

Precalculus
Trig Foundations and Parent Graphs

6-topic bundle | 576 problems | Four activity formats

01 Periodic Functions, Radians, and the Unit Circle

View individual product and its full preview

02 Trig Ratios from Triangles and Coordinates

View individual product and its full preview

03 Exact Trig Values at Special Angles

View individual product and its full preview

04 Trig Signs and Reference Angles

View individual product and its full preview

05 Tangent Values and Domain

View individual product and its full preview

06 Sine and Cosine Parent Graphs

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.

48 PDFs and 6 READMEs; 815 buyer PDF pages across the 6 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
Periodic Functions, Radians, and the Unit Circle

Periodic Functions, Radians, and the Unit Circle | APPC-U03-COMB-P01-P02

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 directed radian measure, supported periodicity claim, recurrence rates and range comparison, exact degrees, exact radians and exact ordering.
8 PDFs and a README; 131 buyer pages.

AP Precalculus

**Periodic Functions, Radians, and
the Unit Circle**

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.

Express $-2\frac{\pi}{9}$ radians as an exact directed angle in degrees.

Bank label: _____

AP Precalculus

Periodic Functions, Radians, and the Unit Circle

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.

On a circle of radius 4 m, a point rotates through $\frac{3}{8}$ radians. Find the directed arc displacement s and state whether the motion is clockwise or counterclockwise. _____ _____	For the directed angle $13\frac{\pi}{6}$, describe its terminal ray and list every coterminal representative in the interval $(\pi, 5\pi]$. Respect the endpoint symbols. _____ _____
An exact periodic graph has period 9. A cycle marker occurs at $t = 5$; the graph reaches a specified decreasing phase 4 time units after every marker. Is $t = 38$ that same phase? Give an equivalent cycle window beginning at the marker. _____ _____	For the directed angle $15\frac{\pi}{8}$, describe its terminal ray and list every coterminal representative in the interval $(0, 4\pi)$. Respect the endpoint symbols. _____ _____

AP Precalculus

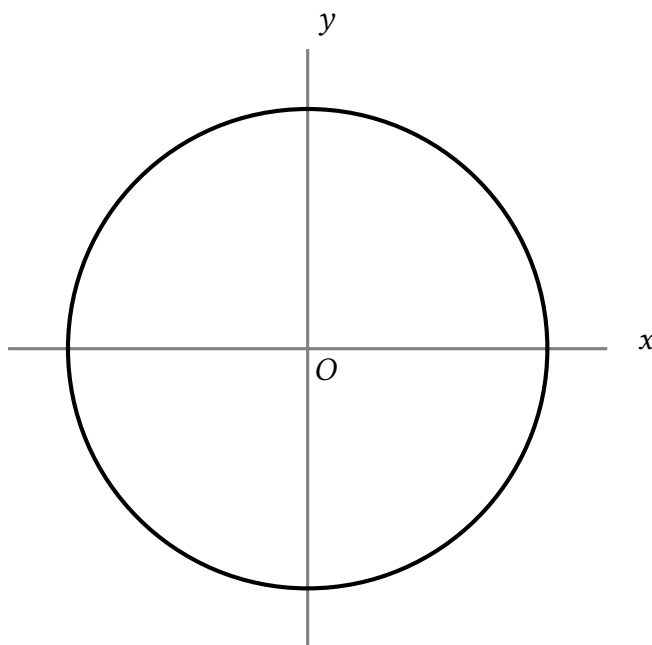
Periodic Functions, Radians, and the Unit Circle

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: 105°

Point $P = (\frac{8}{17}, y)$ lies on the unit circle and is below the x -axis. Find y and verify the point.



Your response: _____

AP Precalculus

Periodic Functions, Radians, and the Unit Circle

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 that the smallest period is 7 time units for these exact repeating (sample index, value) pairs: (0, 78); (1, 71); (2, 76); (3, 73); (4, 72); (5, 73); (6, 82); (7, 78); (8, 71); (9, 76); (10, 73); (11, 72); (12, 73); (13, 82).

Consecutive sample indices are 3 time units apart. Diagnose the claim, state the corrected smallest period, and cite one decisive comparison.

Identify the error or first invalid claim, give the corrected conclusion, and justify the correction.

sample index	value
0	78
1	71
2	76
3	73
4	72
5	73
6	82

sample index	value
7	78
8	71
9	76
10	73
11	72
12	73
13	82

A circle centered at O has radius 18 cm. A point moves counterclockwise along the circle through an arc of length $\frac{162}{5}$ cm. Find the directed angle in radians and explain how the sign records the sweep direction. Before solving, choose and justify the valid method. Method A: Use radius divided by arc length. Method B: Use signed arc length divided by radius.

Periodic Functions, Radians, and the Unit Circle

Full Worked Solutions - excerpt

Worked example

Problem. Convert the directed rotation 225° to an exact radian measure. Preserve its direction.

Answer. $5\frac{\pi}{4}$ radians

Explanation and check.

Multiply by $\frac{\pi}{180}^\circ$: $225(\frac{\pi}{180}) = 5\frac{\pi}{4}$. The sign is preserved.

Worked example

Problem. Convert the directed rotation -24° to an exact radian measure. Preserve its direction.

Answer. $-2\frac{\pi}{15}$ radians

Explanation and check.

Multiply by $\frac{\pi}{180}^\circ$: $-24(\frac{\pi}{180}) = -2\frac{\pi}{15}$. The sign is preserved.

AP Precalculus
Trig Ratios from Triangles and Coordinates

Trig Ratios from Triangles and Coordinates | APPC-U03-P03

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
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Topic focus

Across 96 tasks this topic asks for exact coordinate ratios, radius and three ratios, selected exact ratios, scale, ray relation, and ratio behavior, domain and ratio comparison and ray directions and quotient behavior.

8 PDFs and a README; 112 buyer pages.

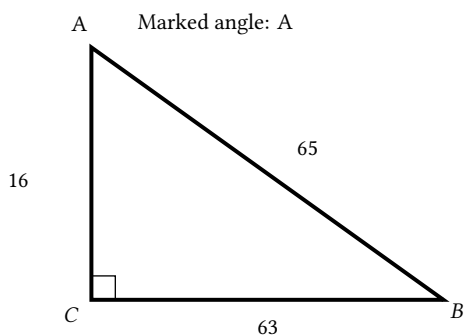
AP Precalculus

Trig Ratios from Triangles and Coordinates

Name: _____ Date: _____ Class: _____

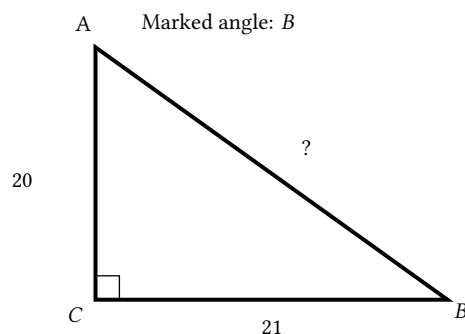
Answer each question and record the matching bank letter. Give exact values. Give the whole requested response, including any reasoning the question asks for.

In right triangle ABC, $\angle C = 90^\circ$, $AC = 16$, $BC = 63$, and $AB = 65$. The marked angle is $\angle A$; the drawing may be rotated. Identify the opposite, adjacent, and hypotenuse sides relative to $\angle A$, then write its sine, cosine, and tangent.



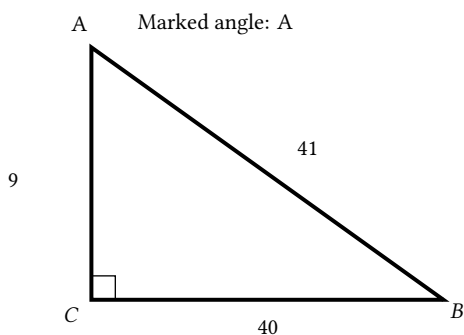
Bank label: _____

Right triangle ABC has $\angle C = 90^\circ$, $AC = 20$, $BC = 21$, and marked angle $\angle B$. First recover AB, then use the side roles relative to $\angle B$ to find sine, cosine, and tangent.



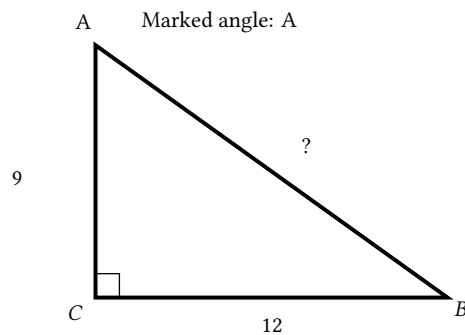
Bank label: _____

In right triangle ABC, $\angle C = 90^\circ$, $AC = 9$, $BC = 40$, and $AB = 41$. The marked angle is $\angle A$; the drawing may be rotated. Identify the opposite, adjacent, and hypotenuse sides relative to $\angle A$, then write its sine, cosine, and tangent.



Bank label: _____

Right triangle ABC has $\angle C = 90^\circ$, $AC = 9$, $BC = 12$, and marked angle $\angle A$. First recover AB, then use the side roles relative to $\angle A$ to find sine, cosine, and tangent.



Bank label: _____

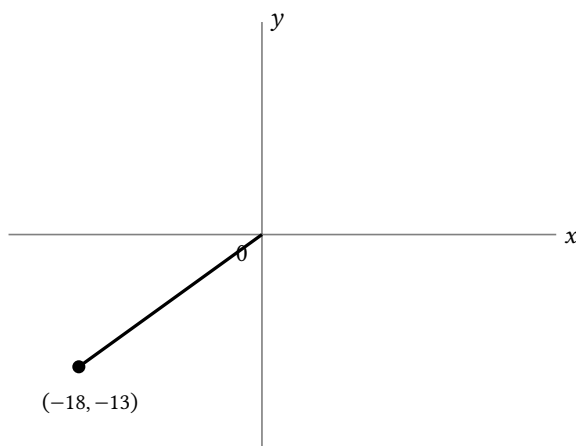
AP Precalculus

Trig Ratios from Triangles and Coordinates

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.

A graphed ray starts at the origin and passes through $(-18, -13)$. Find its slope and interpret that quotient as $\tan \theta$ for the ray's directed angle.



AP Precalculus

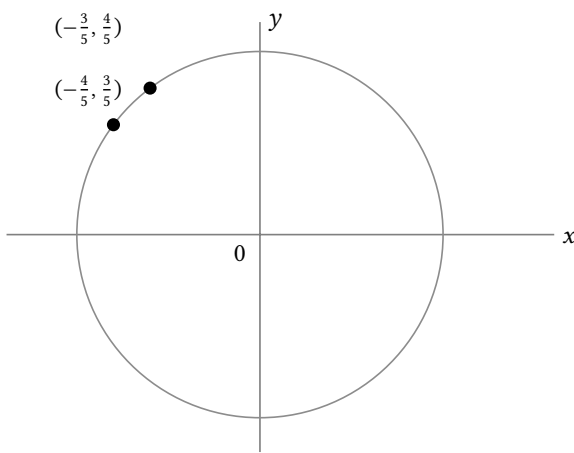
Trig Ratios from Triangles and Coordinates

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

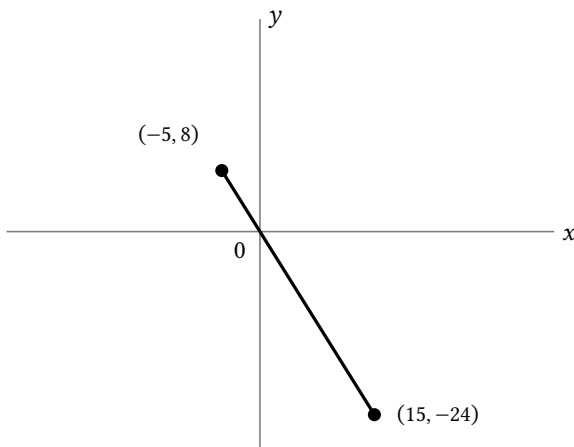
A unit-circle point moves along the shorter counterclockwise arc in the second quadrant from $(-\frac{3}{5}, \frac{4}{5})$ to $(-\frac{4}{5}, \frac{3}{5})$. Describe the endpoint changes in sine and cosine and compare the initial and final tangent ratios.



Your response: _____

Incoming: $\sin: \frac{4}{5} \rightarrow \frac{3}{5}$; $\cos: -\frac{3}{5} \rightarrow -\frac{4}{5}$; $\tan: -\frac{4}{3} \rightarrow -\frac{3}{4}$

Rays OP and OQ pass through $P = (-5, 8)$ and $Q = (15, -24)$. Compare their directions, slopes, and tangent values. Explain what slope loses that sine and cosine would retain.



Your response: _____

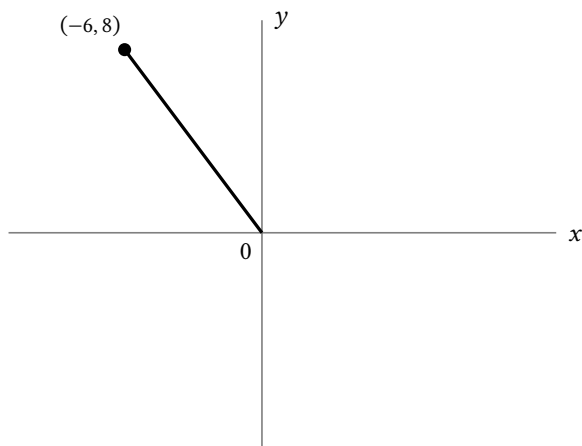
AP Precalculus

Trig Ratios from Triangles and Coordinates

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.

For ray point $(-6, 8)$, a student assigns a negative radius because a coordinate is negative. Diagnose the error, state the correct r , and repair sine and cosine.



Trig Ratios from Triangles and Coordinates

Full Worked Solutions - excerpt

Worked example

Problem. The only information about a nonzero terminal ray is $\tan \theta = -\frac{7}{4}$. Describe the ray or rays that are determined, give representative point(s), and explain the scale or sign ambiguity that remains.

Answer. Two opposite rays, represented by $(4, -7)$ and $(-4, 7)$; any positive scaling on either ray also works.

Explanation and check.

Tangent fixes $\frac{y}{x}$, so it fixes a line through the origin but not which of the two opposite rays or the radial scale.

Worked example

Problem. Can a real nonzero ray satisfy $\sin \theta = \frac{6}{5}$ under the coordinate definition? Decide and prove the conclusion using $|\text{coordinate}| \leq r$.

Answer. No real ray satisfies the claim.

Explanation and check.

For every real point, the magnitude of the relevant coordinate is at most r , so $|\sin \theta| \leq 1$. Here $\left|\frac{6}{5}\right| > 1$, a contradiction.

AP Precalculus
Exact Trig Values at Special Angles

Exact Trig Values at Special Angles | APPC-U03-P04

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
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08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for correct equality and approximation, mode diagnosis and exact value, valid exact and approximate relations, exact equality groups and ordering, all permitted angle labels and completed exact row.

8 PDFs and a README; 128 buyer pages.

AP Precalculus

Exact Trig Values
at Special Angles

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.

A special-angle table row has $(\sin \theta, \cos \theta) = (1, 0)$ but its angle label is missing. Find every label allowed by $[0, 2\pi)$; treat included endpoints as distinct labels when appropriate.

Required response

Angle	$\sin \theta$	$\cos \theta$
_____	1	0

Bank label: _____

On the finite one-turn window $[0, 2\pi)$, locate every special-angle ray satisfying $\cos \theta = \frac{1}{2}$. Use the unit-circle line intersection and check both endpoint flags.

Bank label: _____

AP Precalculus

Exact Trig Values
at Special Angles

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.

The pair at $\frac{\pi}{3}$ is $(\frac{\sqrt{3}}{2}, \frac{1}{2})$. The target ray $\frac{\pi}{6}$ is related by reverse complementary transfer. Track coordinate exchange and any signs to infer its exact pair.

Audit this special-angle table row: $\theta = \frac{\pi}{3}, \sin \theta = \frac{1}{2}, \cos \theta = \frac{1}{2}$.
Identify the earliest exact inconsistency and replace the row with the correct pair.
Required response

Angle	sin θ	cos θ
$\frac{\pi}{3}$	$\frac{1}{2}$	$\frac{1}{2}$

AP Precalculus

Exact Trig Values
at Special Angles

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 A unit-circle table row for $\theta = 7\frac{\pi}{6}$ shows $\cos \theta$ missing and the other coordinate equal to $-\frac{1}{2}$. Complete the row exactly and use the angle's location to justify the square-root sign. Required response <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 33%;">Angle</th> <th style="width: 33%;">sin θ</th> <th style="width: 33%;">cos θ</th> </tr> </thead> <tbody> <tr> <td>$7\frac{\pi}{6}$</td> <td>$-\frac{1}{2}$</td> <td>_____</td> </tr> </tbody> </table> Your response: _____	Angle	sin θ	cos θ	$7\frac{\pi}{6}$	$-\frac{1}{2}$	_____	Incoming: $\sin \theta = -\frac{1}{2}, \cos \theta = -\frac{\sqrt{3}}{2}$ A special-angle table row has $(\sin \theta, \cos \theta) = (\frac{1}{2}, \frac{\sqrt{3}}{2})$ but its angle label is missing. Find every label allowed by $[0, 2\pi)$; treat included endpoints as distinct labels when appropriate. Required response <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 33%;">Angle</th> <th style="width: 33%;">sin θ</th> <th style="width: 33%;">cos θ</th> </tr> </thead> <tbody> <tr> <td>_____</td> <td>$\frac{1}{2}$</td> <td>$\frac{\sqrt{3}}{2}$</td> </tr> </tbody> </table> Your response: _____	Angle	sin θ	cos θ	_____	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$
Angle	sin θ	cos θ											
$7\frac{\pi}{6}$	$-\frac{1}{2}$	_____											
Angle	sin θ	cos θ											
_____	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$											
Incoming: $\theta = \frac{\pi}{6}$ On the finite one-turn window $(-\pi, \pi]$, locate every special-angle ray satisfying $\cos \theta = 1$. Use the unit-circle line intersection and check both endpoint flags. Your response: _____	Incoming: $\theta = 0$ On the finite one-turn window $[0, 2\pi)$, locate every special-angle ray satisfying $\cos \theta = -1$. Use the unit-circle line intersection and check both endpoint flags. Your response: _____												

AP Precalculus**Exact Trig Values
at Special Angles****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 calculator in degree mode evaluates the radian expression $\cos(\frac{\pi}{3})$ and displays 0.9998. Diagnose the mode error, give the correct exact value, and explain why the display is not evidence of equality.

Exact Trig Values at Special Angles

Full Worked Solutions - excerpt

Worked example

Problem. Locate the terminal ray of $\theta = \frac{\pi}{3}$ on the unit circle and evaluate the ordered pair $(\sin \theta, \cos \theta)$ exactly.

Answer. $(\frac{\sqrt{3}}{2}, \frac{1}{2})$

Explanation and check.

The terminal point at $\frac{\pi}{3}$ has $x = \frac{1}{2}$ and $y = \frac{\sqrt{3}}{2}$. Therefore $(\sin \theta, \cos \theta) = (\frac{\sqrt{3}}{2}, \frac{1}{2})$.

Worked example

Problem. Locate the terminal ray of $\theta = \frac{\pi}{6}$ on the unit circle and evaluate the ordered pair $(\sin \theta, \cos \theta)$ exactly.

Answer. $(\frac{1}{2}, \frac{\sqrt{3}}{2})$

Explanation and check.

The terminal point at $\frac{\pi}{6}$ has $x = \frac{\sqrt{3}}{2}$ and $y = \frac{1}{2}$. Therefore $(\sin \theta, \cos \theta) = (\frac{1}{2}, \frac{\sqrt{3}}{2})$.

AP Precalculus

Trig Signs and Reference Angles

Trig Signs and Reference Angles | APPC-U03-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 three signs with coordinate evidence, all allowed angles, terminal location and reference angle, correct boundary classification, possible location or inconsistency and all consistent pairings or contradiction.

8 PDFs and a README; 107 buyer pages.

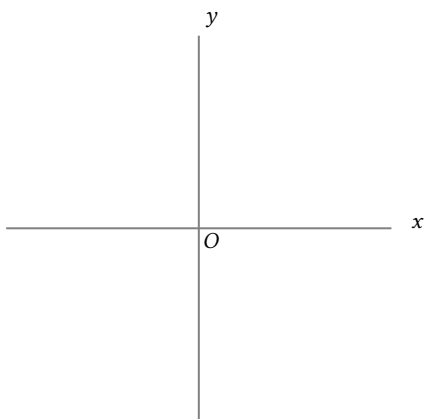
AP Precalculus

Trig Signs and Reference Angles

Name: _____ Date: _____ Class: _____

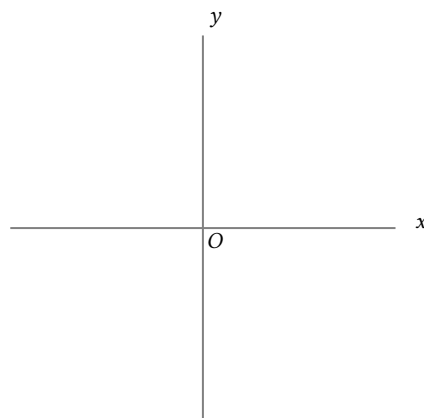
Answer each question and record the matching bank letter. Give exact values. Give the whole requested response, including any reasoning the question asks for.

Intersect the constraints $\sin \theta > 0$, $\cos \theta \neq 0$. State every possible terminal location, distinguishing axes from open quadrants, or prove the conditions inconsistent.



Bank label: _____

Assume $0 < \alpha < \frac{\pi}{2}$. Rewrite $\cos(2\pi - \alpha)$ using $\cos \alpha$ only, and justify the sign from the terminal coordinates rather than evaluating α .



Bank label: _____

Intersect the constraints $\cos \theta < 0$. State every possible terminal location, distinguishing axes from open quadrants, or prove the conditions inconsistent.

Construct every angle in $[0, 2\pi)$ whose acute reference angle is $\frac{\pi}{3}$ and whose terminal ray is in quadrant IV. Respect both endpoint flags and include all admitted turns.

Bank label: _____

Bank label: _____

AP Precalculus

Trig Signs and Reference Angles

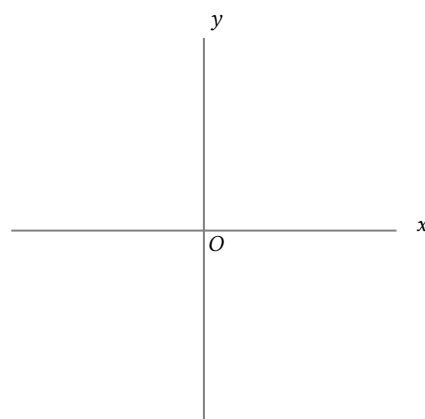
Name: _____ Date: _____ Class: _____

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 quadrant IV coordinate box with $x > 0, y < 0$, classify the signs of sine, cosine, and tangent. Derive them from y, x , and $\frac{y}{x}$, including zero or undefined when required.

Given evidence	Sine	Cosine	Tangent
$x > 0, y < 0$	_____	_____	_____

For positive y -axis ray with $x = 0, y > 0$, classify the signs of sine, cosine, and tangent. Derive them from y, x , and $\frac{y}{x}$, including zero or undefined when required.



Reduce the standard-position rotation $\theta = 7\frac{\pi}{6}$ only as needed, then determine its terminal quadrant and acute reference angle. If it is an axis ray, say so explicitly.

Reduce the standard-position rotation $\theta = 11\frac{\pi}{4}$ only as needed, then determine its terminal quadrant and acute reference angle. If it is an axis ray, say so explicitly.

AP Precalculus

Trig Signs and Reference Angles

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: $\theta = 2\frac{\pi}{3}$ For negative x-axis ray with $x < 0, y = 0$, classify the signs of sine, cosine, and tangent. Derive them from y, x, and $\frac{y}{x}$, including zero or undefined when required. <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 25%;">Given evidence</th> <th style="width: 25%;">Sine</th> <th style="width: 25%;">Cosine</th> <th style="width: 25%;">Tangent</th> </tr> </thead> <tbody> <tr> <td>$x < 0, y = 0$</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table> Your response: _____	Given evidence	Sine	Cosine	Tangent	$x < 0, y = 0$	_____	_____	_____	Incoming: $\theta = 7\frac{\pi}{6}$ Intersect the constraints $\sin \theta = 0, \cos \theta > 0$. State every possible terminal location, distinguishing axes from open quadrants, or prove the conditions inconsistent. Your response: _____
Given evidence	Sine	Cosine	Tangent						
$x < 0, y = 0$	_____	_____	_____						
Incoming: $5\frac{\pi}{6}$ Intersect the constraints $\sin \theta > 0, \cos \theta > 0$. State every possible terminal location, distinguishing axes from open quadrants, or prove the conditions inconsistent. Your response: _____	Incoming: quadrant I Construct every angle in $[0, 4\pi)$ whose acute reference angle is $\frac{\pi}{3}$ and whose terminal ray is in quadrant III. Respect both endpoint flags and include all admitted turns. Your response: _____								

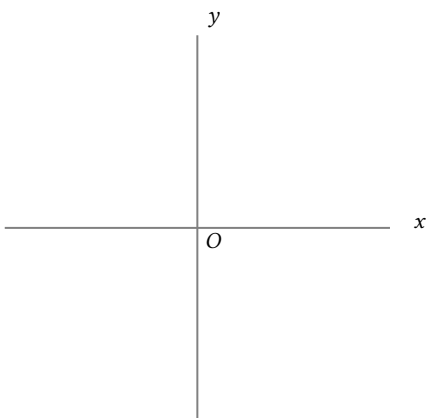
AP Precalculus

Trig Signs and Reference Angles

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.

Assume $0 < \alpha < \frac{\pi}{2}$. Rewrite $\cos(3\pi - \alpha)$ using $\cos \alpha$ only, and justify the sign from the terminal coordinates rather than evaluating α . First select and justify the valid method. Method A: Reduce $3\pi - \alpha$ to $\pi - \alpha$ and use the reflected x -coordinate. Method B: Cancel 3π as though it were an integer multiple of a full turn.



Trig Signs and Reference Angles

Full Worked Solutions - excerpt

Worked example

Problem. Assume $0 < \alpha < \frac{\pi}{2}$. Rewrite $\sin(3\pi - \alpha)$ using $\sin \alpha$ only, and justify the sign from the terminal coordinates rather than evaluating α .

Answer. $\sin(3\pi - \alpha) = \sin \alpha$

Explanation and check.

The reference magnitude is $\sin \alpha$; reduce to $\pi - \alpha$ in quadrant II. Therefore $\sin(3\pi - \alpha) = \sin \alpha$.

Worked example

Problem. Assume $0 < \alpha < \frac{\pi}{2}$. Rewrite $\tan(2\pi - \alpha)$ using $\tan \alpha$ only, and justify the sign from the terminal coordinates rather than evaluating α .

Answer. $\tan(2\pi - \alpha) = -\tan \alpha$

Explanation and check.

The reference magnitude is $\tan \alpha$; quadrant IV has opposite coordinate signs. Therefore $\tan(2\pi - \alpha) = -\tan \alpha$.

AP Precalculus
Tangent Values and Domain

Tangent Values and Domain | APPC-U03-P05

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for classification and decisive evidence, exact slope and sign evidence, classification and earliest error, classification and evidence, exact ordering and earliest error and repair.

8 PDFs and a README; 146 buyer pages.

AP Precalculus

Tangent Values
and Domain

Name: _____ Date: _____ Class: _____

Give exact answers and all requested reasoning; record a bank letter. If bank entries give equivalent final responses for the same quantity and context, either label is valid and may be reused. A shared numerical value alone does not make entries interchangeable.

Order these exact scalar values from least to greatest, grouping ties and using no decimals: $\tan(2\frac{\pi}{3})$, $\sin(3\frac{\pi}{2})$, $\cos(5\frac{\pi}{6})$.

Solve the problem and show enough exact work for the requested result.

$$\tan(2\frac{\pi}{3})$$

$$\sin(3\frac{\pi}{2})$$

$$\cos(5\frac{\pi}{6})$$

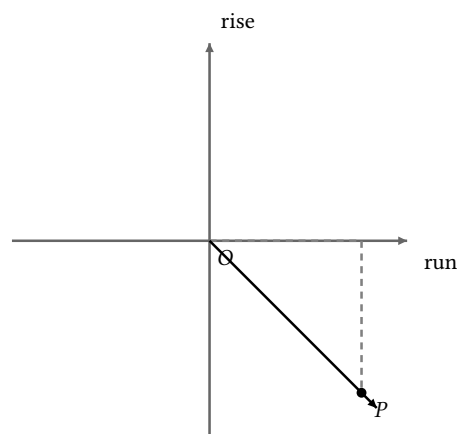
Bank label: _____

Given $\tan(\frac{\pi}{3}) = \sqrt{3}$, use “negate angle” to infer $\tan(-\frac{\pi}{3})$. Explain whether one or both coordinate signs change.

Bank label: _____

A terminal ray passes through $(-4, -4\sqrt{3})$. Evaluate its exact tangent from rise/run and explain why radius normalization is unnecessary.

A marked ray has signed run 12 and rise -12 . Calculate its exact tangent and explain which geometric datum controls the sign.



Bank label: _____

Bank label: _____

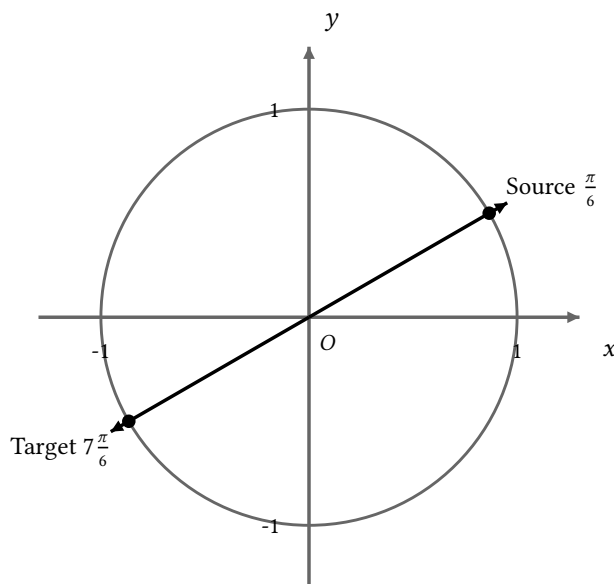
AP Precalculus

Tangent Values and Domain

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.

Given $\tan\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{3}$, use “add π ” to infer $\tan\left(7\frac{\pi}{6}\right)$. Explain whether one or both coordinate signs change.



AP Precalculus

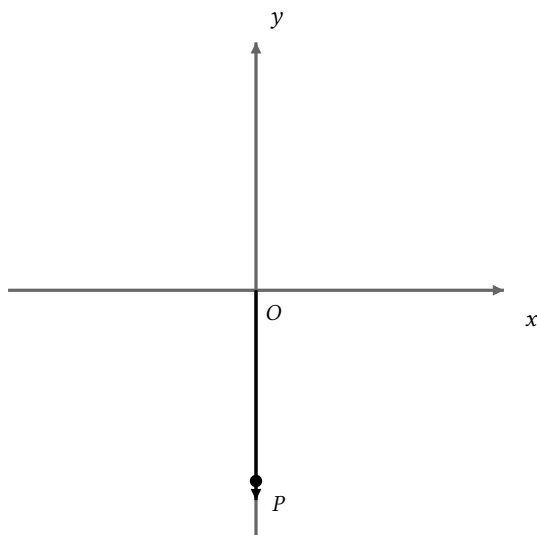
Tangent Values
and Domain

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: $\tan(-5\frac{\pi}{6}) = \frac{\sqrt{3}}{3}$

A ray is represented by the exact point $(0, -3)$. Classify its tangent as zero, nonzero, or undefined and cite numerator and denominator roles.



zero

nonzero

undefined

Your response: _____

AP Precalculus

Tangent Values
and Domain

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.

Audit the claim “ $\tan(\pi)$ is undefined because sine is zero.” Classify tangent correctly and identify the first quotient or domain error.

Identify the error or first invalid step, give the corrected result, and state a brief mathematical reason.

denominator
permission
sign

A student claims: “Because the x -coordinate contains a radical, only a decimal estimate is possible.” Diagnose the first invalid step or assumption, give the corrected conclusion, and justify the correction. Then complete the stated task: Evidence case: an exact point $(2\sqrt{3}, 2)$. Decide whether it determines an exact tangent, only an estimate, or no domain conclusion. State the decisive evidence and any exact datum still needed.

Identify the error or first invalid step, give the corrected result, and state a brief mathematical reason.

Value status	x	y
exact	$2\sqrt{3}$	2

Tangent Values and Domain

Full Worked Solutions - excerpt

Worked example

Problem. At $\theta = \pi$, $(\sin \theta, \cos \theta) = (0, -1)$. Evaluate $\tan \theta$ as a signed coordinate quotient and simplify exactly.

Answer. $\tan(\pi) = 0$

Explanation and check.

Cosine -1 is the denominator. The quotient $\frac{0}{-1}$ simplifies to 0 .

Worked example

Problem. Given $\tan(3\frac{\pi}{4}) = -1$, use “add π ” to infer $\tan(7\frac{\pi}{4})$. Explain whether one or both coordinate signs change.

Answer. $\tan(7\frac{\pi}{4}) = -1$

Explanation and check.

Adding π takes the opposite ray, so both x and y change sign. The quotient $\frac{y}{x}$ is unchanged, giving $\tan(7\frac{\pi}{4}) = -1$.

AP Precalculus

Sine and Cosine Parent Graphs

Sine and Cosine Parent Graphs | APPC-U03-P07

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 direction, sign, turning, and bending description, exact average rate and interpretation, missing projection and graph identity, parent graph and projection explanation, projection error and correction and missing anchors and verified curve.

8 PDFs and a README; 191 buyer pages.

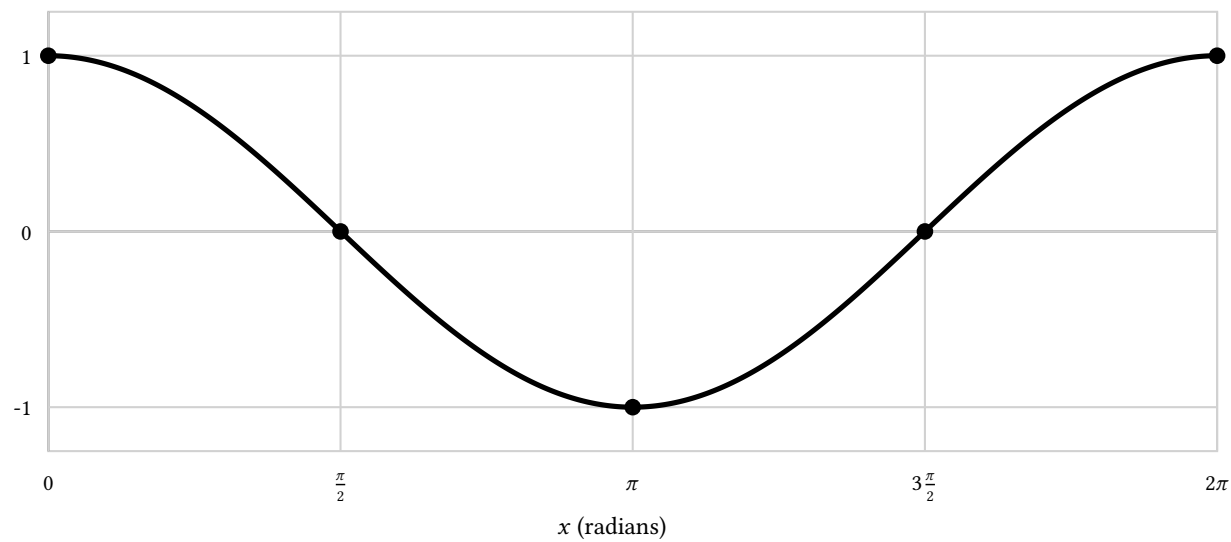
AP Precalculus

Sine and Cosine
Parent Graphs

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.

From the labeled parent graph $y = \cos x$ on the closed window $[0, 2\pi]$, identify its zeros. List event coordinates rather than confusing x -locations with output values, and include boundary events.



x	y
0	1
$\frac{\pi}{2}$	0
π	-1
$\frac{3\pi}{2}$	0
2π	1

Bank label: _____

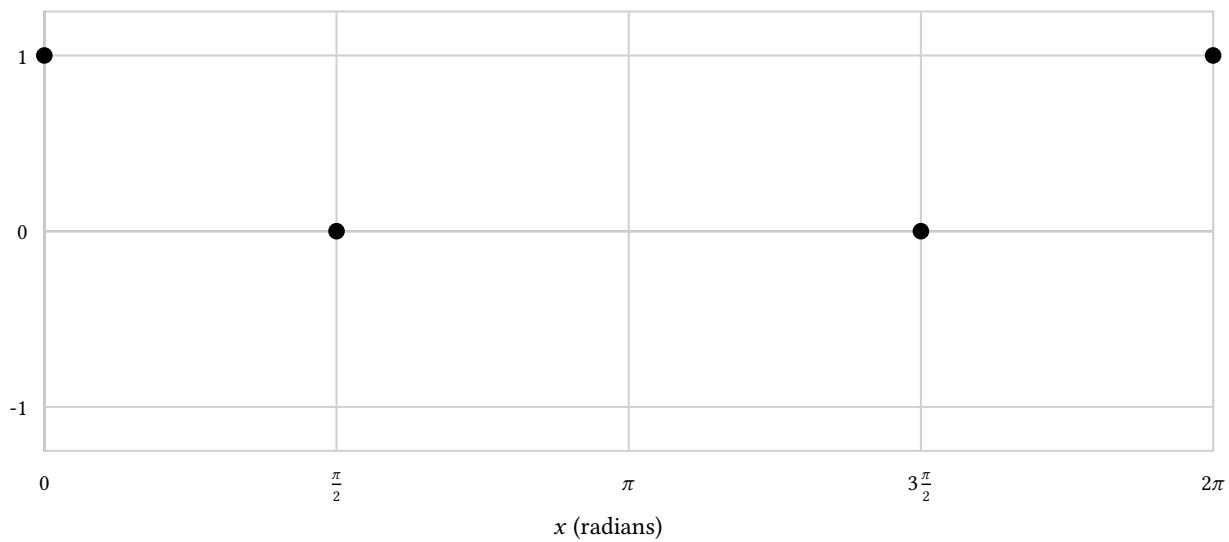
AP Precalculus

Sine and Cosine
Parent Graphs

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 stated parent $y = \cos x$ on $[0, 2\pi]$, restore every question-mark quarter-turn anchor from the partial data, then sketch one smooth continuous parent curve with exact endpoints.



x	y
0	1
$\frac{\pi}{2}$	0
π	_____
$3\frac{\pi}{2}$	0
2π	1

AP Precalculus

Sine and Cosine Parent Graphs

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 $y = \cos x$ on $[0, \frac{\pi}{2}]$, compute the finite average rate of change in output per radian from the exact endpoint values. Interpret the sign, and do not use derivative language.

Required response

x	y
0	1
$\frac{\pi}{2}$	0

Your response: _____

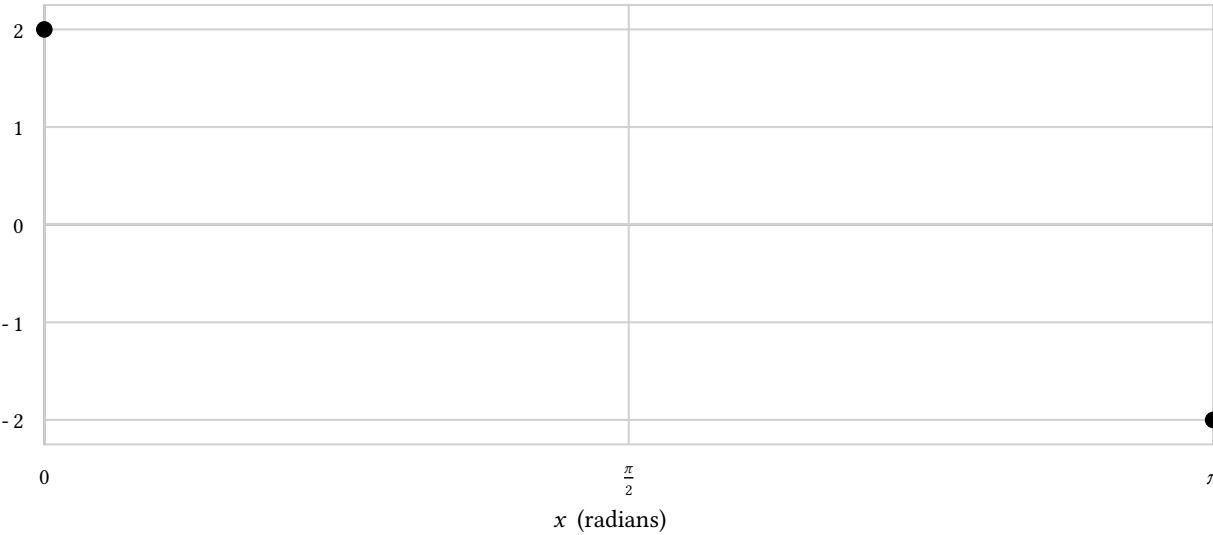
AP Precalculus

Sine and Cosine
Parent Graphs

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.

Audit the proposed $y = \cos x$ sketch using value at zero, quarter-turn anchors, range, cycle joins, and smoothness. Identify the first structural error and give the smallest sufficient repair.



x	y
0	2
π	-2

Sine and Cosine Parent Graphs

Full Worked Solutions - excerpt

Worked example

Problem. For $y = \cos x$ on $[\frac{\pi}{2}, 2\pi]$, compute the finite average rate of change in output per radian from the exact endpoint values. Interpret the sign, and do not use derivative language.

Answer. average rate = $\frac{2}{3\pi}$; output rises overall

Explanation and check.

Compute $\frac{(1)-(0)}{(2\pi)-(\frac{\pi}{2})} = \frac{2}{3\pi}$. Thus output rises overall.

Worked example

Problem. For $y = \cos x$ on $[3\frac{\pi}{2}, 2\pi]$, compute the finite average rate of change in output per radian from the exact endpoint values. Interpret the sign, and do not use derivative language.

Answer. average rate = $\frac{2}{\pi}$; output rises overall

Explanation and check.

Compute $\frac{(1)-(0)}{(2\pi)-(3\frac{\pi}{2})} = \frac{2}{\pi}$. Thus output rises overall.