

ALGEBRA 2

Interactive Notebook

Full-Year Bundle

Grades 10-11 | 101 Pages | 11 Units | 17 Graphs

Unit 1: Functions & Transformations

Unit 2: Linear Functions & Systems Review

Unit 3: Quadratic Functions

Unit 4: Polynomial Functions

Unit 5: Rational Exponents & Radicals

Unit 6: Rational Functions

Unit 7: Exponential & Logarithmic Functions

Unit 8: Sequences & Series

Unit 9: Probability & Statistics

Unit 10: Matrices & Systems of Equations

Unit 11: Introduction to Trigonometry

UM Printables

Premium Secondary Math Resource

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Assembly Tips:

1. Print pages single-sided. 2. Cut along dashed lines. 3. Fold flaps along dotted lines.
4. Apply glue to back of foldable. 5. Press into notebook. 6. Label all tabs and flaps.

Vocabulary Foldable

Cut along outer dashed lines. Fold flaps along dotted lines. Glue into notebook.

Function

Definition:

A relation where each input (x-value) has exactly one output (y-value). Passing the vertical line test confirms a function.

Example:

$f(x) = 2x + 3$; each x gives exactly one y

Domain

Definition:

The set of all possible input values (x-values) for a function. The leftmost to rightmost extent of the graph.

Example:

For $f(x) = \sqrt{x}$, domain is $x \geq 0$

Range

Definition:

The set of all possible output values (y-values) for a function. The lowest to highest extent of the graph.

Example:

For $f(x) = x^2$, range is $y \geq 0$

Parent Function

Definition:

The simplest form of a function family. All transformations are applied to this base function.

Example:

$f(x) = x$ is the parent linear function

Transformation

Definition:

A change to a function's graph, including shifts, reflections, and stretches/compressions.

Example:

$f(x) = -(x+2)^2 + 3$ has 3 transformations

Vertical Line Test

Definition:

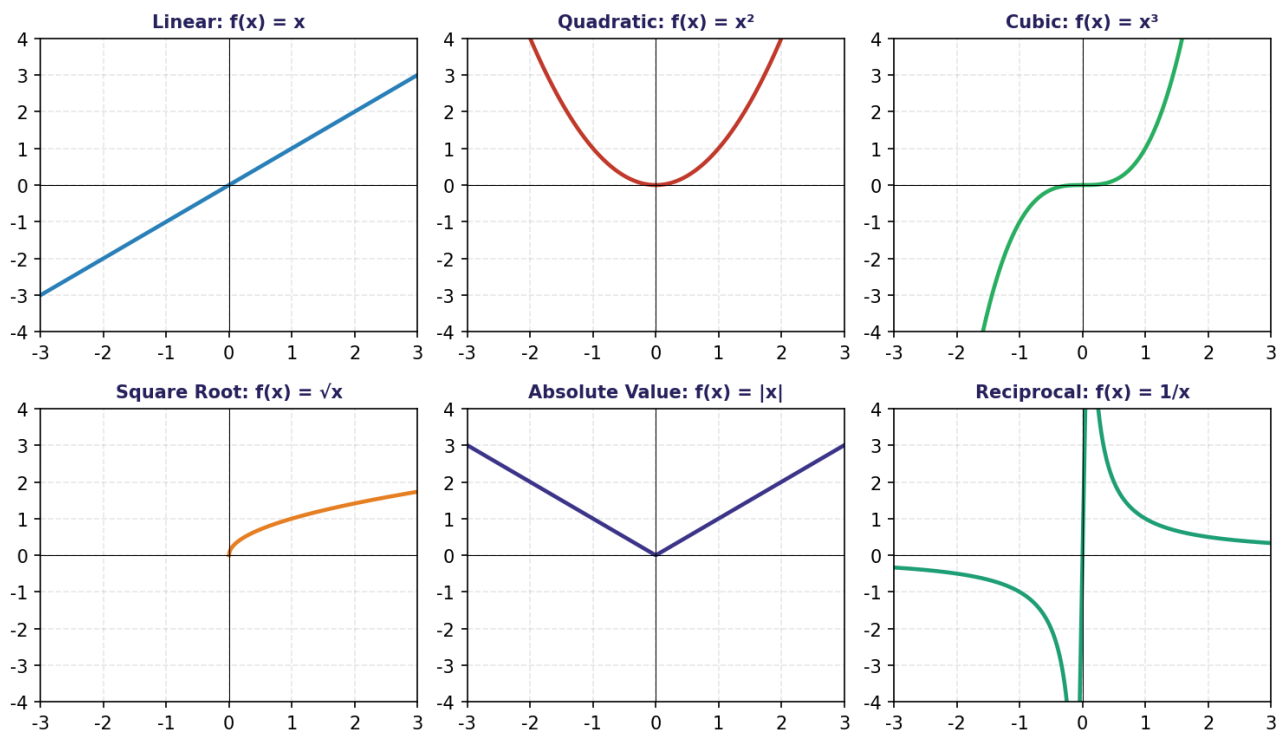
A method to determine if a graph represents a function. If any vertical line crosses the graph more than once, it is NOT a function.

Example:

A circle fails the vertical line test

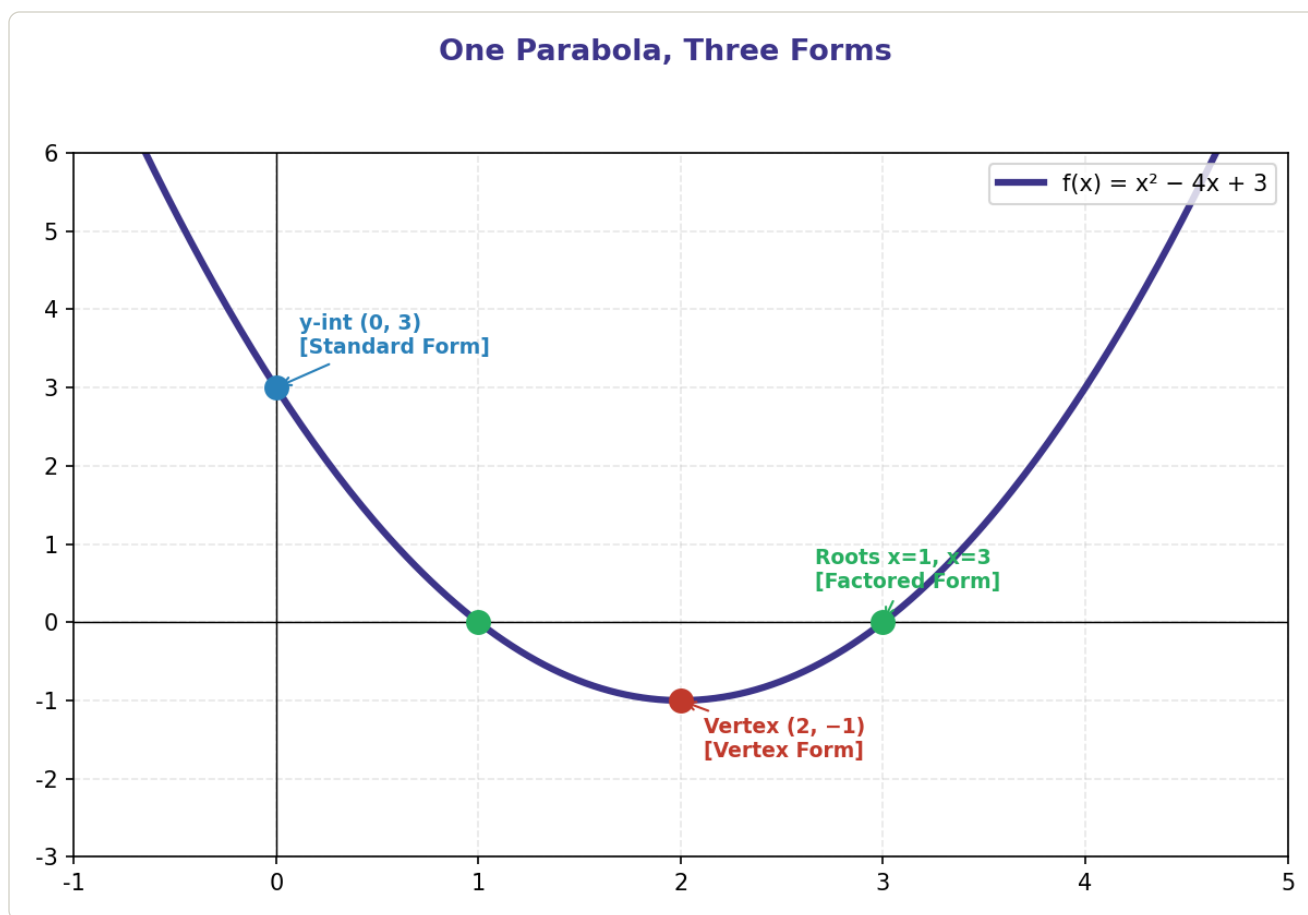
Visual Reference

The Six Parent Functions



The six parent functions. Memorize their shapes, domains, and ranges.

Visual Reference



The SAME parabola in three forms. Standard shows y-int, Vertex form shows vertex, Factored form shows roots.

Flip-Flap Worked Examples

Cut out each panel. Fold along dotted line to hide solution. Glue back into notebook.

Example 1: Convert to vertex form: $f(x) = 2x^2 - 12x + 7$

Solution Steps:

Step 1: Factor out 'a' from x terms: $f(x) = 2(x^2 - 6x) + 7$

Step 2: Complete the square: $(-6/2)^2 = 9$

Step 3: Add/subtract 9 inside parentheses: $f(x) = 2(x^2 - 6x + 9) + 7 - 2(9)$

Step 4: Factor and simplify: $f(x) = 2(x - 3)^2 + 7 - 18$

Step 5: $f(x) = 2(x - 3)^2 - 11$. Vertex is (3, -11).

Example 2: Solve using quadratic formula: $3x^2 - 5x - 2 = 0$

Solution Steps:

Step 1: Identify $a=3$, $b=-5$, $c=-2$

Step 2: Apply formula $x = (-b \pm \sqrt{b^2 - 4ac}) / 2a$

Step 3: $x = (5 \pm \sqrt{25 - 4(3)(-2)}) / 6$

Step 4: $x = (5 \pm \sqrt{25 + 24}) / 6 = (5 \pm \sqrt{49}) / 6$

Step 5: $x = (5 \pm 7) / 6$

Step 6: $x_1 = 12/6 = 2$, $x_2 = -2/6 = -1/3$. Solutions: $x=2$, $x=-1/3$.

Example 3: Application: A farmer has 40 ft of fencing. What rectangle dimensions maximize area?

Solution Steps:

Step 1: Perimeter $2L + 2W = 40 \Rightarrow L + W = 20 \Rightarrow L = 20 - W$

Step 2: Area $A = L \cdot W = (20 - W) \cdot W = -W^2 + 20W$

Step 3: Find vertex: $a=-1$, $b=20$. $W = -20/(2(-1)) = 10$

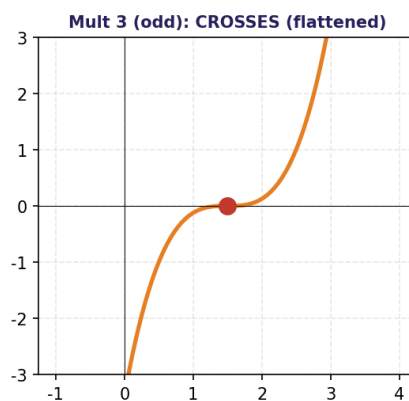
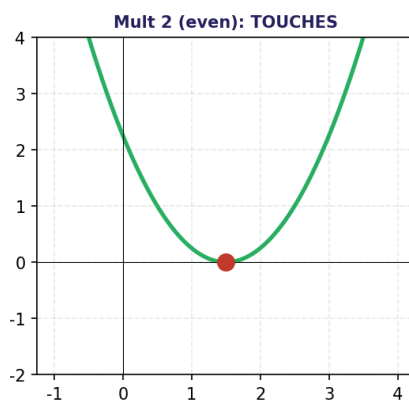
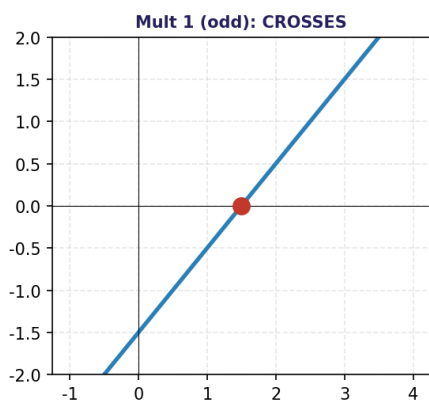
Step 4: Max area occurs at $W = 10$ ft

Step 5: $L = 20 - 10 = 10$ ft

Step 6: A square 10 ft by 10 ft gives max area of 100 sq ft.

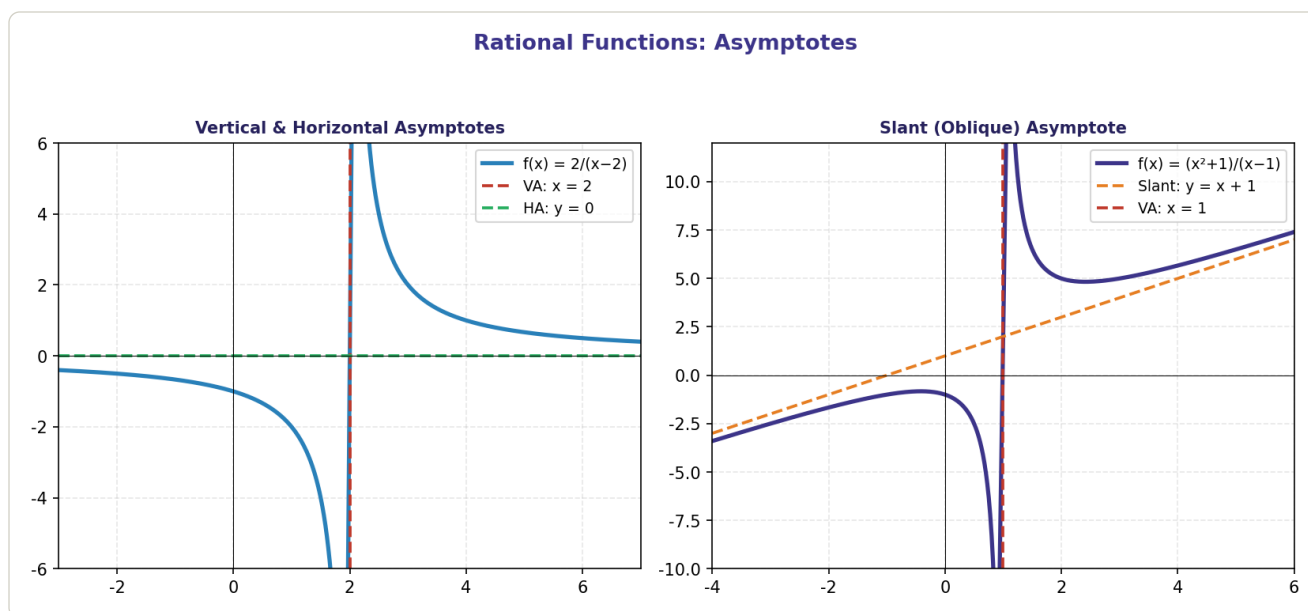
Visual Reference

Multiplicity: How Roots Affect the Graph



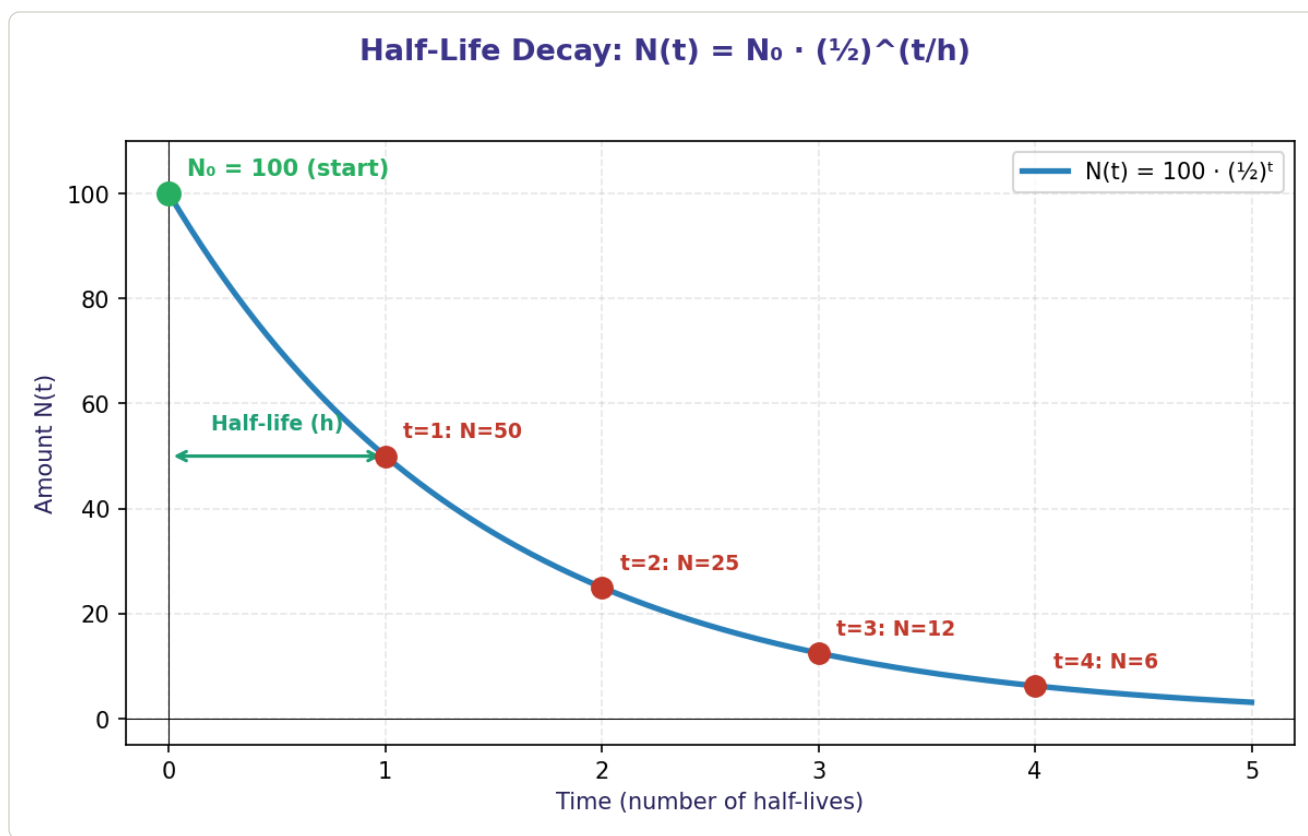
Odd multiplicity CROSSES the x-axis; even multiplicity TOUCHES and TURNS.

Visual Reference



Left: VA and HA for $f(x) = \frac{2}{(x-2)}$. Right: Slant asymptote for $f(x) = \frac{(x^2+1)}{(x-1)}$.

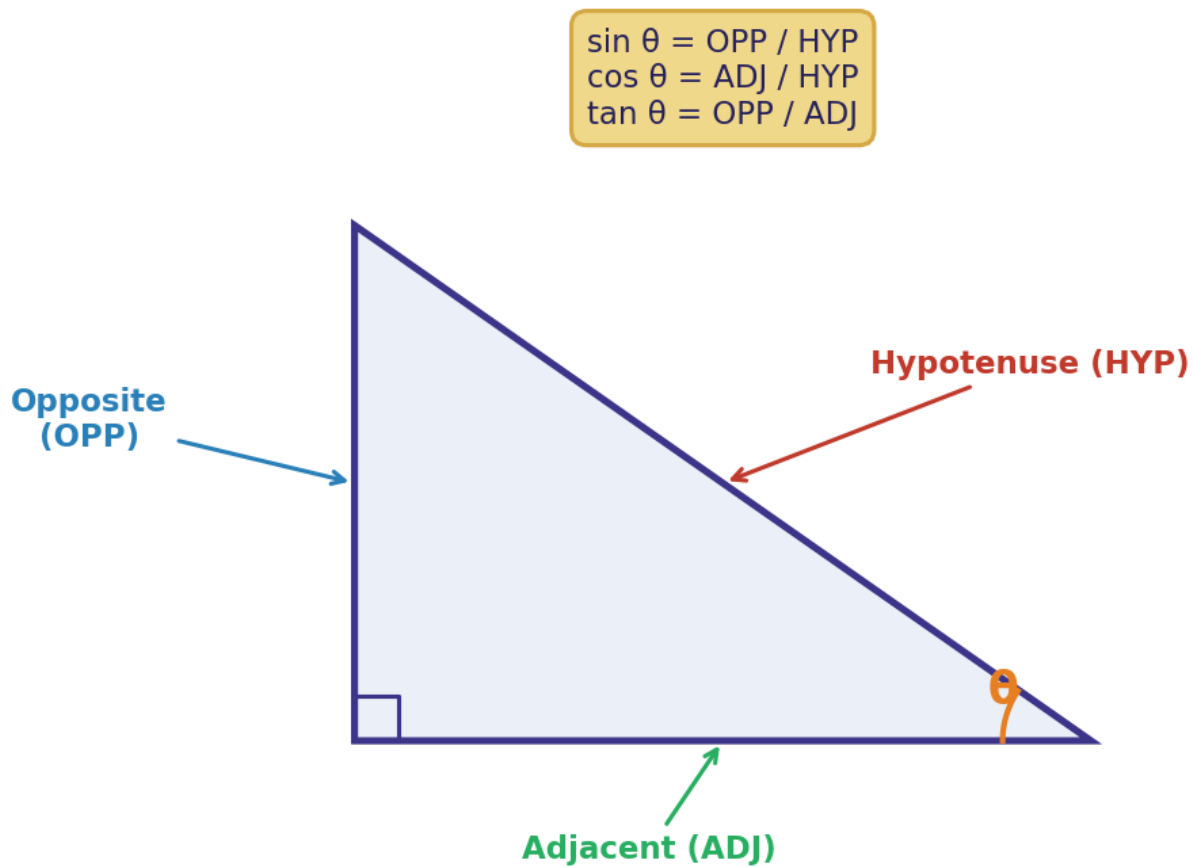
Visual Reference



Half-life decay: the amount halves every period. Formula: $N(t) = N_0 \cdot (1/2)^{t/h}$.

Visual Reference

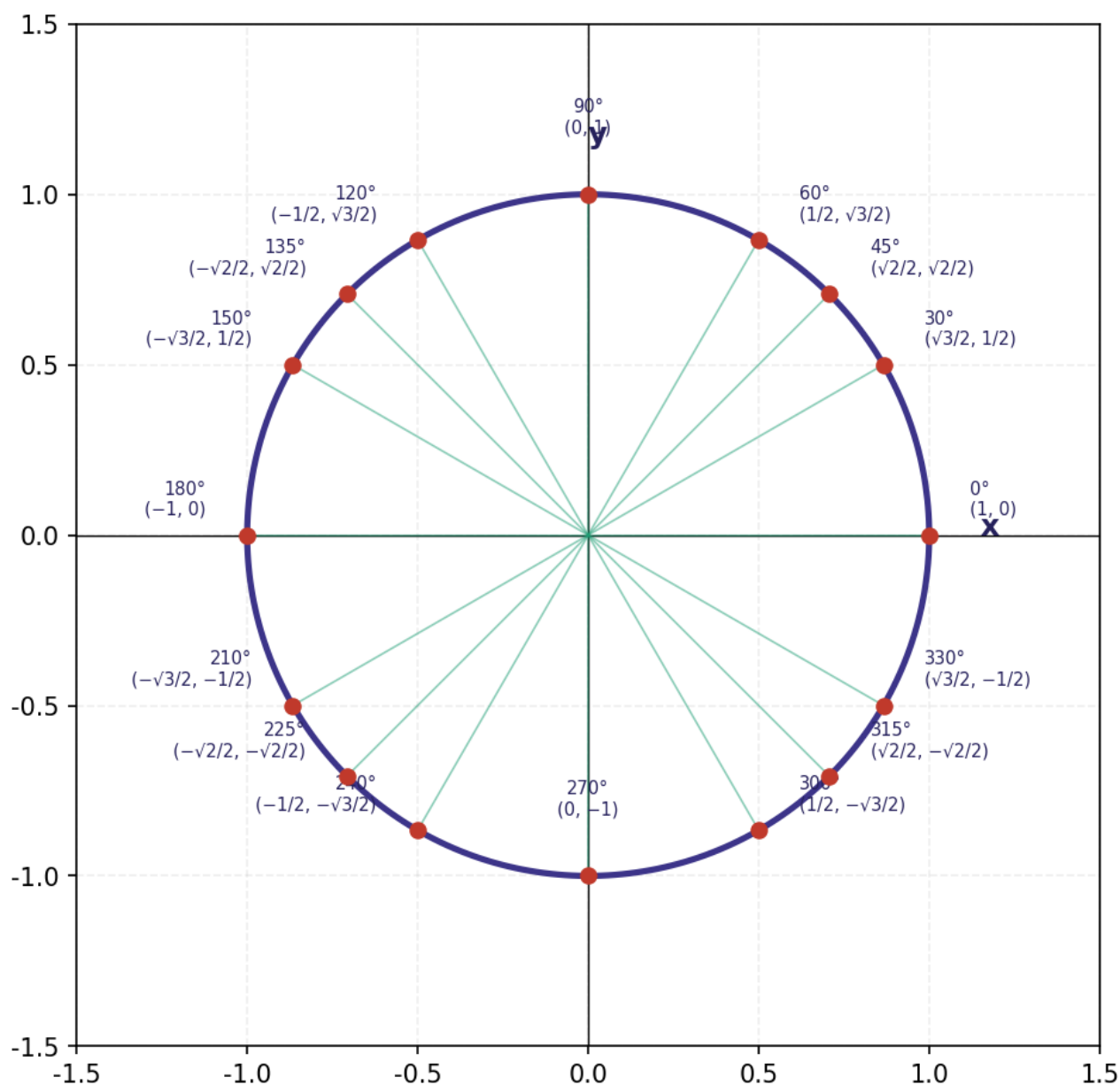
SOH-CAH-TOA in a Right Triangle



SOH-CAH-TOA in a right triangle. Label opposite, adjacent, and hypotenuse relative to the reference angle.

Visual Reference

The Unit Circle



The Unit Circle: coordinates (cos theta, sin theta) for key angles. Memorize Q-I values and use symmetry for the rest.

Unit 1: Functions & Transformations Answer Key

1. Determine whether the relation is a function: $\{(1,3), (2,5), (3,7), (2,8)\}$

Step 1: Recall the definition - a function requires each input (x-value) to map to exactly one output (y-value). Step 2: List the x-values and their outputs: $x=1 \rightarrow y=3$, $x=2 \rightarrow y=5$, $x=3 \rightarrow y=7$, $x=2 \rightarrow y=8$. Step 3: Check for repeated x-values with different y-values. Here, $x=2$ maps to BOTH $y=5$ AND $y=8$. Step 4: Since one input produces two different outputs, this violates the definition of a function. Answer: NOT a function. The input $x=2$ has two different outputs (5 and 8).

2. Find the domain and range of $f(x) = \sqrt{x-4} + 3$. Write in interval notation.

Step 1 (Domain): The expression under a square root must be non-negative. Set the radicand ≥ 0 : $x-4 \geq 0$, so $x \geq 4$. Domain: $[4, +\infty)$. Step 2 (Range): The square root function $\sqrt{x-4}$ produces values ≥ 0 (minimum is 0 when $x=4$). Step 3: Adding 3 shifts the minimum up: $0 + 3 = 3$. So the minimum y-value is 3. Step 4: As x increases, $\sqrt{x-4}$ increases without bound, so y has no upper limit. Answer: Domain = $[4, +\infty)$, Range = $[3, +\infty)$.

3. Evaluate $g(x) = 2x^2 - 3x + 1$ for $x = -2$

Step 1: Substitute $x = -2$ into the function: $g(-2) = 2(-2)^2 - 3(-2) + 1$. Step 2: Evaluate the exponent first (order of operations): $(-2)^2 = 4$, so $g(-2) = 2(4) - 3(-2) + 1$. Step 3: Multiply: $2(4) = 8$ and $-3(-2) = +6$, so $g(-2) = 8 + 6 + 1$. Step 4: Add: $8 + 6 + 1 = 15$. Answer: $g(-2) = 15$.

4. Identify the parent function and describe its shape: $f(x) = x^3$

Step 1: The function has the form $f(x) = x^n$ where $n = 3$ (odd integer greater than 1). Step 2: This matches the Cubic parent function family. Step 3: The graph of $f(x) = x^3$ is an S-shaped curve that passes through the origin $(0, 0)$, falls to the lower-left, and rises to the upper-right. Answer: Cubic function. S-shaped curve through the origin.

5. Describe all transformations: $f(x) = x^2 \rightarrow g(x) = -(x-4)^2 + 7$

Step 1: Compare $g(x) = -(x-4)^2 + 7$ to the general form $a(x-h)^2 + k$. Here $a = -1$, $h = 4$, $k = 7$. Step 2: The sign of 'a' is negative ($a = -1$), so there is a reflection over the x-axis. The parabola opens downward. Step 3: $h = 4$ means a horizontal shift RIGHT by 4 units. Step 4: $k = 7$ means a vertical shift UP by 7 units. Step 5: The vertex moves from $(0, 0)$ to $(4, 7)$. Answer: (1) Reflected over x-axis, (2) shifted right 4, (3) shifted up 7. Vertex at $(4, 7)$.

6. Write the equation: $f(x) = |x|$ shifted left 3, reflected over x-axis, shifted down 2.

Step 1: Start with the parent function: $f(x) = |x|$. Step 2: Apply horizontal shift left 3 (replace x with $(x + 3)$): $f(x) = |x + 3|$. Step 3: Apply reflection over x-axis (multiply by -1): $f(x) = -|x + 3|$. Step 4: Apply vertical shift down 2 (subtract 2): $f(x) = -|x + 3| - 2$. Answer: $g(x) = -|x + 3| - 2$.

7. The graph of $f(x) = \sqrt{x}$ has starting point $(0,0)$. Find the starting point of $g(x) = \sqrt{x+2} - 5$.

Step 1: The starting point of $\sqrt{x-h} + k$ is at (h, k) . Step 2: Rewrite $g(x) = \sqrt{x+2} - 5$ as $\sqrt{x - (-2)} + (-5)$. So $h = -2$, $k = -5$. Step 3: The starting point is $(h, k) = (-2, -5)$. Step 4: Verify - set radicand to 0: $x + 2 = 0$, so $x = -2$. Then $y = \sqrt{0} - 5 = -5$. Answer: Starting point is $(-2, -5)$.

8. A function $g(x)$ is obtained from $f(x) = x^2$ by a vertical stretch of 3, a shift right 2, and a shift down 1. Write $g(x)$.

Step 1: Start with the parent: $f(x) = x^2$. Step 2: Apply vertical stretch by 3 (multiply function by 3): $g(x) = 3x^2$. Step 3: Apply horizontal shift right 2 (replace x with $x - 2$): $g(x) = 3(x - 2)^2$. Step 4: Apply vertical shift down 1 (subtract 1): $g(x) = 3(x - 2)^2 - 1$. Answer: $g(x) = 3(x - 2)^2 - 1$.

9. The graph of $f(x) = 1/x$ has asymptotes $x=0$ and $y=0$. Find the asymptotes of $g(x) = 1/(x-3) + 2$.

Step 1 (VA): Set denominator to 0: $x - 3 = 0$, so $x = 3$. VA: $x = 3$. Step 2 (HA): The parent $1/x$ has HA at $y = 0$. The $+2$ shifts everything up by 2. Step 3: HA: $y = 0 + 2 = 2$. Answer: VA: $x = 3$, HA: $y = 2$.

10. Determine the domain and range of $f(x) = -|x| + 4$.

Step 1 (Domain): The absolute value function is defined for all real numbers. No restrictions. Domain: $(-\infty, +\infty)$. Step 2 (Range): Parent $|x|$ has range $[0, +\infty)$. The negative sign flips it to $(-\infty, 0]$. Step 3: Adding 4 shifts the range up by 4: $(-\infty, 4]$. Step 4: The vertex is at $(0, 4)$, which is the maximum point. Answer: Domain = $(-\infty, +\infty)$, Range = $(-\infty, 4]$.

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Grades 10-11 | Premium Secondary Math Resource

WHAT'S INSIDE THE FULL RESOURCE

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BONUS: 17 Professional Graphs

EVERY UNIT INCLUDES

- ✓ Vocabulary Foldable (cut-and-fold interactive)
- ✓ Guided Notes with Key Concepts & Worked Examples
- ✓ Professional Math Graphs & Diagrams (inline)
- ✓ Flip-Flap Worked Examples (foldable solutions)
- ✓ 10 Practice Problems per unit with workspace
- ✓ Unit Summary Graphic Organizer

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