrected value-limit-hole statement, separate limit and point-value claims, exact removable point coordinates and required point value or impossibility.

8 PDFs and a README; 116 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

Holes in Rational Functions

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.

Locate every removable hole of $f(x) = \frac{(x+6)(x+2)(-x-1)}{(x+6)(x+2)}$. The reduced rule is not the original value at an excluded input; report full coordinates and ignore any residual pole except to keep it distinct.

Bank label: ______

The exact approach table follows the continuation $g(x) = -x + 1$ near $x = -8$. The point definition says: $f(c)$ is undefined. State the two-sided limit when justified and state $f(-8)$ separately.

Given original rule: $f(x) = \frac{(x+8)(-x+1)}{(x+8)}, x \neq -8$

x	reported f(x)
-9	10
$-\frac{17}{2}$	$\frac{19}{2}$
$-\frac{81}{10}$	$\frac{91}{10}$
$-\frac{79}{10}$	$\frac{89}{10}$
$-\frac{15}{2}$	$\frac{17}{2}$
-7	8

Bank label: ______

AP Precalculus

Holes in Rational Functions

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.

Locate every removable hole of $f(x) = \frac{x(-x-2)}{x(x-5)}$. The reduced rule is not the original value at an excluded input; report full coordinates and ignore any residual pole except to keep it distinct.

The exact approach table follows the continuation $g(x) = 2x - 1$ near $x = 5$. The point definition says: $f(5) = 11$ is separately defined. State the two-sided limit when justified and state $f(5)$ separately.

Given original rule: $f(x) = \frac{(x-5)(2x-1)}{(x-5)}, x \neq 5$

x	reported f(x)
4	7
$\frac{9}{2}$	8
$\frac{49}{10}$	$\frac{44}{5}$
$\frac{51}{10}$	$\frac{46}{5}$
$\frac{11}{2}$	10
6	11

AP Precalculus

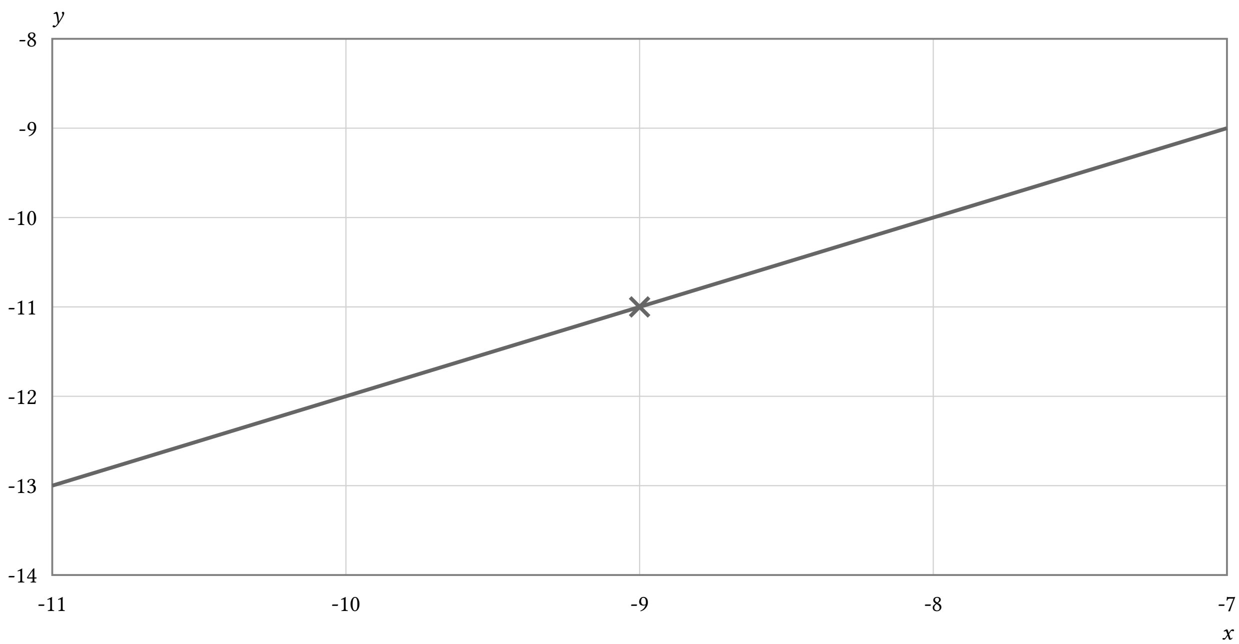
Holes in Rational Functions

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

Construct an original rational function satisfying reduced graph $y = x - 2$ with one hole at $(-9, -11)$, or prove it impossible. Verify every target height against the reduced graph.



Your response: ______________

AP Precalculus

Holes in Rational Functions

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: "For $f(x) = \frac{(x-2)(x-1)}{x-2}$, $\frac{0}{0}$ means $f(2) = 0$." Diagnose the implication and distinguish nearby equality, the limit, and the original point value. Identify the invalid inference. Give the nearby simplified rule, the two-sided limit when justified, and the original point value separately.

A student claims: "For $f(x) = \frac{(x+1)(x-1)}{x+1}$, $\frac{0}{0}$ means $f(-1) = 0$." Diagnose the implication and distinguish nearby equality, the limit, and the original point value. Identify the invalid inference. Give the nearby simplified rule, the two-sided limit when justified, and the original point value separately.

Holes in Rational Functions

Full Worked Solutions - excerpt

Worked example

Problem. Determine the point value, if any, that makes this function continuous at $x = 9$: $f(x) = \frac{1}{x-9}$ for $x \neq 9$, with a proposed finite $f(9)$. Verify a finite two-sided limit before assigning the point.

Answer. No finite point value can make the function continuous.

Explanation and check.

The one-sided outputs diverge with opposite signs at $x = 9$, so no finite two-sided limit exists to use as a fill value.

Worked example

Problem. Determine the point value, if any, that makes this function continuous at $x = 0$: $f(x) = \frac{1}{x}$ for $x \neq 0$, with a proposed finite $f(0)$. Verify a finite two-sided limit before assigning the point.

Answer. No finite point value can make the function continuous.

Explanation and check.

The one-sided outputs diverge with opposite signs at $x = 0$, so no finite two-sided limit exists to use as a fill value.