

# Utah Secondary Math III Summer Math Review

*8-Week Core Review with Practice, Weekly Quizzes, and Answer Explanations*

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# ☀️ Welcome to Summer Math Review! ☀️

*This 8-week plan reviews the Algebra 2 math students already learned this year.*

## **How each week works**

- 📅 *Monday through Thursday are short review days.*
- 💡 *Each day starts with a Lesson Review.*
- ✍️ *Each practice day has 6 problems.*
- 📋 *Friday is a 10-question quiz.*
- ✅ *Answers explain the thinking, not just the final number.*

***Try your best first. Then use the answer key like a teacher.***

# Your 8-Week Summer Review Plan

Use this book four days a week, then take the quiz on Friday.

## Weekly Schedule

Week	Monday	Tuesday	Wednesday	Thursday	Friday
1	Foundations	Equations	Linear	Systems	Quiz 1
2	Functions	Transforms	Quadratics	Quad Models	Quiz 2
3	Complex	Polynomials	Zeros	Rational Expr.	Quiz 3
4	Rational Eq.	Radicals	Radical Eq.	Exp/Logs	Quiz 4
5	Exp/Log Eq.	Sequences	Sigma/Binomial	Matrices	Quiz 5
6	Unit Circle	Identities	Applied Trig	Sine/Cosine	Quiz 6
7	Tangent/Inverse	Circles/Parabolas	Conics	Statistics	Quiz 7
8	Probability	Regression/Finance	Mixed Algebra	Final Review	Final Quiz

### For students

Read the Lesson Review first. Try all 6 problems before checking answers. If you miss one, read the explanation and fix your work.

### For parents and teachers

The daily pages are meant to be short. If a student struggles, use the answer explanation as the teaching step, then have the student correct the problem.

### Goal

By the end of 8 weeks, students will have completed 192 daily practice problems and 80 quiz questions, with review across the full Algebra 2 math year.



# Algebra 2 Reference Sheet



High-yield formulas to keep nearby during summer review.

## Functions

Domain = allowed inputs; range = outputs.

Average rate:  $\frac{f(b) - f(a)}{b - a}$

$f(x) + k$ : up/down;  $f(x - h)$ : right/left

$a \cdot f(x)$ : vertical stretch/reflection

$f(bx)$ : horizontal change

Inverse:  $f^{-1}(f(x)) = x$

## Linear

Slope:  $m = \frac{y_2 - y_1}{x_2 - x_1}$

Point-slope:  $y - y_1 = m(x - x_1)$

Slope-intercept:  $y = mx + b$

Standard:  $Ax + By = C$

Parallel: same  $m$ ; perpendicular:  $m_1 m_2 = -1$

## Systems

Solutions are intersections.

Substitution: solve one equation, plug in.

Elimination: align terms, add/subtract.

No solution: parallel lines.

Infinitely many: same line.

## Quadratics

Standard:  $y = ax^2 + bx + c$

Vertex:  $y = a(x - h)^2 + k$

Factored:  $y = a(x - r_1)(x - r_2)$

Axis:  $x = -\frac{b}{2a}$

Formula:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Discriminant:  $b^2 - 4ac$

Roots:  $r_1 + r_2 = -\frac{b}{a}$ ,  $r_1 r_2 = \frac{c}{a}$

## Polynomials

Remainder: divide by  $x - a$ , remainder  $f(a)$ .

Factor:  $x - a$  factor iff  $f(a) = 0$ .

Zeros and factors:  $x = r \leftrightarrow (x - r)$

Even degree: same end behavior.

Odd degree: opposite end behavior.

Even multiplicity touches; odd crosses.

## Complex Numbers

$i^2 = -1$ ,  $i^3 = -i$ ,  $i^4 = 1$

$(a + bi) + (c + di) = (a + c) + (b + d)i$

$(a + bi)(c + di) = (ac - bd) + (ad + bc)i$

Conjugates:  $a + bi$ ,  $a - bi$

Real polynomials have conjugate complex roots.

## Rational

Excluded values come from original denominator.

Factor first; cancel common factors.

Vertical asymptotes: uncanceled denominator zeros.

Holes: canceled denominator zeros.

Horizontal asymptote compares degrees.

Rational inequality: use sign chart.

## Radicals

$a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$

$a^m a^n = a^{m+n}$

$\frac{a^m}{a^n} = a^{m-n}$

Power function:  $f(x) = ax^p$

Radical equations: isolate, power, check.

Even roots need nonnegative radicands.

## Exponential

Model:  $y = ab^x$

Growth:  $b > 1$ ; decay:  $0 < b < 1$

Compound:  $A = P(1 + \frac{r}{n})^{nt}$

Continuous:  $A = Pe^{rt}$

Half-life/decay:  $A = A_0(1 - r)^t$

## Logarithms

$\log_b(x) = y \leftrightarrow b^y = x$

$\log_b(MN) = \log_b M + \log_b N$

$\log_b(M/N) = \log_b M - \log_b N$

$\log_b(M^p) = p \log_b M$

Change base:  $\log_b x = \frac{\log x}{\log b}$

Log domain: argument  $> 0$ .

## Sequences

Arithmetic:  $a_n = a_1 + (n - 1)d$

Arithmetic recursive:  $a_n = a_{n-1} + d$

Arithmetic sum:  $S_n = \frac{n(a_1 + a_n)}{2}$

Geometric:  $a_n = a_1 r^{n-1}$

Geometric recursive:  $a_n = r a_{n-1}$

Finite sum:  $S_n = \frac{a_1(1 - r^n)}{1 - r}$

Infinite sum:  $S = \frac{a_1}{1 - r}$ ,  $|r| < 1$

## Matrices

Matrix size: rows  $\times$  columns.

Add/subtract only same dimensions.

Multiply  $A_{m \times n} B_{n \times p} = C_{m \times p}$ .

Identity:  $AI = IA = A$

For  $2 \times 2$ , determinant  $ad - bc$ .



# Algebra 2 Reference Sheet



Trig, conics, data, probability, and modeling reminders

## Trigonometry

Unit point:  $(\cos \theta, \sin \theta)$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$\sin = \frac{\text{opp}}{\text{hyp}}, \cos = \frac{\text{adj}}{\text{hyp}}, \tan = \frac{\text{opp}}{\text{adj}}$$

Sine/cosine period:  $\frac{2\pi}{|b|}$

Tangent period:  $\frac{\pi}{|b|}$

$$\text{Law of Sines: } \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$\text{Law of Cosines: } c^2 = a^2 + b^2 - 2ab \cos C$$

## Trig Graphs

$$y = A \sin(B(x - C)) + D$$

Amplitude:  $|A|$

Period:  $\frac{2\pi}{|B|}$  for sine/cosine

Period:  $\frac{\pi}{|B|}$  for tangent

Phase shift:  $C$

Midline:  $y = D$

Max/min:  $D \pm |A|$

## Special Angles

$$30^\circ = \frac{\pi}{6}, 45^\circ = \frac{\pi}{4}, 60^\circ = \frac{\pi}{3}$$

$$\sin 30^\circ = \frac{1}{2}, \cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\sin 45^\circ = \cos 45^\circ = \frac{\sqrt{2}}{2}$$

$$\sin 60^\circ = \frac{\sqrt{3}}{2}, \cos 60^\circ = \frac{1}{2}$$

Quadrant signs: ASTC.

## Conics

$$\text{Circle: } (x - h)^2 + (y - k)^2 = r^2$$

$$\text{Parabola: } (x - h)^2 = 4p(y - k)$$

$$\text{or } (y - k)^2 = 4p(x - h)$$

$$\text{Ellipse: } \frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$$

$$\text{Hyperbola: } \frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$$

## Conic Details

Circle center  $(h, k)$ , radius  $r$ .

Parabola vertex  $(h, k)$ , focus is  $|p|$  away.

Ellipse: larger denominator gives major axis.

$$\text{Ellipse: } c^2 = a^2 - b^2$$

$$\text{Hyperbola: } c^2 = a^2 + b^2$$

Asymptotes guide hyperbola branches.

## Statistics

$$\text{Mean: } \bar{x} = \frac{\sum x}{n}$$

$$z = \frac{x - \mu}{\sigma}$$

Residual = actual - predicted

Correlation  $r$  is between  $-1$  and  $1$ .

Normal: about 68%, 95%, 99.7% within 1, 2, 3 SDs.

## Data Displays

$$\text{IQR: } Q_3 - Q_1$$

$$\text{Outlier fence: } Q_1 - 1.5(IQR), Q_3 + 1.5(IQR)$$

Median resists outliers.

Mean is pulled by outliers.

Standard deviation measures typical distance from mean.

## Regression

Residual: actual - predicted.

Positive  $r$ : as  $x$  rises,  $y$  tends to rise.

Negative  $r$ : as  $x$  rises,  $y$  tends to fall.

Strong linear fit:  $|r|$  close to 1.

$R^2$  is percent of variation explained.

## Probability

$$P(A | B) = \frac{P(A \cap B)}{P(B)}$$

Independent:  $P(A \cap B) = P(A)P(B)$

Either/or:  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$\text{Permutations: } {}_n P_r = \frac{n!}{(n-r)!}$$

$$\text{Combinations: } {}_n C_r = \frac{n!}{r!(n-r)!}$$

$$\text{Binomial: } {}_n C_r p^r (1-p)^{n-r}$$

## Counting

Fundamental counting principle: multiply choices.

Permutation: order matters.

Combination: order does not matter.

With replacement: choices stay the same.

Without replacement: choices decrease.

## Finance

$$\text{Simple interest: } I = Prt$$

$$\text{Future amount: } A = P + I$$

$$\text{Compound: } A = P(1 + \frac{r}{n})^{nt}$$

$$\text{Continuous: } A = Pe^{rt}$$

$$\text{Depreciation: } A = P(1 - r)^t$$

$$\text{Percent change: } \frac{\text{new} - \text{old}}{\text{old}}$$

## Modeling Checks

Linear: constant first differences.

Quadratic: constant second differences.

Exponential: constant ratios.

Domain should match the context.

Round only at the end unless directed.

# Summer Progress Tracker

Check off each day as you finish it.

Week	Mon	Tue	Wed	Thu	Fri Quiz
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Small practice adds up.**

Four short days and one quiz each week is  
enough to keep Algebra 2 math fresh all summer.

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*Your 8-week summer review plan*

**Answer Key** ..... **4**

PREVIEW

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**Day 1** Real Numbers, Properties, and Expressions

Algebra 2 review works best when you name the structure before you calculate.

- Number sets are nested: natural, whole, integer, rational, and real.
- Interval notation uses brackets for included endpoints and parentheses for excluded endpoints.
- Order of operations controls simplifying; properties justify equivalent rewrites.
- Negative exponents move a factor across the fraction bar; they do not make a value negative.
- Evaluate by substituting with parentheses, then simplify carefully.
- Combine only like terms with exactly the same variable part.

 **Practice**

1. Classify  $\sqrt{81}$  as precisely as possible.
2. Write  $\{x \mid -2 \leq x < 5\}$  in interval notation. \_\_\_\_\_
3. Evaluate  $4 + 3(2^3 - 5)$ . \_\_\_\_\_
4. Simplify  $(2x^3y^{-2})(5x^{-1}y^5)$  with positive exponents.
5. Evaluate  $2a^2 - 3b$  when  $a = -4$  and  $b = 5$ . \_\_\_\_\_
6. Simplify  $4(3x - 2) - 5x$ . \_\_\_\_\_



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**Day 2 Equations, Inequalities, and Absolute Value**

Algebra 2 review works best when you name the structure before you calculate.

- Use inverse operations to isolate the variable in equations.
- Do the same operation to both sides to preserve equality or the solution set.
- Reverse an inequality sign when multiplying or dividing by a negative number.
- Compound inequalities describe overlap with “and” or separated regions with “or.”
- Absolute value measures distance from 0, so  $|A| = c$  gives two cases.
- For  $|A| < c$ , keep the expression between  $-c$  and  $c$ .

** Practice**

1. Solve  $3x - 7 = 20$ . \_\_\_\_\_
2. Solve  $\frac{m + 4}{5} = -2$ . \_\_\_\_\_
3. Solve  $2(3p - 1) \leq 16$ . \_\_\_\_\_
4. Write  $-1 < x \leq 6$  in interval notation. \_\_\_\_\_
5. Solve  $|x - 5| = 9$ . \_\_\_\_\_
6. Solve  $|2x + 1| < 7$ . \_\_\_\_\_



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 Week 1 Quiz

## Foundations and Linear Models Check

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score: \_\_\_\_\_/10

- Which is the most precise classification of  $-\sqrt{36}$ ?  
A. natural  
B. whole  
C. integer  
D. irrational
- Write  $x > 3$  in interval notation. \_\_\_\_\_
- Simplify  $2(4x - 1) - 3x$ . \_\_\_\_\_
- True or False: Solving  $-2x < 8$  gives  $x < -4$ .  True  False
- Solve  $|x + 2| = 6$ . \_\_\_\_\_
- Find the slope between  $(1, -2)$  and  $(5, 10)$ . \_\_\_\_\_
- Which line is parallel to  $y = -\frac{1}{2}x + 7$ ?  
A.  $y = 2x - 1$   
B.  $y = -\frac{1}{2}x + 3$   
C.  $y = \frac{1}{2}x + 7$   
D.  $y = -2x$
- Solve the system  $y = x + 1$  and  $y = 3x - 5$ .
- Does  $(2, 5)$  satisfy  $y \leq 2x + 1$ ?
- A taxi charges \$4 plus \$2.50 per mile. Write a model and find the cost for 9 miles.



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**Week 1, Day 1** Answer Key Real Numbers, Properties, and Expressions

**Answers**

1 natural number

2  $[-2, 5)$ 

3 13

4  $10x^2y^3$ 

5 17

6  $7x - 8$ 
**Explanations**

- Evaluate the radical first:  $\sqrt{81} = 9$ . The smallest precise set is natural numbers, even though 9 is also whole, integer, rational, and real.
- The endpoint  $-2$  is included, so it uses a bracket. The endpoint 5 is not included, so it uses a parenthesis.
- Use order of operations: first  $2^3 = 8$ , then  $8 - 5 = 3$ . Multiply  $3 \cdot 3 = 9$  and add 4 to get 13.
- Multiply coefficients and add exponents on like bases:  $2 \cdot 5 = 10$ ,  $x^{3+(-1)} = x^2$ , and  $y^{-2+5} = y^3$ . The result has only positive exponents.
- Substitute with parentheses:  $2(-4)^2 - 3(5)$ . The square gives 16, so  $2 \cdot 16 - 15 = 17$ .
- Distribute first to get  $12x - 8 - 5x$ . Combine like terms,  $12x - 5x = 7x$ , so the expression is  $7x - 8$ .

**Week 1, Day 2** Answer Key Equations, Inequalities, and Absolute Value

**Answers**
1  $x = 9$ 2  $m = -14$ 3  $p \leq 3$ 4  $(-1, 6]$ 5  $x = -4$  or  $x = 14$ 6  $-4 < x < 3$ 
**Explanations**

- Add 7 to both sides to undo subtraction:  $3x = 27$ . Divide by 3 to isolate the variable, so  $x = 9$ .
- Multiply both sides by 5 to get  $m + 4 = -10$ . Subtract 4 from both sides, giving  $m = -14$ .
- Distribute to get  $6p - 2 \leq 16$ . Add 2 and divide by positive 6, so the inequality direction stays the same and  $p \leq 3$ .
- The value  $-1$  is excluded because the inequality is strict, so use a parenthesis. The value 6 is included because of  $\leq$ , so use a bracket.
- An absolute value equation asks for two distances:  $x - 5 = 9$  or  $x - 5 = -9$ . Solving those gives  $x = 14$  and  $x = -4$ .
- For an absolute value less than 7, write  $-7 < 2x + 1 < 7$ . Subtract 1 and divide by 2 to get  $-4 < x < 3$ .



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**Week 1 Quiz** Answer Key Foundations and Linear Models Check

**Answers**

- 1 C    2  $(3, \infty)$     3  $5x - 2$     4 False    5  $x = 4$  or  $x = -8$     6 3    7 B    8  $(3, 4)$   
 9 yes    10  $C = 2.5m + 4$ ; \$26.50

**Explanations**

- 1 Since  $-\sqrt{36} = -6$ , the number is an integer. It is also rational and real, but integer is the most precise choice listed.
- 2 The value 3 is not included, so use a parenthesis. Infinity always uses a parenthesis.
- 3 Distribute first:  $2(4x - 1) = 8x - 2$ . Then combine like terms,  $8x - 3x = 5x$ , giving  $5x - 2$ .
- 4 Dividing by the negative number  $-2$  reverses the inequality sign. The correct solution is  $x > -4$ , so the stated answer has the sign facing the wrong way.
- 5 An absolute value equation represents two distances from 0, so split it into  $x + 2 = 6$  or  $x + 2 = -6$ . Solving the two linear equations gives  $x = 4$  and  $x = -8$ .
- 6 Use  $m = \frac{10 - (-2)}{5 - 1} = \frac{12}{4} = 3$ . The slope is the change in  $y$  divided by the change in  $x$ .
- 7 Parallel lines have the same slope. Choice B has slope  $-\frac{1}{2}$ , matching the given line.
- 8 At the intersection, both equations have the same  $y$ -value, so set  $x + 1 = 3x - 5$ . Then  $6 = 2x$ , so  $x = 3$ , and substituting gives  $y = 4$ .
- 9 Substitute the point:  $5 \leq 2(2) + 1 = 5$ . Because equality is allowed by  $\leq$ , the point satisfies the inequality.
- 10 The fixed charge is 4 and the rate is 2.50 per mile. Substitute  $m = 9$  to get  $2.5(9) + 4 = 26.5$  dollars.

PREP

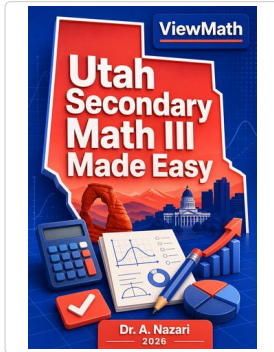


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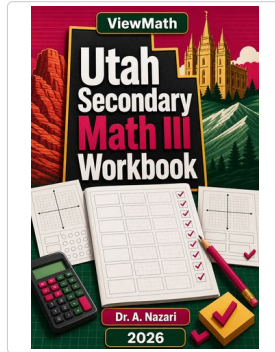
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Study Guide



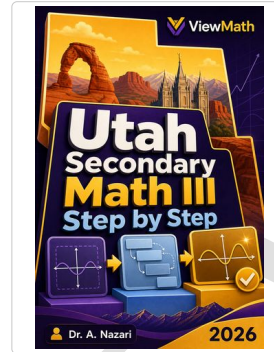
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Workbook



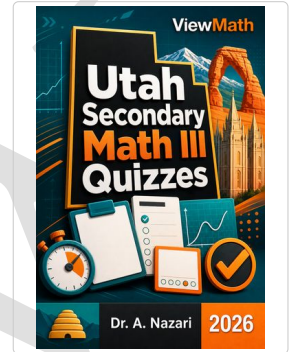
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Step-by-Step



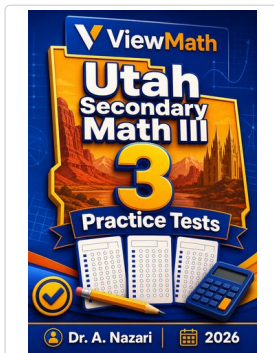
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Quizzes



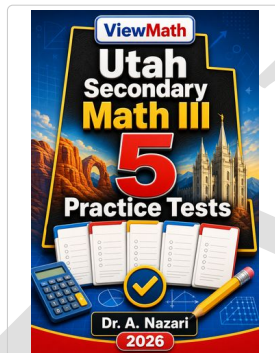
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3 Practice Tests



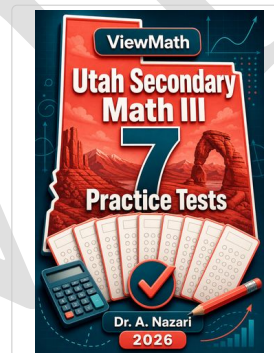
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5 Practice Tests



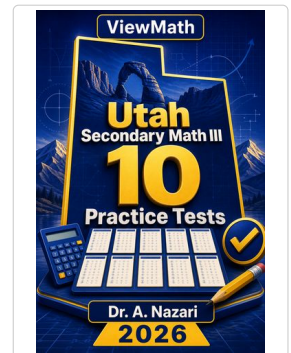
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7 Practice Tests



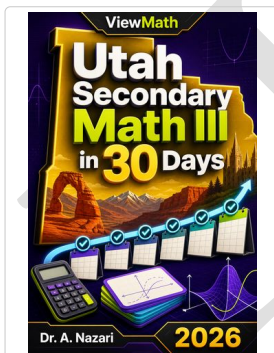
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10 Practice Tests



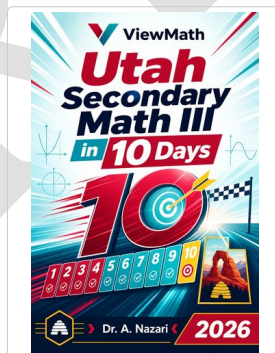
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Math in 30 Days



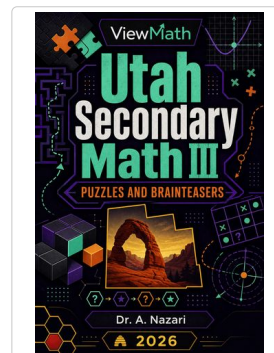
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Math in 10 Days



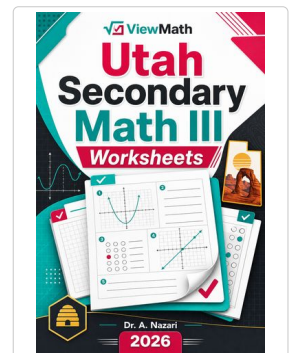
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