

SAT Math Topics

Ratios, Proportions, Percentages

- Relationships between units → ratios; multiple ratios → proportions
- Units are key – they give clues as to how to set up ratios and proportions
- Part/whole = part/whole, or just interpret the words (e.g., “20% of a number is 4” → $0.2x = 4$).
- Percent change = $100 * (\text{final} - \text{original}) / \text{original}$; remember the discounted shirt problem

General Functions

- Function substitution – plug in an x value to get an output y value
- Factoring – common factor first, difference of squares, general quadratic

Polynomial Functions

- The following are equivalent: factors, x -intercepts, zeros/solutions/roots – if you know one, you know them all
- Polynomial operations (add, subtract, mult, div)

Linear Functions

- General equation: $y = mx + b$; interpret m and b ; $m = \text{slope} = \text{rise/run} = \text{average rate of change}$
- Line plot and line of best fit interpretation
- “Point lies on line”, “Line passes through point”: plug in the (x,y) coordinate(s)
- Number of intersections: 0 → parallel lines, 1 → crossing lines, infinite → the same lines

Quadratic Functions

- Intercept form (factored form) → vertex x -coordinate is in the middle of the two intercepts; substitute to get the y -coordinate
- Vertex form: get the vertex form from the intercept form
- Solve quadratic equations by setting = 0 and factoring

Exponential Functions

- Standard forms: $y = a(b)^x = a(1 + r)^x$, where $b = \text{base}$, $a = \text{initial value}$, $r = \text{rate of change}$
- Exponent rules:
 - $2^2 * 2^3 = 2^{2+3}$
 - $2^5 / 2^2 = 2^{5-2}$
 - $(2^2)^3 = 2^{2*3}$
 - $3^{1/2} = \sqrt{3}$

Rational Functions

- Apply standard fraction techniques: least common denominator for add/subtract
- Simplifying rational functions by factoring and canceling like terms
- A rational function is a division problem: any value of x that makes the bottom 0 is not allowed

Radical Functions

- Simplifying: $\sqrt{18} = \sqrt{9 * 2} = \sqrt{9}\sqrt{2} = 3\sqrt{2}$
- Simplifying: $\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$
- Simplifying: $\frac{1}{\sqrt{2}-1} = \frac{1}{\sqrt{2}-1} \frac{\sqrt{2}+1}{\sqrt{2}+1} = \frac{\sqrt{2}+1}{1}$ (difference of squares technique)

Systems of Equations

- Goal: to eliminate a variable
- Techniques: add/subtract (maybe with multiplication), substitution

Data Analysis and Probability

- Mean, median, mode – based on a list of data values
- Mean, median, mode – based on a frequency table
- Probability = (# of items of interest)/(total # of items)
- Probabilities from two-way table

Geometry

- Many topics, but focus on intersecting lines (angles), triangle angles, parallel line angles
- Similar triangles have proportional sides
- Right triangles (perhaps with SOHCAHTOA or Pythagorean)
- The (small central angle/total angle) is proportional to (small arc length/total arc length) and to (small sector area/total sector area)
- Circle equation: $x^2 + y^2 = r^2$, with shifts left/right/up/down to change the center from the origin

Inequalities

- Algebraic operations (add/subtract/mult/div) work the same as with equations with two exceptions: multiplication or division by a negative causes the inequality to switch
- Plugging in test values is a great approach

Basic Trig

- 2π radians = 1 revolution of a circle = 360°
- SOHCAHTOA, Pythagorean for right triangles

Complex Numbers

- Complex numbers are of the form $x + iy$ and can be graphed as a coordinate (x,y)
- The modulus $|x + iy| = \sqrt{x^2 + y^2}$ (the distance of the coordinate from the origin via Pythag thm)
- $i = \sqrt{-1}$, so $i^2 = -1$
- Complex number operations (add, subtract, mult) work just polynomials
- Division problems work just like radical divisions discussed above: $\frac{1}{1-i} = \frac{1}{1-i} \cdot \frac{1+i}{1+i} = \frac{1+i}{2}$ (difference of squares technique)

General Techniques

- Assume problems are “easy” rather than “hard” – they usually are
- The SAT makes problems “hard” by requiring multiple steps to solve; so, look for words that delineate “steps”
- You have a technique if you get stuck:
 - find what they want (write a target expression if possible)
 - look at the kinds of things they are talking about
 - what patterns do you know about those things
 - simplify
 - repeat
- Feel free to write math expressions using words; if you are a word person you will benefit
- Feel free to draw pictures and write down info; if you are a visual person you will benefit