# Contest Corner: The 2019 State Tournament of Mathematics Results

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***Abstract:*** *In this article, the authors summarize results from the 2019 Ohio Mathematics Tournament. Included in the summary are sample tasks from the contest.*

***Keywords:*** *Problem solving, contests*

## 1 Introduction

No one would question that sports encourage physical fitness. Similarly competition in mathematics inspire students to be good mathematicians. Preparation for competition encourages teamwork, camaraderie, and friendship that are similar to that achieved in athletic activities. In short, physical fitness for the mind.

The Ohio Council of Teachers of Mathematics 46th annual State Tournament of Mathematics took place on February 23rd with a total of 727 participating students representing 69 schools. The overall results for the top 25 schools are summarized in Table 1.

**Table 1:** *2019 Overall State Tournament Results*

| Rank | School | Score | Rank | School | Score |
|---|---|---|---|---|---|
| 1 | Sycamore High School | 155 | 14 | St. Xavier High School | 98 |
| 2 | Columbus Academy High School | 143 | | Thomas Worthington High School | 98 |
| 3 | Western Reserve Academy School | 128 | 16 | Miami Valley High School | 97 |
| 4 | Revere High School | 124 | 17 | Summit Country Day School | 93 |
| | Seven Hills Upper School | 124 | 18 | Brecksville-Broadview Heights | 90 |
| 6 | Dublin Jerome High School | 121 | 19 | Strongsville High School | 88 |
| 7 | Copley High School | 118 | 20 | Aurora High School | 86 |
| | Upper Arlington High School | 118 | 21 | Walnut Hills High School | 85 |
| 9 | Avon Lake High School | 115 | 22 | Hilliard Darby High School | 84 |
| 10 | Dublin Coffman School | 114 | 23 | Cincinnati Hills Christian Academy | 81 |
| | William Mason High School | 114 | 24 | Hilliard Bradley | 78 |
| 12 | Hawken Upper School | 111 | | Olentangy Berlin High School | 78 |
| 13 | Hathaway Brown High School | 110 | | | |

As has been done for many years, the OCTM also presented awards and recognition to participating schools by their size. In this way, small schools are not put in direct competition with larger schools. OCTM uses a five level system to group schools. For 2019 Level 1 schools had fewer than 104 students per grade level, Level 2 schools had between 104 and 187 students per grade level, Level 3 schools had between 188 and 422 students per grade level, Level 4 schools had between 306 and 422 students per grade level and Level 5 schools had more than 422 students per grade level. Table 2 shows the 2019 tournament results by level.

**Table 2:** *2019 State Tournament Results by Level (Levels 1-3)*

| **Level 1:** $(n \leq 103)$ | **Level 2:** $(103 < n \leq 187)$ | **Level 3:** $(187 < n \leq 316)$ |
|---|---|---|
| 1. 143 Columbus | 1. 111 Hawken Upper | 1. 124 Revere |
| 2. 128 Western Reserve | 2. 71 Perkins | 2. 118 Copley |
| 3. 124 Seven Hills Upper | 3. 68 Taylor | 3. 115 Avon Lake |
| 4. 110 Hathaway Brown | 4. 66 Edison | 4. 86 Aurora |
| 5. 97 Miami Valley | 66 Oakwood | 5. 78 Olentangy Berlin |
| 6. 93 Summit Country Day | 6. 62 Francis De Sales | 6. 77 Athens |
| 7. 81 Cincinnati Hills Christian | 7. 56 Poland Seminary | 7. 71 Carroll |
| 8. 76 Wellington | 8. 48 Mount Notre Dame | 8. 66 Ashland |
| 9. 62 Worthington Christian | 9. 43 Shelby | 9. 65 Rocky River |
| 10. 50 Kirtland | 10. 42 Jonathan Alder | 10. 55 Sylvania Southview |
| 11. 47 Lucas | 11. 41 Black River | 11. 51 Archbishop Hoban |
| 12. 39 Bluffton | 12. 40 St. Vincent-St. Mary | 12. 48 Olmsted Falls |
| 13. 37 Ayersville | 13. 7 Alexander | 13. 38 Madison |
| 14. 22 West Union | — | 14. 36 Nordonia |

**Table 3:** *2018 State Tournament Results by Level (Levels 4-5)*

| **Level 4:** $(316 < n \leq 422)$ | **Level 5:** $(422 < n)$ |
|---|---|
| 1. 155 Sycamore | 1. 118 Upper Arlington |
| 2. 121 Dublin Jerome | 2. 114 Dublin Coffman |
| 3. 98 St. Xavier | 114 William Mason |
| 98 Thomas Worthington | 4. 88 Strongsville |
| 5. 90 Brecksville-Broadview Heights | 5. 85 Walnut Hills |
| 6. 84 Hilliard Darby | 6. 78 Hilliard Bradley |
| 7. 76 Perry | 7. 66 Lakota West |
| 8. 61 Perrysburg | 8. 63 Glenoak |
| 9. 57 Sylvania Northview | 9. 62 Berea-Midpark |
| 10. 56 Loveland | 62 Hilliard Davidson |
| 11. 55 Hudson | 11. 38 McKinley |
| 12. 40 New Albany | 12. 36 Olentangy Orange |
| 13. 13 Dublin Scioto | 13. 35 Whitmer |
| 14. — | 14. 31 Lorain |

A tally summary describing the frequency of scores for all participants is provided in Table 4.

**Table 4:** *Frequency of scores*

| **score** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***n*** | 3 | 10 | 11 | 24 | 21 | 30 | 36 | 30 | 44 | 42 | 49 | 42 | 44 | 39 | 37 | 31 | 31 | 25 | 19 | 17 | 13 |
| **score** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** | |
| ***n*** | 15 | 14 | 10 | 11 | 7 | 6 | 7 | 8 | 4 | 3 | 6 | 4 | 2 | 6 | 4 | 3 | 5 | 4 | 4 | 6 | |

In all, 727 students participated in the contest, representing 69 different schools. The mean, median, and mode scores were 13.68, 12, and 10, respectively.

## 2 Sample Contest Items

Six problems selected from the 2019 tournament are shown in Table 3. All of the problems can be solved using principles of algebra, geometry, and arithmetic intermixed with strong problem solving skills. Calculators are always allowed on the OCTM tournament. Visit the contest website (`www.octmtournament.org`) for copies of previous contests as well as answers. Problems from these contests can be used with mathematics clubs or in math class to prepare mathletes for future competition.

| | ANSWERS |
|---|---|
| 1. A quadratic function satisfies f (20) = 19 and has roots x = 18 and x = 21. Find f (19). | 19 |
| 2. In a square, two opposite sides are increased by 20% and the other two sides are decreased by 19%. What is the percent decrease of the area of the resulting rectangle? | 2.8% |
| 3. If line L has the equation y = 2019x – 2019, which of the following is the equation of a line perpendicular to L?<br>A. 2019x – y = 19;<br>B. 2019x + y = 19;<br>C. x – 2019y = 19;<br>D. x + 2019y = 19. | D |
| 4. A ***palindromic number*** is one that reads the same backwards and forwards, like 1234321. What palindromic number between 10 and 100 has the property that the sum of its digits equals the product of its digits? | 22 |
| 5. What is the surface area of a cube whose volume is 2019 $cm^3$? | $6(2019)^{2/3}$ or 958.4632 $cm^2$ |
| 6. A sequence is defined recursively by: $a_1=20$, $a_2=19, \wedge a_{n+1}=\frac{1+a_n}{a_{n-1}}$ for n > 2. Determine $a_{2019}$. | $\frac{2}{19}$ |

**Fig. 1:** *Sample contest problems.*

## 3 Get Involved! Get Ready!

So start assembling a team to represent your school in the 2020 tournament today. The 2020 tournament will take place on February 22 at test centers located throughout Ohio. You can find registration information on the OCTM State Tournament of Mathematics at www.octmtournament.org. One of the most important things we as teachers can do for our students is to make competition available. Competition helps build comradery, a lifelong interest in mathematics and a desire to achieve while building a self-esteem to succeed. The calendar of events for the 2020 tournament is shown below. Hope to see your school in February at the 2020 State Tournament of Mathematics!

| | |
|---|---|
| October 1, 2019 | Coaches Begin Sign-up |
| October 1, 2019 | Student Tournament Registration Opens Online |
| February 8, 2020 | Deadline for receiving Registration Fee without late fee. (no late fee if postmarked by this date) |
| February 17, 2020 | LAST Day for receiving Registration Fee - must include $25.00 late fee |
| February 18, 2020 | Student Tournament Registration Closes - No Registrations accepted after this date. |
| February 19, 2020 | Deadline for Coaches to Finalize Student List Online |
| February 22, 2020 | Tournament Test Day |

**Fig. 2:** *Important Contest Dates.*

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