THE SCHOOL DISTRICT OF
PHILADELPHIA
Office of Evaluation, Research, and Accountability

Research Roundup Webinar Series #2: Assessing Student Math Performance in Grades 3-8

April 20, 2022

Agenda

- **About ERA and the Research Roundup Webinar Series**
- **Part 1:** Math in grades 3-8: What is it and why is it important?
- **Part 2:** How the within-year tests we administer measure math skills
- **Part 3:** Additional context and resources
- **Q & A**

This webinar is being recorded.

The recording and a PDF of the slide deck will be available at: philasd.org/research/roundup

Please introduce yourself in the chat!

Evaluation, Research, and Accountability

philasd.org/era

Office of Research and Evaluation

District Performance Office

Planning and Evidence-Based Supports Office

Office of Assessments

Office of Data Governance

Evaluation, Research, and Accountability

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phledresearch.org/

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What is a Research Roundup?

- Monthly webinar series with a topical focus
- Work in progress
- Sign up to be notified when webinars are scheduled and when recordings are available

www.philasd.org/research/roundup

Goals for This Presentation

Attendees will better understand:

1. Key math skills covered in grades 3-8
2. How the District's within-year tests (Renaissance Star) measure math skills
3. How we track the progress of students' math skills over time (PSSA & Star)

ORE Reports related to math: https://www.philasd.org/research/category/math/

Part 1: Math in grades 3-8: What is it and why is it important?

Major Work in Grades 3-5

Multiplication and division of whole numbers and fractions – concepts, skills, and problem solving

Grade 3	Grade 4	Grade 5
Algebra: Operations & Algebraic Thinking ☐ Represent and solve problems involving multiplication and division ☐ Understand properties of multiplication and the relationship between multiplication and division ☐ Multiply and divide within 100 ☐ Solve problems involving the four operations, and identify and explain patterns in arithmetic **Measurement & Data** ☐ Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects ☐ Geometric measurement: Understand concepts of area and relate area to multiplication and to addition **Numbers & Operations: Fractions** ☐ Develop understanding of fractions as numbers	**Algebra: Operations & Algebraic Thinking** ☐ Use the four operations with whole numbers to solve problems **Numbers & Operations: Base Ten** ☐ Generalize place value understanding for multi-digit whole numbers ☐ Use place value understanding and properties of operations to perform multi-digit arithmetic **Numbers & Operations: Fractions** ☐ Extend understanding of fraction equivalence & ordering ☐ Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers ☐ Understand decimal notation for fractions, and compare decimal fractions	**Measurement & Data** ☐ Geometric measurement: Understand concepts of volume and relate volume to multiplication and to addition **Numbers & Operations: Base Ten** ☐ Understand the place value system ☐ Perform operations with multi-digit whole numbers and decimals to hundredths **Numbers & Operations: Fractions** ☐ Use equivalent fractions as a strategy to add and subtract fractions ☐ Apply and extend understandings of multiplication and division to multiply and divide fractions
Required Fluencies ☐ Single-digit products and quotients ☐ Add/subtract within 1000	**Required Fluencies** ☐ Add/subtract within 1,000,000	**Required Fluencies** ☐ Multi-digit multiplication

Major Work in Grades 6-8

Ratios & proportional relationships, expressions & equations, arithmetic of rational numbers, linear equations & linear functions

Grade 6	Grade 7	Grade 8
Algebra: Expressions & Equations ☐ Apply and extend previous understandings of arithmetic to algebraic expressions ☐ Reason about and solve one-variable equations and inequalities ☐ Represent and analyze quantitative relationships between dependent and independent variables **Numbers & Operations:** **Ratios & Proportional Relationships** ☐ Understand ratio concepts and use ratio reasoning to solve problems **Numbers & Operations: The Number System** ☐ Apply and extend previous understandings of multiplication and division to divide fractions by fractions ☐ Apply and extend previous understandings of numbers to the system of rational numbers	**Algebra: Expressions & Equations** ☐ Use properties of operations to generate equivalent expressions ☐ Solve real-life and mathematical problems using numerical and algebraic expressions and equations **Numbers & Operations:** **Ratios & Proportional Relationships** ☐ Analyze proportional relationships and use them to solve real-world and mathematical problems **Numbers & Operations: The Number System** ☐ Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers	**Algebra: Expressions & Equations** ☐ Work with radicals and integer exponents ☐ Understand the connections between proportional relationship, lines, and linear equations ☐ Analyze and solve linear equations and pairs of simultaneous linear equations **Functions** ☐ Define, evaluate, and compare functions ☐ Use functions to model relationships between quantities **Geometry** ☐ Understand congruence and similarity using physical models, transparencies, or geometry software ☐ Understand and apply the Pythagorean Theorem
Required Fluencies ☐ Multi-digit division ☐ Multi-digit decimal operations		

Information taken from achievethecore.org

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Domain Group	Domain Name	PK	K	1	2	3	4	5	6	7	8	A1	GM	A2
Algebra	Operations and Algebraic Thinking	•	•	•	•	•	•	•						
	Expressions and Equations								•	•	•			
	Seeing Structure in Expressions											•		•
	Arithmetic with Polynomials and Rational Expressions											•		•
	Creating Equations											•		•
	Reasoning with Equations and Inequalities											•		•
Functions	Functions										•			
	Interpreting Functions											•		•
	Building Functions											•		•
	Linear, Quadratic, and Exponential Models											•		•
	Trigonometric Functions													•
Geometry	Modeling with Geometry												•	
	Geometry	•	•	•	•	•	•	•	•	•	•			
	Congruence												•	
	Similarity, Right Triangles, and Trigonometry												•	
	Circles												•	
	Expressing Geometric Properties with Equations												•	
	Geometric Measurement and Dimension												•	
Measurement and Data	Measurement and Data	•	•	•	•	•	•	•						
Number and Quantity	Vector and Matrix Quantities													•
	The Real Number System											•		
	Quantities											•		
	The Complex Number System													•
Numbers and Operations	Counting and Cardinality	•	•											
	Number and Operations in Base Ten		•	•	•	•	•	•						
	Number and Operations—Fractions					•	•	•						
	Ratios and Proportional Relationships								•	•				
	The Number System								•	•	•			
Statistics and Probability	Statistics and Probability								•	•	•			
	Interpreting Categorical and Quantitative Data											•		•
	Making Inferences and Justifying Conclusions													•
	Conditional Probability and the Rules of Probability												•	
	Using Probability to Make Decisions												•	•

Part 2: How the District's within-year tests measure math skills

Board Goals and Guardrails

GOALS

01 Grade 3-8 Reading

02 Grade K-3 Reading

03 Grade 3-8 Math

04 High School Keystones

05 High School CTE

philasd.org/goalsandguardrails
philasd.org/era/goals-and-guardrails/

GUARDRAILS

01 Welcome and Supportive Schools

02 Enriching and Well-Rounded School Experiences

03 Partnering with Parents and Families

04 Addressing Racist Practices

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Goal 3: Math (Grades 3-8)

Goal 3: The percentage of students in grades 3-8 who are proficient on the PSSA math will grow from 21.6% in August 2019 to 52.0% by August 2026. **Target 2021-22: 28.7%**

Indicator 3.1:

The percentage of students in grades 3-8 who score at or above grade-level on the District's within-year math assessment in Fall, Winter, and Spring each year. **Target 2021-22: 33.8%**

https://www.philasd.org/era/goals-and-guardrails/

PSSA Math Performance Over Time

Figure 1. Overall SDP Performance Levels on the Math PSSA Exam, by Year, 2015-16 through 2018-19
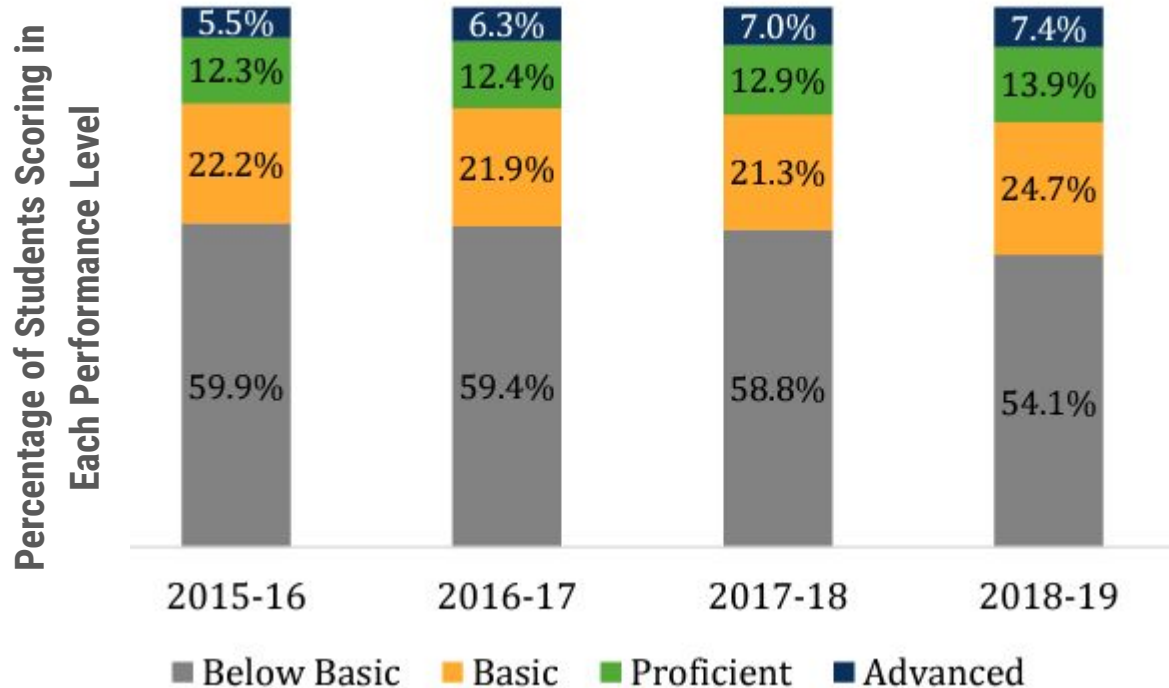
PSSA Math Performance Over Time

Figure 3. Performance Levels by Grade, Combined 2015-16 through 2018-19

PSSA Math Performance Over Time

Lines indicate combined Proficient/Advanced rates for each grade

	2015-16	2016-17	2017-18	2018-19
Grade 3	21.6%	23.1%	24.5%	26.9%
Grade 4	17.4%	17.4%	16.8%	19.0%
Grade 5	17.2%	17.6%	19.9%	20.8%
Grade 6	17.3%	17.7%	19.6%	19.7%
Grade 7	17.5%	19.2%	21.3%	22.2%
Grade 8	14.7%	15.8%	16.7%	18.1%
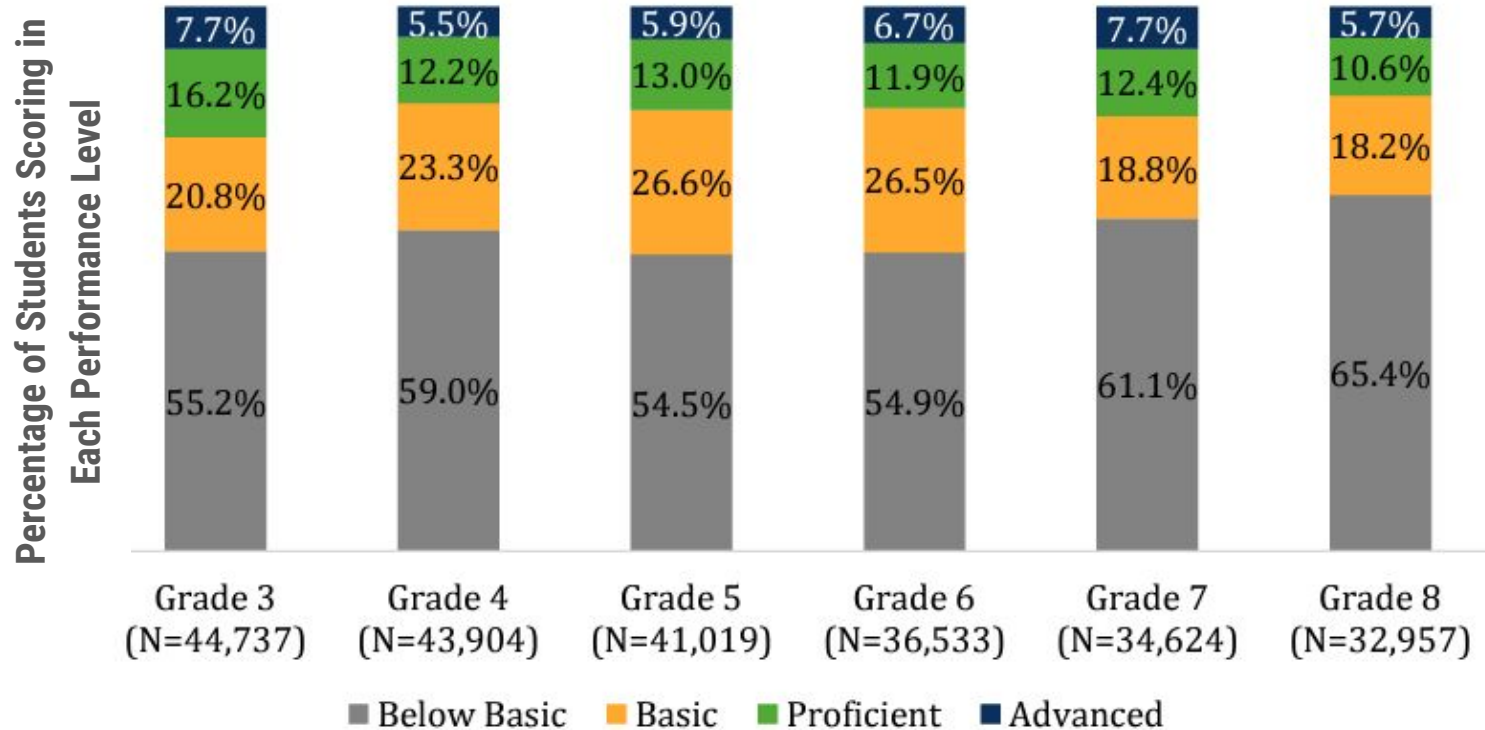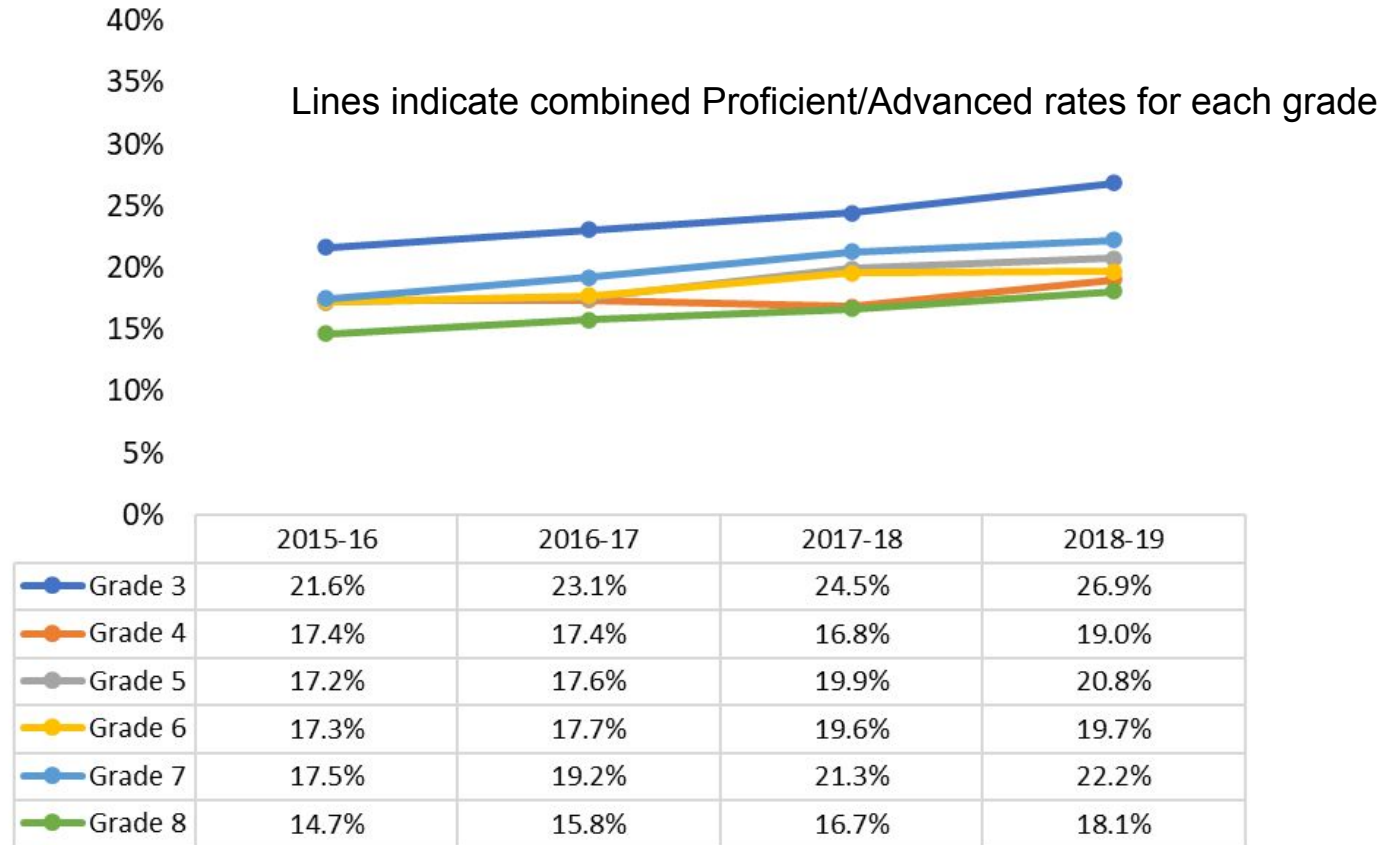
PSSA Math Performance Over Time

Figure 8. Performance Levels by Race/Ethnicity, Combined 2015-16 through 2018-19
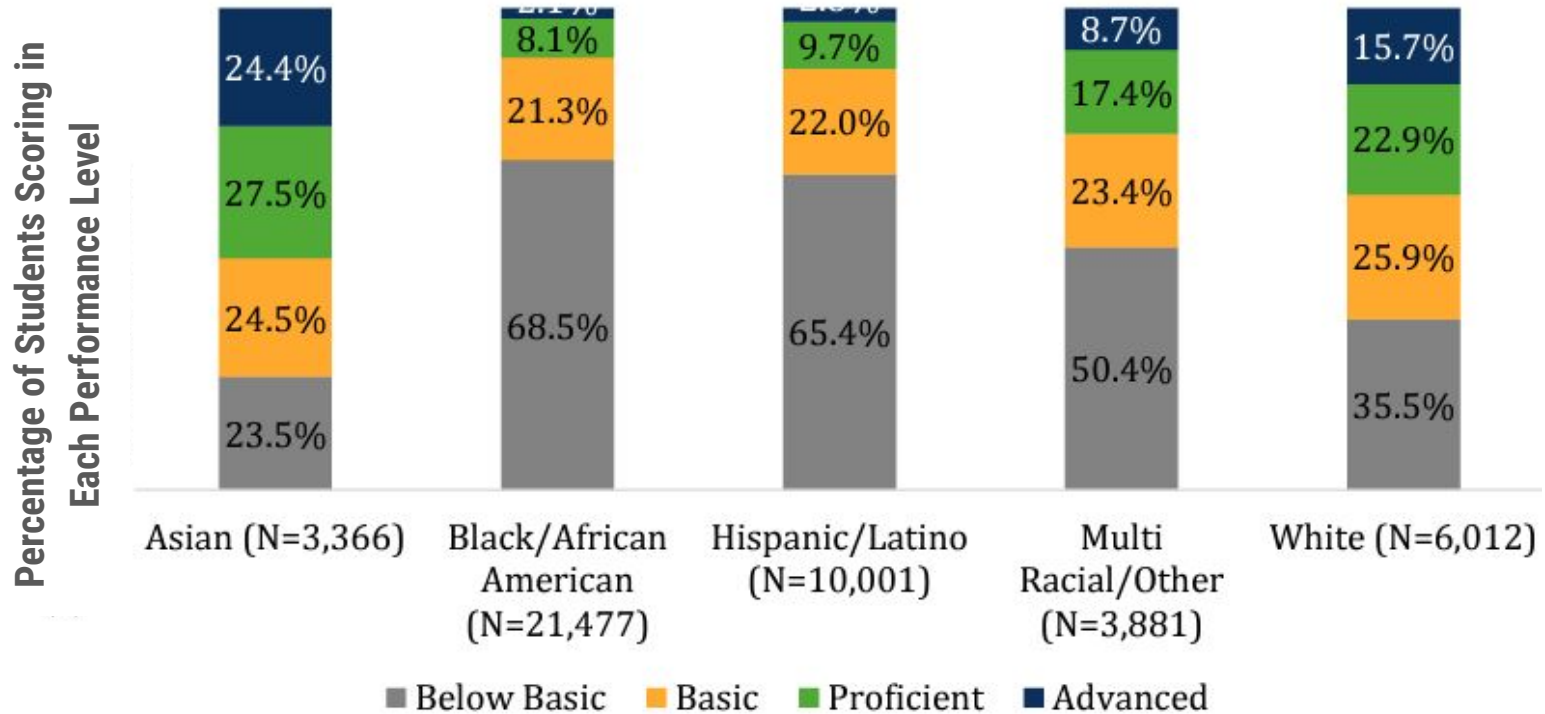
Percentage of Students Scoring in Each Performance Level (y-axis)

Asian (N=3,366): 23.5% Below Basic, 24.5% Basic, 27.5% Proficient, 24.4% Advanced

Black/African American (N=21,477): 68.5% Below Basic, 21.3% Basic, 8.1% Proficient

Hispanic/Latino (N=10,001): 65.4% Below Basic, 22.0% Basic, 9.7% Proficient

Multi Racial/Other (N=3,881): 50.4% Below Basic, 23.4% Basic, 17.4% Proficient, 8.7% Advanced

White (N=6,012): 35.5% Below Basic, 25.9% Basic, 22.9% Proficient, 15.7% Advanced

Legend: ■ Below Basic ■ Basic ■ Proficient ■ Advanced

PSSA Math Performance Over Time

Lines indicate combined Proficient/Advanced rates for each grade
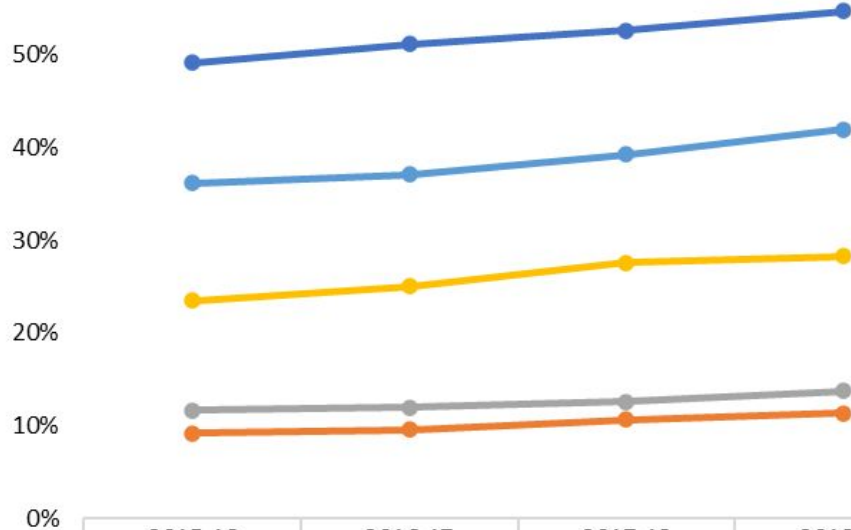
	2015-16	2016-17	2017-18	2018-19
Asian	49.2%	51.1%	52.6%	54.7%
Black/African American	9.2%	9.5%	10.6%	11.4%
Hispanic/Latino	11.7%	11.9%	12.6%	13.7%
Multi Racial/Other	23.5%	25.0%	27.6%	28.3%
White	36.1%	37.1%	39.2%	42.0%

Two Types of Star Assessments

CAT
Computer Adaptive Tests (3-12)

Adaptive tests that adjust the difficulty of items depending on how the student performed on previous items.

- Domains:
  - Numbers and Operations
  - Algebra
  - Geometry and Measurement
  - Data Analysis, Statistics, and Probability

CBM
Curriculum-Based Measures (K-3)

1-minute probes that measure foundational math skills.

- Kindergarten: Numeral Recognition, Quantity Comparison
- 1st Grade: Numeral Recognition, Quantity Comparison, Addition to 10
- 2nd Grade: Addition to 10, Addition to 20, Subtraction from 10
- 3rd Grade: Subtraction from 10, Mixed Addition and Subtraction, Multiplication to 100

Star Math Computer Adaptive Test

Four domains → 54 skill areas → 790 grade-specific skills

Domain	Example Skill Areas
Numbers and Operations	● Decimal Concepts and Operations ● Integers
Algebra	● Evaluate Numerical Expressions ● Linear Equations and Inequalities
Geometry and Measurement	● Right Angles and Trigonometry ● Two-Dimensional Shapes and Attributes
Data Analysis, Statistics, and Probability	● Data Representation and Analysis ● Combinatorics and Probability

https://help2.renaissance.com/US/PDF/SM/SMRPTechnicalManual.pdf

Star Math Computer Adaptive Test
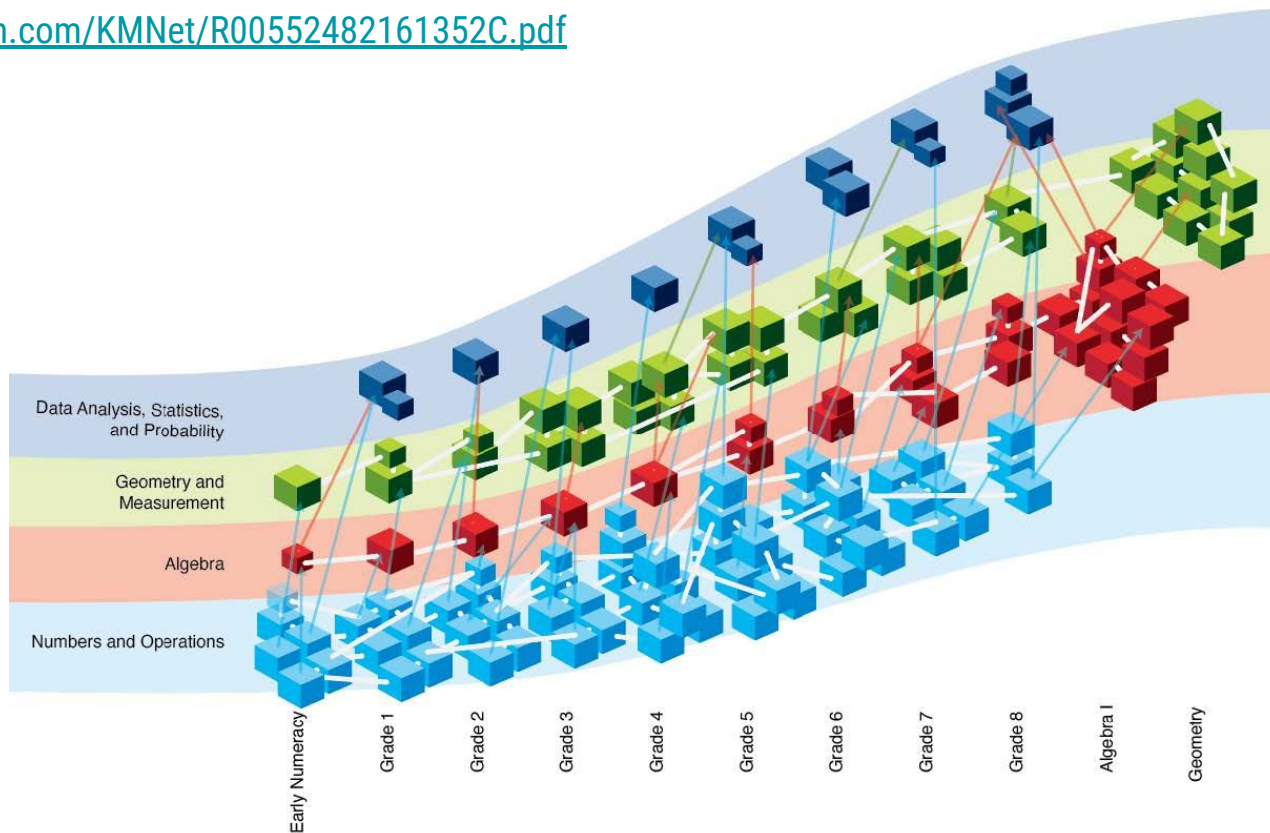
Example Geometry & Measurement CAT Problems

3rd Grade

4th Grade

What temperature does the thermometer show?

°F 70°
    60°
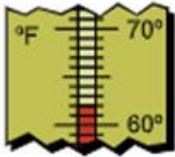
(A) 60°F   (B) 62°F

(C) 65°F   (D) 78°F

Which of the angles appears to be a right angle?

A   B

C   D
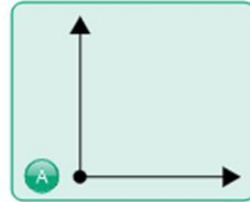
Example Geometry & Measurement CAT Problems

5th Grade

The radius of a circle is 9 inches. What is the diameter of the circle?

- Ⓐ 5 inches
- Ⓑ 36 inches
- Ⓒ 18 inches
- Ⓓ 15 inches

6th Grade

What is the volume of the rectangular prism?

(Not drawn to scale)

15 cm
22 cm
12 cm
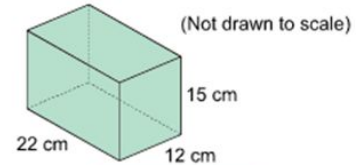
- Ⓐ 3,960 cm³
- Ⓑ 3,096 cm³
- Ⓒ 306 cm³
- Ⓓ 196 cm³

Example Geometry & Measurement CAT Problems

7th Grade

What is the measure of angle J?
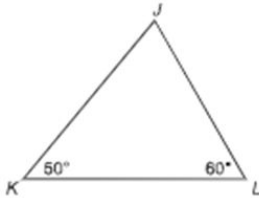
- Ⓐ 130°
- Ⓑ 110°
- Ⓒ 80°
- Ⓓ 70°

8th Grade

Abram is designing a tile pattern made up of squares and right triangles for a kitchen backsplash.
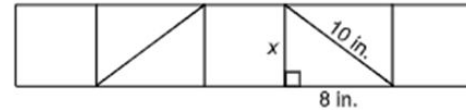
What is x, the height of the row of tiles?

- Ⓐ 6 in.
- Ⓑ 7 in.
- Ⓒ 8 in.
- Ⓓ 10 in.

Star Math Performance: Grades 3-8

Legend:
- ■ At/Above Benchmark (70-100%ile) In Math
- ■ On Watch (25-69%ile) in Math
- ■ Strategic Intervention (10-24%ile) in Math
- ■ Intensive Intervention (<10%ile) in Math

Fall 2021-2022 (n = 48,652):
- Intensive Intervention: 42%
- Strategic Intervention: 20%
- On Watch: 27%
- At/Above Benchmark: 11%

Winter 1 2021-2022 (n = 47,629):
- Intensive Intervention: 36%
- Strategic Intervention: 19%
- On Watch: 30%
- At/Above Benchmark: 15%

Winter 2 2021-2022 (n = 46,476):
- Intensive Intervention: 35%
- Strategic Intervention: 18%
- On Watch: 30%
- At/Above Benchmark: 18%

Y-axis: Percentage of students in each group
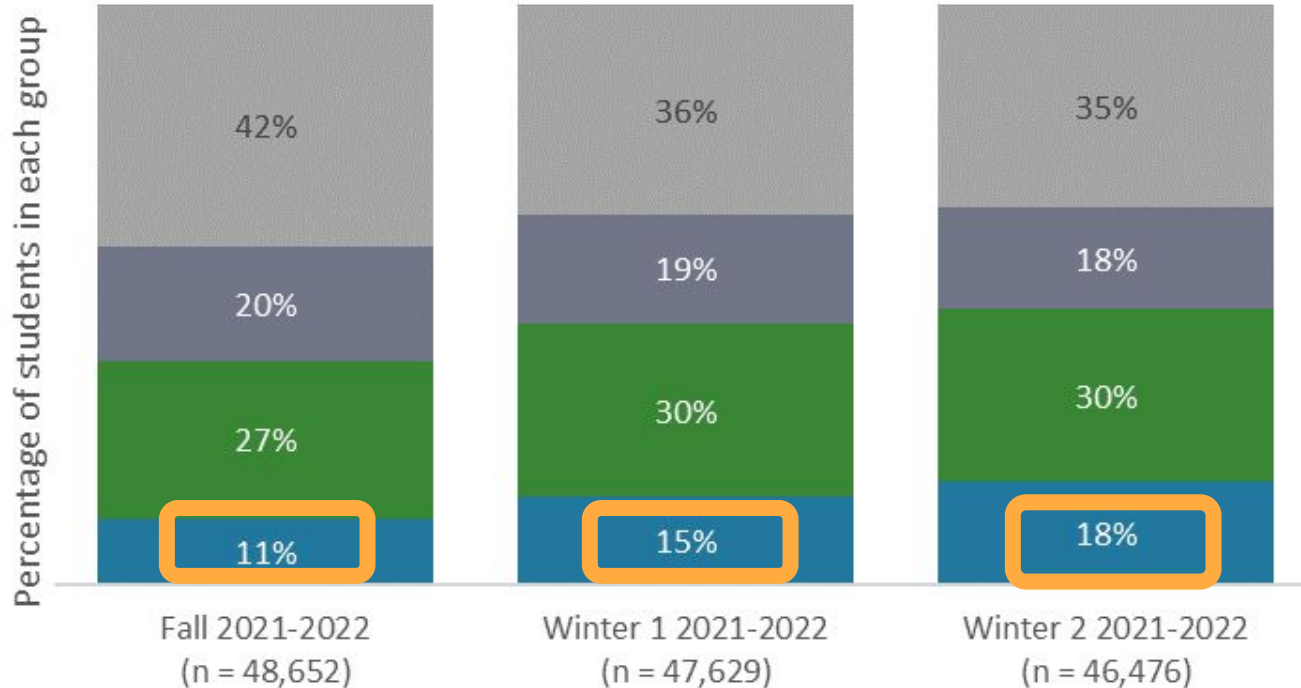
The percentage of 3rd-8th grade students scoring **At/Above Grade Level** increased by seven percentage points from fall (September) to winter 2 (March).

Source: Qlik Academic Screeners Dashboard, Accessed March 28, 2022

Star Math Performance: Grades 3-5

The percentage of 3rd-5th grade students scoring **At/Above Grade Level** increased by six to eight percentage points from fall (September) to winter 2 (March)

Source: Qlik Academic Screeners Dashboard, Accessed March 28, 2022
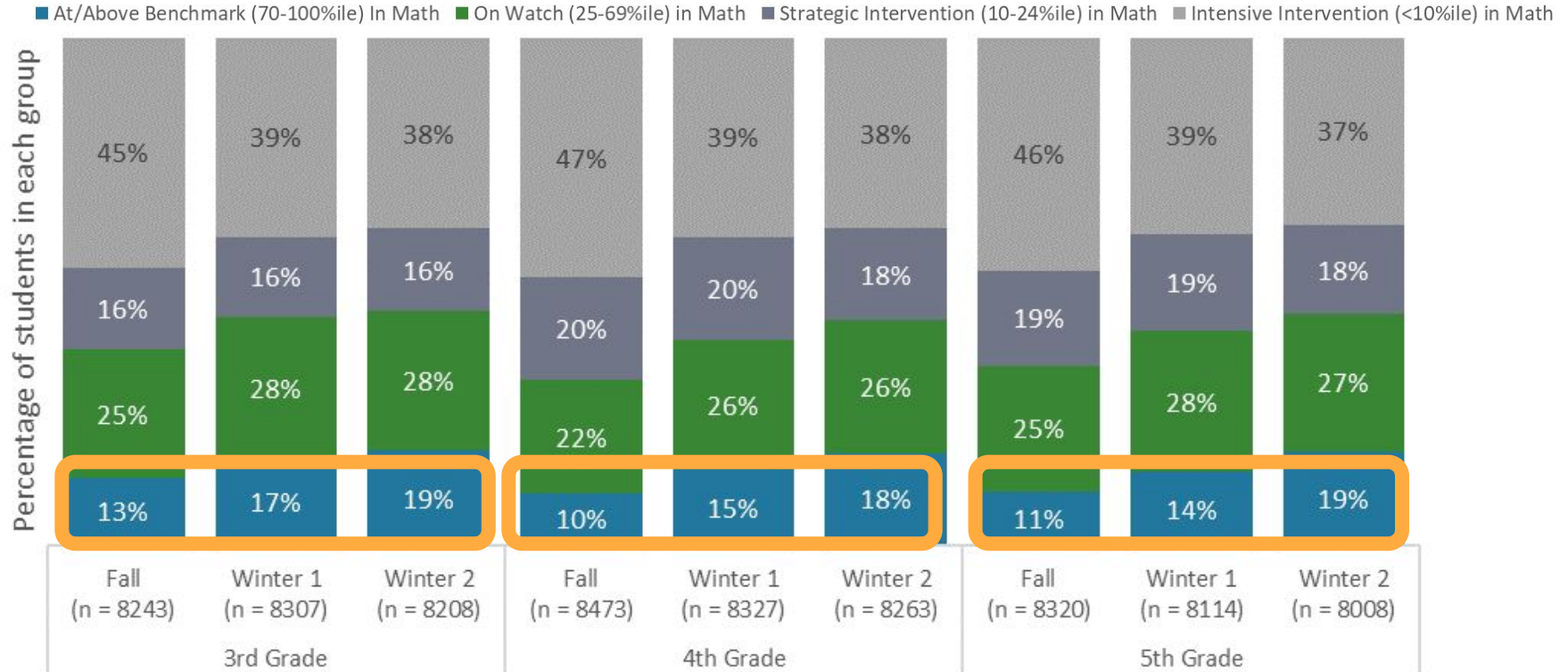
Star Math Performance: Grades 6-8

The percentage of 6th-8th grade students scoring **At/Above Grade Level** increased by four to eight percentage points from fall (September) to winter 2 (March).

Legend: ■ At/Above Benchmark (70-100%ile) In Math ■ On Watch (25-69%ile) in Math ■ Strategic Intervention (10-24%ile) in Math ■ Intensive Intervention (<10%ile) in Math

Percentage of students in each group

6th Grade

	Fall (n = 7745)	Winter 1 (n = 7561)	Winter 2 (n = 7431)
Intensive Intervention	43%	38%	36%
Strategic Intervention	20%	18%	17%
On Watch	28%	31%	30%
At/Above Benchmark	9%	13%	17%

7th Grade

	Fall (n = 7808)	Winter 1 (n = 7518)	Winter 2 (n = 7165)
Intensive Intervention	36%	33%	32%
Strategic Intervention	22%	20%	18%
On Watch	30%	32%	32%
At/Above Benchmark	12%	16%	18%

8th Grade

	Fall (n = 8063)	Winter 1 (n = 7802)	Winter 2 (n = 7401)
Intensive Intervention	32%	28%	28%
Strategic Intervention	22%	20%	19%
On Watch	35%	37%	37%
At/Above Benchmark	12%	15%	16%

Source: Qlik Academic Screeners Dashboard, Accessed March 28, 2022

Star Math Performance: Tracking Growth

Average Star Math Performance for Students in Grade 3 who scored On Watch in the fall
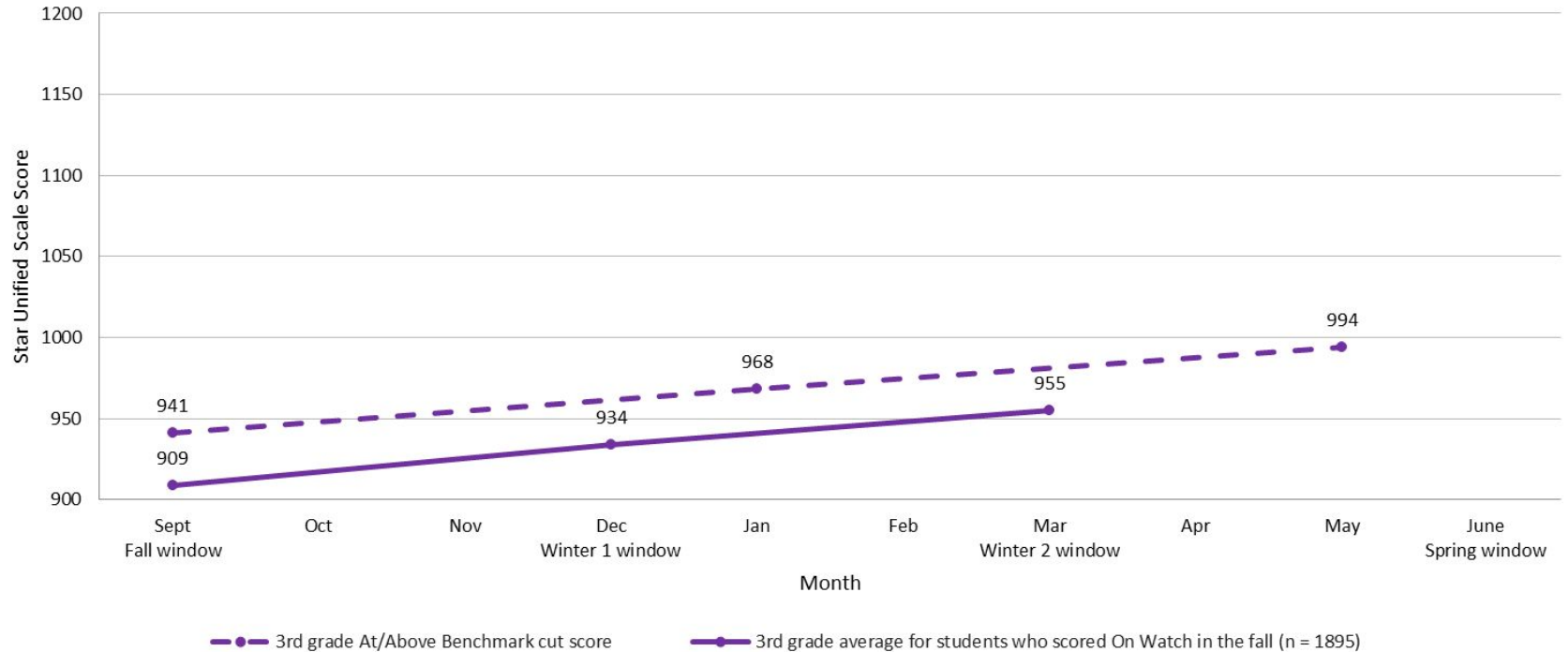
Star Unified Scale Score vs Month

- - ● - - 3rd grade At/Above Benchmark cut score
- —●— 3rd grade average for students who scored On Watch in the fall (n = 1895)

Data points (At/Above Benchmark cut score): 941 (Sept), 968 (Jan), 994 (May)

Data points (On Watch in fall average): 909 (Sept), 934 (Dec), 955 (Mar)

X-axis: Sept Fall window, Oct, Nov, Dec Winter 1 window, Jan, Feb, Mar Winter 2 window, Apr, May, June Spring window

Star Math Performance: Tracking Growth

Average Star Math Performance for Students in Grades 3 and 4 who scored On Watch in the fall

- 3rd grade At/Above Benchmark cut score
- 4th grade At/Above Benchmark cut score
- 3rd grade average for students who scored On Watch in the fall (n = 1895)
- 4th grade average for students who scored On Watch in the fall (n = 1706)

Star Math Performance: Tracking Growth

Average Star Math Performance for Students in Grades 3-5 who scored On Watch in the fall

Y-axis: Star Unified Scale Score (900 to 1200)
X-axis: Month

	Sept (Fall window)	Oct	Nov	Dec (Winter 1 window)	Jan	Feb	Mar (Winter 2 window)	Apr	May	June (Spring window)

Data labels:
- 5th grade cut score: 1040 (Sept), 1055 (Jan), 1070 (May)
- 5th grade average: 1002 (Sept), 1019 (Dec), 1042 (Mar)
- 4th grade cut score: 996 (Sept), 1016 (Jan), 1035 (May)
- 4th grade average: 961 (Sept), 985 (Dec), 1010 (Mar)
- 3rd grade cut score: 941 (Sept), 968 (Jan), 994 (May)
- 3rd grade average: 909 (Sept), 934 (Dec), 955 (Mar)

Legend:
- 3rd grade At/Above Benchmark cut score
- 3rd grade average for students who scored On Watch in the fall (n = 1895)
- 4th grade At/Above Benchmark cut score
- 4th grade average for students who scored On Watch in the fall (n = 1706)
- 5th grade At/Above Benchmark cut score
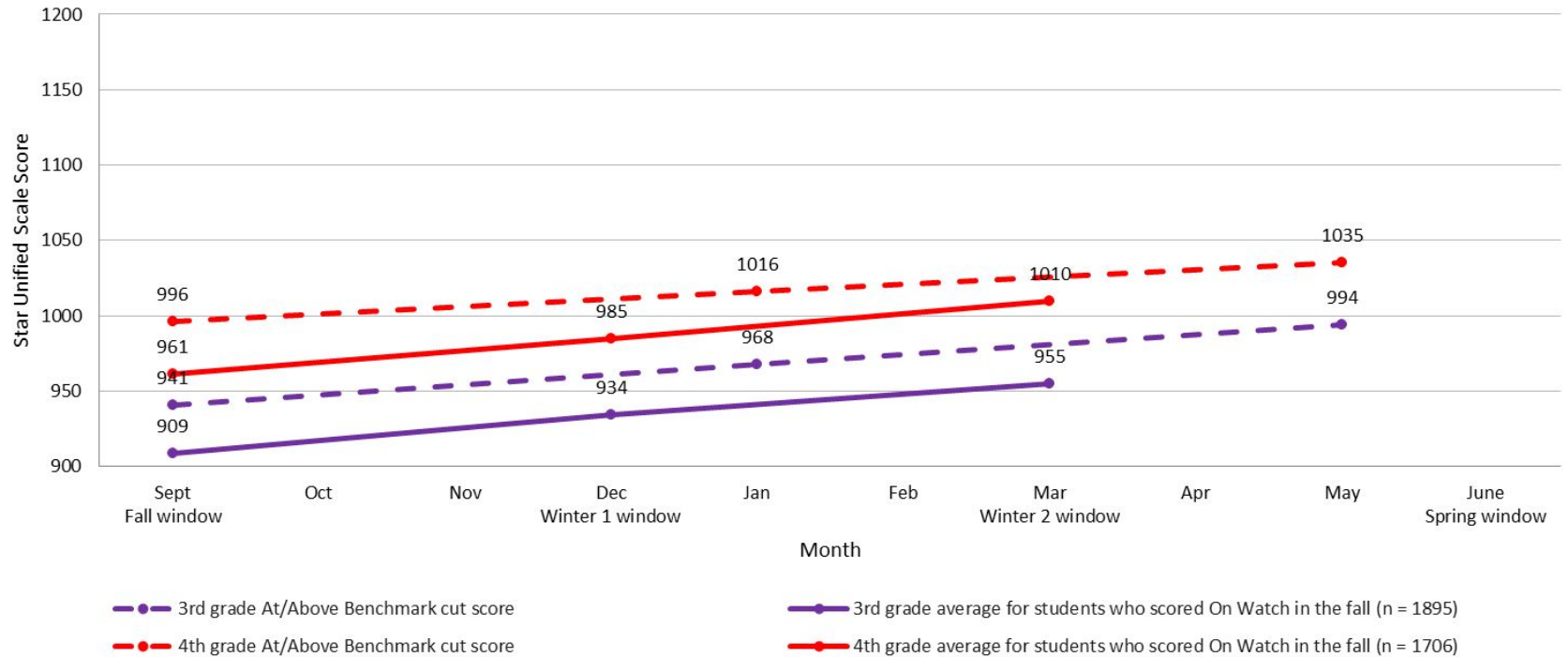- 5th grade average for students who scored On Watch in the fall (n = 1844)

Star Math Performance: Tracking Growth

Average Star Math Performance for Students in Grades 6-8 who scored On Watch in the fall

Y-axis: Star Unified Scale Score (900 to 1200)
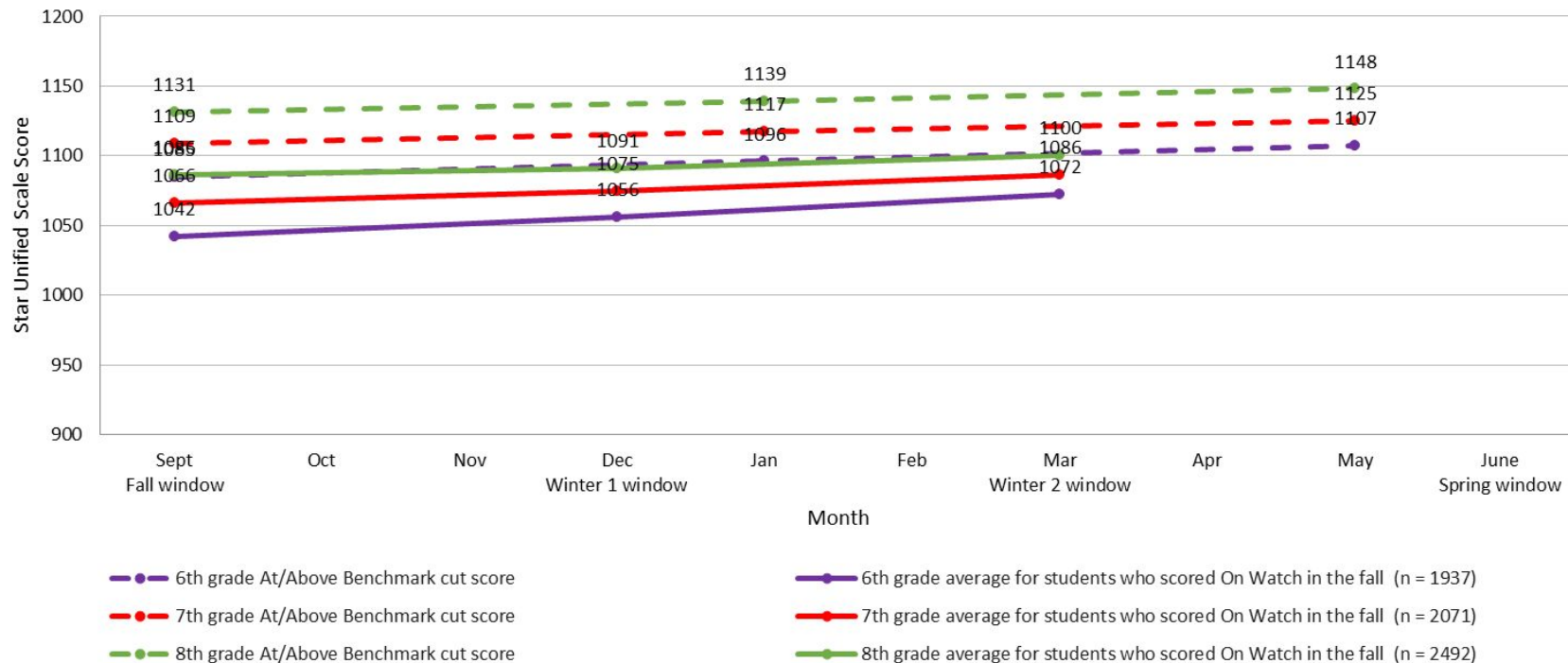X-axis: Month — Sept (Fall window), Oct, Nov, Dec (Winter 1 window), Jan, Feb, Mar (Winter 2 window), Apr, May, June (Spring window)

Data labels:
- 1131, 1139, 1148
- 1109, 1117, 1125
- 1085, 1096, 1100, 1107
- 1081, 1091
- 1075, 1086
- 1066, 1072
- 1056
- 1042

Legend:
- 6th grade At/Above Benchmark cut score
- 7th grade At/Above Benchmark cut score
- 8th grade At/Above Benchmark cut score
- 6th grade average for students who scored On Watch in the fall (n = 1937)
- 7th grade average for students who scored On Watch in the fall (n = 2071)
- 8th grade average for students who scored On Watch in the fall (n = 2492)

Part 3: Additional Context and Resources

Renewed focus on math

- With the introduction of Star we now have a single assessment to track math progression across grades
- Explicitly included in one of our five Board Goals (Goal 3)
- Revised Academic Framework

Goal 3 (Grade 3-8 Math): Progress Toward the Board Goal
% of students in grades 3-8 who are at or above grade level
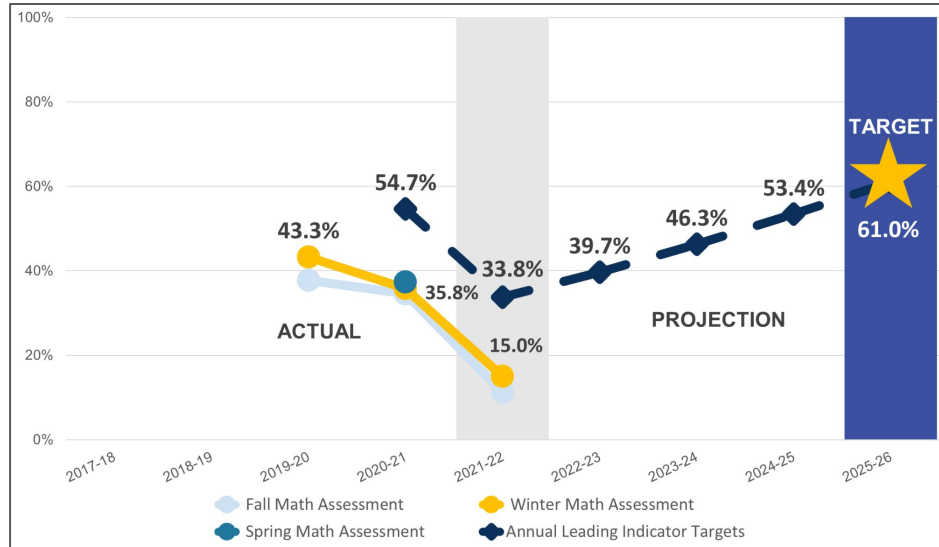
% At/Above Grade Level	Fall	Winter	Winter 2	Spring	2021-22 Annual Target
2021-22	11.2%	15.0%	18.0%	*Forthcoming*	33.8%

Additional math resources

Math Instructional Guide

Math Scope and Sequence

ORE Website

Q&A

[Join our mailing list](#) to be notified when recordings are available and when webinars are scheduled. We also welcome your suggestions for future topics. Link in the chat!