TSI Math Complete Cheat Sheet (Updated January 2026)

Core Linear Equations & Forms
- Slope formula: $m = (y_2 – y_1)/(x_2 – x_1)$
- Slope-intercept form: $y = mx + b$
- Standard form: $Ax + By = C$

Quadratic Equations
- Quadratic formula: $x = [-b \pm \sqrt{(b^2 – 4ac)}] / (2a)$
- Vertex form: $y = a(x – h)^2 + k \rightarrow$ vertex at (h, k)
- Vertex x-coordinate (standard form): $x = –b/(2a)$
- Difference of squares factoring: $a^2 – b^2 = (a – b)(a + b)$

Systems of Equations
- Solve using substitution: replace one variable with an expression from the other equation
- Solve using elimination: make coefficients of one variable opposites, then add/subtract equations
- Solve by graphing: solution is the intersection point

Functions – Basics
- Function notation: $f(x) =$ expression $\rightarrow$ $f(2)$ means substitute $x = 2$
- Evaluate example: if $f(x) = 3x + 5$, then $f(2) = 3(2) + 5 = 11$
- Zeros of a function: values of x where $f(x) = 0$ (x-intercepts)

Inequalities – Rules
- Distribute first when solving inequalities
- Combine like terms and get variables on one side, constants on the other
- Flip the inequality sign when multiplying or dividing by a negative number
- Graph: closed circle (●) for ≥ or ≤; open circle (○) for > or <
- Shade left for “less than” solutions; shade right for “greater than” solutions

Compound Inequalities (“And” Type – Most Common on TSI)
- “And” compound: $a \le x \le b$ or $a < x < b \rightarrow$ x must satisfy both parts
- Solve by performing the same operation on all three parts
- Shortcut for $a < bx + c < d$: subtract c $\rightarrow$ $a – c < bx < d – c$, then divide (flip if b negative)

Temperature Conversions
- Celsius to Fahrenheit: $°F = (°C \times 9/5) + 32$
- Fahrenheit to Celsius: $°C = (°F – 32) \times 5/9$
- Freezing point: $0°C = 32°F$
- Hot summer day example: $\sim 32°C \approx 90°F$
- Comfortable room temperature: $\sim 22°C \approx 72°F$

Function Domain & Range Summary
- Linear functions: domain all real numbers, range all real numbers
- Quadratic (parabola): domain all real numbers; range [vertex y, ∞) if opens up or (-∞, vertex y] if opens down
- Square root: domain inside ≥ 0; range y ≥ 0

- Rational (1 over linear): domain denominator ≠ 0; vertical asymptote where denominator = 0
- Absolute value: domain all real numbers; range y ≥ vertex y

Exponential Functions
- Form: f(x) = a · b^x (a = starting value, b = base)
- Growth when b > 1; decay when 0 < b < 1
- Domain: all real numbers
- Range: y > 0 (never touches y = 0)
- Horizontal asymptote: y = 0
- Y-intercept: (0, a)
- No x-intercepts (if a > 0)

Logarithmic Functions
- Form: y = log_b(x) means b^y = x
- Domain: x > 0
- Range: all real numbers
- Vertical asymptote: x = 0
- X-intercept: (1, 0)
- Key properties: log_b(b^x) = x and b^{log_b(x)} = x
- Inverses: swap x and y to switch between exponential and log forms

Geometry Formulas
- Triangle area: A = (1/2) × base × height
- Rectangle area: A = length × width
- Circle circumference: C = 2πr
- Circle area: A = πr²
- Pythagorean theorem (right triangle): a² + b² = c² (c = hypotenuse)
- Rectangular prism volume: V = length × width × height
- Cylinder volume: V = πr² × height
- Distance formula: d = $\sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$

Square Root Basics
- Principal square root (√) is always ≥ 0
- √(a²) = |a| (absolute value)
- Perfect squares: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144

Simplifying Square Roots
- Factor out perfect squares
  Example: √72 = √(36 × 2) = 6√2
  Example: √50 = √(25 × 2) = 5√2
  Example: √200 = √(100 × 2) = 10√2
- Rules:
  √(a × b) = √a × √b (only when a, b ≥ 0)
  √(a/b) = √a / √b (when b ≠ 0 and a, b ≥ 0)

Solving Square Root Equations
1. Isolate the square root
2. Square both sides
3. Solve the resulting equation

4. Check for extraneous solutions (very common TSI trap!)

Common TSI Square Root Questions
- Simplify √(expression)
- Solve √(linear) = number
- Solve √(linear) = linear (check solutions)
- Find domain of f(x) = √(quadratic or linear)
- Evaluate f(perfect square)

Rational Expressions Basics
- A rational expression is a fraction with polynomials in numerator and/or denominator
  Example: $(x^2 – 4)/(x + 3)$ or $5/(x – 2)$
- Domain: Denominator ≠ 0 → exclude values that make denominator zero
  Example: For $(x + 1)/(x – 5)$, domain is all real numbers except $x \neq 5$

Simplifying Rational Expressions
- Factor numerator and denominator completely
- Cancel common factors (never cancel individual terms!)

Multiplying & Dividing Rational Expressions
- Multiply: (num1 × num2)/(den1 × den2) → simplify
- Divide: Multiply by reciprocal → flip second fraction

Adding & Subtracting Rational Expressions
- Need common denominator (LCD = least common multiple of denominators)
- Combine numerators, keep common denominator
- Simplify final result

Solving Rational Equations
- Find LCD, multiply both sides by LCD to clear denominators
- Solve resulting equation
- Check solutions (extraneous if they make original denominator zero)

Common TSI Rational Questions
- Simplify expression
- Add/subtract with LCD
- Multiply/divide
- Solve equation (check extraneous)
- Find domain of rational function
- Identify excluded values

Rational Practice Problems (Add as Flashcards)
- Simplify $(x^2 – 25)/(x^2 – 10x + 25)$ → $(x + 5)/(x – 5)$
- $(2/(x + 3)) + (5/x)$ → $(2x + 15)/(x(x + 3))$
- Solve $4/(x + 1) = 3/x$ → $x = –12$ (check: valid)
- Domain of $f(x) = (x – 2)/(x^2 – 4)$ → $x \neq \pm 2$
- Solve $2/x = 5/(x – 3)$ → $x = 6/7$ (check: valid)

Probability & Statistics

- Probability of an event: P(event) = favorable outcomes / total possible outcomes (0 ≤ P ≤ 1)
- Complement: P(not event) = 1 – P(event)
- Independent events (“and”): P(A and B) = P(A) × P(B)
- Mutually exclusive events (“or”): P(A or B) = P(A) + P(B)
- Non-mutually exclusive (“or”): P(A or B) = P(A) + P(B) – P(A and B)

Measures of Center & Spread
- Mean (average): sum of values ÷ number of values
- Median: middle value when ordered (average two middle if even count)
- Mode: most frequent value (can be none or multiple)
- Range: maximum – minimum

Common TSI Data/Probability Questions
- Calculate mean/median/mode from a data set
- Basic probability (dice, cards, spinners)
- Interpret graphs/tables (bar, line, pie, scatter)
- Identify trends or outliers

Probability & Statistics Practice Problems (Add as Flashcards)
1. Data: 3, 7, 8, 5, 12, 14, 21, 13, 18 → Mean = 11, Median = 12, Mode = none
2. P(red) = 3/8 → P(not red) = 5/8
3. Two dice sum = 7 → P = 6/36 = 1/6
4. Bag: 5 red, 3 blue; draw two without replacement → P(both red) = (5/8) × (4/7) = 5/14
5. P(A) = 0.4, P(B) = 0.3, mutually exclusive → P(A or B) = 0.7

This is now your complete, consistent, and fully updated TSI Math cheat sheet covering **all four tested areas**. Ready for direct import into your app!