imagine plus math

Alg II

Fluency Activities

Algebra II

imagine learning

Algebra II Fluency Activities

Math fluency activities in Imagine+ Math help students develop accuracy, efficiency, and flexibility in mathematical thinking. They provide structured practice to strengthen number sense, reinforce foundational skills, and build automaticity with key math concepts. Fluency activities increase student confidence by engaging them in problem-solving, developing a deeper understanding of mathematical relationships, and preparing them for more complex tasks.

Some activities require materials found in your classroom.

Contents

Activity 1 — Exponent and Radical Tap-In

Topic/Concept

Identify Equivalent Forms of Exponent Expressions

Objective

Students will rewrite expressions using exponent and radical rules to generate equivalent forms and justify the transformations.

Materials

- Pre-chosen exponent expressions
- Mini whiteboard or paper

Steps

1. Post a card. Students quickly write two equivalent forms (e.g., $a^{\frac{3}{2}} = \sqrt{a^3} = \sqrt[a]{a}$).
2. Quick check as a class; call "Tap-In" to have one student explain the rule used.
3. **Speed round:** Mix in complex numbers (for example, $(3 - 4i)(3 + 4i)$).
4. **Exit slip:** Students convert a radical to a rational exponent and justify the step.

Resource List

- Examples for pre-chosen exponent expressions:

$a^{\frac{3}{2}}$	$\frac{4a^5b^2}{2a^2b}$
$x^{\frac{5}{3}}$	$(3x^2y^{-1})^2$
$\frac{y^7}{7^3}$	$16^{\frac{3}{4}}$
$(m^2)^4$	$\sqrt[3]{t^5}$
p^{-3}	$(2 + 3i)^2$

Activity 2 Discriminant Dash

Topic/Concept

Identify Solutions to Quadratic Equations

Objective

Students will determine the number and type of solutions to a quadratic equation by identifying a, b, and c, calculating the discriminant $b^2 - 4ac$, and predicting the graph's x-intercepts.

Materials

- 20 quick quadratic prompts in diverse forms
- Multicolor cards: "2 real," "1 real," "2 non-real" (can use sticky notes, notecards)

Steps

1. Display a quadratic in standard form. Students first identify a, b, and c (including signs) and then compute the discriminant $b^2 - 4ac$.
2. Students hold up the card that matches their conclusion about solution type—"2 real," "1 real (double root)," or "2 non-real (complex)." Call on a volunteer to justify.
3. Without solving for x, students state whether the parabola will cross the x-axis twice, touch it once, or not intersect it at all, and sketch or annotate a quick graph to show the intercept behavior.
4. **Radical round:** Switch to one or two square root equations from the unit (for example, $\sqrt{2x + 3} = x - 1$). Before solving, students name the domain restriction (e.g., radicand ≥ 0), predict whether an extraneous solution might occur after squaring, then solve and check in the original equation to confirm or discard any solutions.

Resource List

- 20 quick quadratic prompts

Standard form	Factored form	Vertex form	Mixed
$x^2 - 5x + 6 = 0$	$(x - 4)(x + 1) = 0$	$(x - 3)^2 - 4 = 0$	$x^2 - 4x + 1 = 0$
$x^2 + 6x + 9 = 0$	$(x + 3)^2 = 0$	$(x + 2)^2 + 1 = 0$	$x^2 + 1 = 4x$
$x^2 + 2x - 3 = 0$	$2(x - 2)(x + 5) = 0$	$2(x - 1)^2 - 8 = 0$	$2x^2 + 7 = 3x$
$2x^2 - 3x - 2 = 0$	$(x - 1)(x - 1) = 0$	$(x - 5)^2 = 9$	$(x - 2)(x + 2) = 5$
$3x^2 + 12x + 12 = 0$	$(x + 6)(x - 2) = 0$	$(x + 4)^2 = 16$	$x^2 + 6x = -10$

Activity 3 Log Laws Sort and Solve

Topic/Concept

Describing Exponential and Logarithmic Equations

Objective

Students will apply logarithm laws to rewrite expressions, solve exponential and logarithmic equations, and explain how exponential and logarithmic functions are inverses.

Materials

- Cards with expressions (e.g., $\log_b(xy)$, $\log_b(x^3)$, $\ln e^{2x}$, $b^{\log_b(x)}$)
- Small "laws" tents: product, quotient, power, inverse, change of base (written/printed on notecards)

Steps

1. Teams sort expressions under the correct law.
2. Check with a quick verbal proof.
3. **Speed solve:** One exponential, one logarithmic equation per team; swap and critique.
4. **Graph check:** Sketch and identify inverse points between $y = b^x$ and $y = \log_b x$.

Resource List

- Expressions Cards

Expressions Cards

SORT (name the law):
$\log_b(xy)$

REWRITE:
Write as a sum of logs.

SOLVE: $2^x = 32$

SORT (name the law):
$\log_b\left(\frac{x}{y}\right)$

REWRITE:
Write as a difference of logs.

SOLVE: $3^{x+1} = 81$

SORT (name the law):
$\log_b(x^5)$

REWRITE:
Move the exponent in front.

SOLVE: $\log_2(x) = 6$

SORT (name the law):
$\log_b(b^x)$

SIMPLIFY:
Write in simplest form.

SOLVE: $\ln(x) = 2$

SORT (name the law):
$\log_5(12)$

REWRITE:
Use common logs or natural logs.

SOLVE: $10^x = 0.01$

SORT (name the law used first):
$\ln(3x) - \ln(2)$

REWRITE:
Combine into a single log.

SOLVE: $\log_3(x - 1) = 2$
(state any restrictions)

Activity 4 Zero Factor Graph Relay

Topic/Concept

Writing Polynomials in Factored Form

Objective

Students will connect zeros, factors, and graphs by writing polynomials in factored form, sketching key features (including multiplicities), and using degree and leading coefficient to determine end behavior.

Materials

- Relay sheets: set of zeros (with multiplicities), or a factored form, or a rough graph
- Graph paper or mini whiteboards

Steps

1. **Station 1:** Students convert zeros to a factored form and pass it to Station 2.
2. **Station 2:** Students then expand or sketch, and mark multiplicity behavior at each zero.
3. **Station 3:** Students state the end behavior and verify with degree/leading coefficient.
4. **Quick Rational Round:** Students identify asymptotes/holes from $\frac{(x-2)(x+1)}{(x-2)(x+3)}$.

Resource List

- Relay sheets

Relay Sheets

RELAY SHEET 1 (cubic, mix of multiplicities)

Station 1 (given zeros):
$x = 2$ (mult. 2), $x = -1$ (mult. 1)

Station 2:
Expand or sketch; label x-intercepts and whether the graph touches or crosses at each.

Station 3:
Determine end behavior assuming the leading coefficient is positive.

RELAY SHEET 2 (quartic, both even multiplicities)

Station 1 (given zeros):
$x = 3$ (mult. 2), $x = -2$ (mult. 2)

Station 2:
Sketch; show that both intercepts are "bounce" points.

Station 3:
End behavior with leading coefficient positive.

RELAY SHEET 3 (cubic, negative leading coefficient)

Station 1 (given zeros):
$x = 0$ (mult. 1), $x = 4$ (mult. 2)

Station 2:
Write a possible polynomial and sketch.

Station 3:
End behavior with leading coefficient negative.

RELAY SHEET 4 (quartic, one odd, one even)

Station 1 (given zeros):
$x = -3$ (mult. 3), $x = 1$ (mult. 1)

Station 2:
Expand or sketch; identify which zero flattens/crosses slowly.

Station 3:
End behavior with leading coefficient positive.

RELAY SHEET 5 (quintic, multiple intercepts)

Station 1 (given zeros):
$x = -2$ (mult. 1), $x = 1$ (mult. 2), $x = 5$ (mult. 2)

Station 2:
Sketch; mark behavior at each intercept.

Station 3:
End behavior with leading coefficient positive.

RELAY SHEET 6 (cubic, all simple zeros)

Station 1 (given zeros):
$x = -4$, $x = 1$, $x = 3$ (all mult. 1)

Station 2:
Expand or sketch; show graph crosses at all zeros.

Station 3:
End behavior with leading coefficient positive.

Activity 5 — Transform and Tell

Topic/Concept

Describing Transformations of Parent Functions

Objective

Students will sketch and describe transformations of parent functions by interpreting changes in the form $y = a \cdot f(x - h) + k$, including shifts, reflections, and stretches/compressions.

Materials

- Parent graphs on transparencies or slides: x^2, $|x|$, $\sqrt{x}$, x^3, 2^x, $\log x$
- Deck of transformation cards: $y \pm k$, $a \cdot f(x)$, $f(x \pm h)$, $f(-x)$, $-f(x)$
  (Can be written on notecards and passed out, or displayed on a whiteboard for class reference)

Steps

1. Draw or show a parent graph and deal or point out a transformation card.
2. Students sketch the result and narrate the change: "Left 3, reflect over x-axis, vertical stretch by 2," etc.
3. **Quick inverse check:** Apply $x \leftrightarrow y$ and test one-to-one.
4. **Composition mini-round:** Given f and g, compute/interpret $f \circ g$ at a point.

Resource List

no additional resources needed

Activity 6 — Trig Ratio Triangle Lab

Topic/Concept

Using Similar Right Triangles for Ratios

Objective

Students will measure similar right triangles and compute the sine, cosine, and tangent ratios to show that these ratios remain constant for a given angle.

Materials

- Precut sets of similar right triangles
- Protractors
- Rulers
- Ratio recording sheet, mini whiteboards, or scratch paper

Steps

1. Measure sides and angles for a small and a scaled similar triangle.
2. **Compute:**
   - opposite/hypotenuse
   - adjacent/hypotenuse
   - opposite/adjacent
3. Compare ratios across pairs to argue invariance (foundation for proof).
4. **Quick model:** Match verbal scenarios to sin, cos, or tan.

Resource List

no additional resources needed

Activity 7 System Sort: Method Match

Topic/Concept

Choosing Efficient Methods to Solve a System

Objective

Students will choose and justify an efficient method (graphing, substitution, elimination, or technology) to solve a system and verify the solution(s).

Materials

- Card sets of systems (linear–linear, linear–quadratic, linear–absolute value, linear–rational)
- Method tents: graph, substitution, elimination, "try a numeric/tech check"

Steps

1. Teams sort each system to a preferred method and justify.
2. Solve one per category; trade with another team to verify or critique.
3. **Inequality Round:** Sketch solution regions and identify a point that works/fails.
4. **Reflection:** When would a graphing calculator be the best first step?

Resource List

- System Sort Set

System Sort: Method Match – Ready-to-Print Set (Algebra II)

System Cards · Page 1 of 4

CARD 1
Linear–Linear

SYSTEM: $x + y = 5$
$2x - y = 1$

Best method: _____

Why? _____

CARD 2
Linear–Linear

SYSTEM: $3x + 2y = 12$
$x - 2y = -4$

Best method: _____

Why? _____

CARD 3
Linear–Linear

SYSTEM: $x - 3y = 7$
$2x + y = 1$

Best method: _____

Why? _____

CARD 4
Linear–Linear

SYSTEM: $4x - y = 10$
$-2x + 3y = -1$

Best method: _____

Why? _____

CARD 5
Linear–Quadratic

SYSTEM: $y = x + 1$
$y = x^2 - 4$

Best method: _____

Why? _____

System Sort: Method Match – Ready-to-Print Set (Algebra II)

System Cards · Page 2 of 4

CARD 6
Linear–Quadratic

SYSTEM: $y = -x + 2$
$y = x^2$

Best method: _____

Why? _____

CARD 7
Linear–Quadratic

SYSTEM: $y = 2x - 3$
$y = (x - 1)^2$

Best method: _____

Why? _____

CARD 8
Linear–Quadratic

SYSTEM: $y = -2x + 5$
$y = x^2 - 1$

Best method: _____

Why? _____

CARD 9
Linear–Absolute Value

SYSTEM: $y = |x| + 1$
$y = 3$

Best method: _____

Why? _____

CARD 10
Linear–Absolute Value

SYSTEM: $y = |x - 2|$
$y = x$

Best method: _____

Why? _____

System Sort: Method Match – Ready-to-Print Set (Algebra II)

CARD 11
Linear–Absolute Value

SYSTEM: $y = |2x + 1|$
$y = 4x - 3$

Best method: _____

Why? _____

CARD 12
Linear–Absolute Value

SYSTEM: $y = |x + 3| - 2$
$y = 0$

Best method: _____

Why? _____

CARD 13
Linear–Rational

SYSTEM: $y = \frac{(x + 1)}{(x - 2)}$
$y = 1$

Best method: _____

Why? _____

CARD 14
Linear–Rational

SYSTEM: $y = \frac{(2x - 3)}{(x + 1)}$
$y = 3$

Best method: _____

Why? _____

CARD 15
Linear–Rational

SYSTEM: $y = \frac{(x^2 - 1)}{(x - 1)}$
$y = x + 1$

Best method: _____

Why? _____

System Sort: Method Match – Ready-to-Print Set (Algebra II)

System Cards · Page 4 of 4

CARD 16
Linear–Rational

SYSTEM: $y = \frac{4}{(x - 1)}$
$y = x + 1$

Best method: _____

Why? _____

CARD 17
Linear–Linear (Dependent)

SYSTEM: $2x + 4y = 8$
$x + 2y = 4$

Best method: _____

Why? _____

CARD 18
Linear–Linear (Inconsistent)

SYSTEM: $x + y = 2$
$2x + 2y = 5$

Best method: _____

Why? _____

CARD 19
Linear–Quadratic

SYSTEM: $y = x^2 - 5x + 6$
$y = 0$

Best method: _____

Why? _____

CARD 20
Linear–Rational

SYSTEM: $y = \frac{(x - 4)}{(x + 2)}$
$y = -1$

Best method: _____

Why? _____

System Sort: Method Match

Student Recording Sheet

Name: _____ Date: _____

Card #	Type	Chosen Method	Why This Method?	Solution(s)	Check/Notes

Reflection: When is a graphing calculator/Desmos the best first step? Why?

System Sort: Method Match

Teacher Key

(Solutions and notes)

Card 1: (2, 3) *(Elimination or substitution)*

Card 2: (2, 3) *(Substitution [or elimination])*

Card 3: $(2, -\frac{5}{3})$ *(Elimination [avoid fractions until end])*

Card 4: $(\frac{29}{10}, \frac{8}{5})$ *(Elimination)*

Card 5: $x = \frac{(1 \pm \sqrt{21})}{2}$; $y = x + 1$ *(Graph or substitution)*

Card 6: (–2, 4) and (1, 1) *(Substitution)*

Card 7: (2, 1) (double intersection) *(Substitution; discriminant 0)*

Card 8: $x = -1 \pm \sqrt{7}$; $y = -2x + 5$ *(Substitution; irrational)*

Card 9: (–2, 3) and (2, 3) *(Split absolute value cases)*

Card 10: (1, 1) *(Split into cases)*

Card 11: (2, 5) *(Split into cases; check sign condition)*

Card 12: (–5, 0) and (–1, 0) *(Solve $|x + 3| = 2$)*

Card 13: No solution *(Contradiction after clearing denominators)*

Card 14: (–6, 3) *(Clear denominator)*

Card 15: Infinitely many solutions, but $x \neq 1$ (hole) *(Simplify first)*

Card 16: $(\sqrt{5}, \sqrt{5} + 1)$ and $(-\sqrt{5}, 1 - \sqrt{5})$ *(Clear denominator → quadratic)*

Card 17: Infinitely many solutions *(Same line)*

Card 18: No solution *(Parallel lines)*

Card 19: (2, 0) and (3, 0) *(Factoring)*

Card 20: (1, –1) *(Clear denominator)*