2023 Middle School Tenacity Challenge
Sample Math Quiz Bowl Questions

The Math Quiz Bowl questions are rated based on a tiered system of difficulty. For sample problems the MathCounts Competition is a great resource. The correlation can be found in the table below.

MathCounts Competition	MS Tenacity Quiz Bowl
Spirit Round	Level I (2 points)
Target Round	Level II (5 points)
Team Round	Level III (10 points)

The Mathematical Olympiads for Elementary and Middle School website is also a great resource for Level III questions.

For 2023, we have also added a Logic Puzzle or Hands-On Challenge. This challenge could include a traditional logic puzzle where certain conditions are defined and the reader needs to figure out the rest of the puzzle or a Sudoku type puzzle. It may also include a challenge that involves manipulatives such as tangrams, pentominoes, or wooden blocks such as SOMA blocks. One excellent website for Tangram puzzles is ClipArt etc, for SOMA blocks is this website, and for pentominoes this website.

The following pages have the questions and solutions the MathCounts Competition used for the 2021-22 school year, the 2017 Middle School MOEMS competition questions, 3 sample logic puzzles and a set of pentomino puzzles.

We hope that this information will serve as a sampling of possibilities. It is not intended to be the exclusive source for preparing for the competition though. We reserve the right to add any question in the areas of Pre-Algebra, Algebra, Geometry, Logic, Statistics, and Probability to the competition.

MATHCOUNTS®

2022 Chapter Competition Solutions

Are you wondering how we could have possibly thought that a Mathlete® would be able to answer a particular Sprint Round problem without a calculator?

Are you wondering how we could have possibly thought that a Mathlete would be able to answer a particular Target Round problem in less 3 minutes?

The following pages provide detailed solutions to the Sprint and Target Rounds of the 2022 MATHCOUNTS Chapter Competition. These solutions show creative and concise ways of solving the problems from the competition.

There are certainly numerous other solutions that also lead to the correct answer, some even more creative and more concise!

We encourage you to find a variety of approaches to solving these fun and challenging MATHCOUNTS problems.

Special thanks to solutions author
Howard Ludwig
for graciously and voluntarily sharing his solutions with the MATHCOUNTS community.

Sprint 1

$3^4 - 2 \times 4^2 = 81 - 2 \times 16$ [Exponentiation first.]
$= 81 - 32$ [Multiplication next.]
$= \mathbf{49}$. [Subtraction last.]

Sprint 2

$$\begin{array}{r} 4\,326\,052 \\ -\underline{4\,325\,131} \\ \mathbf{921} \end{array}$$

Sprint 3

Reordering the set elements in increasing order yields $\{0, 3, 4, 7, 8, 11, 16\}$. Since we have an odd number of elements, the median is the middle element of this ordered set. In the case of this set, the middle element is the fourth element, which is **7**.

Sprint 4

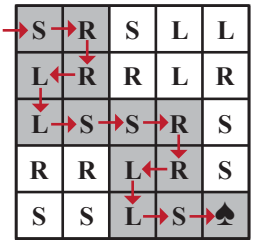
Parker got 11. Each friend got twice that: $2 \times 11 = 22$. There are 3 friends, so the total count is $11 + 3 \times 22 = 11 + 66 = \mathbf{77}$ pieces.

Sprint 5

The iterative steps 3 and 4 yield what is called the digits-sum of the original number. Summing the digits of a number and taking the remainder upon dividing the sum of the digits by 9 gives the remainder upon dividing the original number by 9. The only nonnegative integer that yields a digit-sum of 0 is 0; a positive integer that is divisible by 9 has a digit-sum of 9, instead of the actual remainder value 0. The sum of the digits of 135 is 9, so its digit-sum is 9, indicating 135 to be divisible by 9. If we multiply a positive multiple of 9 by *any* positive integer (it does not have to be two-digit), the result is also a multiple of 9, so the digit-sum is **9**.

Sprint 6

Let's trace through the rooms, starting with the arrow entering the room at the upper left, shading each room that we enter, and drawing an arrow into the next room in accordance with the L, R, or S in the room we just entered. Once we reach the spade room, we count the number of shaded rooms, which is **13** rooms.



Sprint 7

$n + 18 = 4 \times 5 = 20$, so $n = 20 - 18 = \mathbf{2}$.

Sprint 8

We need an integer that is divisible by both 2 and 3, thus by 6, and it must be greater than 100. Since $100 \div 6 = 16$ R 4, the next multiple of 6 up from 100 is $17 \times 6 = 102$. So, the fewest number of students who could have signed up is **102** students.

Sprint 9

Rectangular prisms have 6 faces. For any 1 face, there are 4 adjacent faces that must not be colored the same as the first face, and only the 1 remaining face is non-adjacent and permitted to be the same color. Therefore, at most 2 faces (opposite faces) are allowed to be the same color, so at least $6/2 = 3$ colors are needed. There are 3 pairs of opposite sides, so the minimum number of colors needed is **3** colors.

Sprint 10

Let l be the length of the rectangle. Then the width $w = l + 1$. We need the perimeter, which is $2(l + w) = 2(l + l + 1) = 4l + 2$. We are given that 72 ft^2 is the enclosed area lw. Therefore, $72 = lw = l(l + 1) = l^2 + 1l$. Rearranging yields: $0 = l^2 + 1l - 72 = (l + 9)(l - 8)$, so $l = -9$ feet or $l = 8$ feet. It makes no sense for the length of a side to be negative, so we must have $l = 8$ feet and perimeter 4×8 ft $+ 2$ ft $= \mathbf{34}$ feet.

Sprint 11

Because there are $\frac{3}{8}$ as many heads as there are legs, there are $\frac{8}{3}$ as many legs as heads, so the average number of legs per head is $2\frac{2}{3}$, which is $\frac{2\frac{2}{3} - 2}{4 - 2} = \frac{2/3}{2} = \frac{1}{3}$ of the way from 2 [# legs per chicken] to 4 [# legs per goat]. Therefore, $\frac{1}{3}$ of the animals are goats, and $\frac{2}{3}$ are chickens, so the goat-to-chicken ratio is 1:2. Thus, the minimum number of animals is $1 + 2 = 3$ animals, meaning there is 1 goat and $\mathbf{2}$ chickens.

Sprint 12

The two highest scores are 8.5 and one of the two 8.0 scores, so these are discarded; the two lowest scores are 7.0 and 7.0 (both of the two 7.0 scores), so these are discarded. The scores that are used are the one remaining 8.0 and the two scores of 7.5. Therefore, the point total for the dive is $3.5(8.0 + 7.5 + 7.5) = 3.5(23) = 3(23) + \frac{1}{2}(23) = 69 + 11.5 = \mathbf{80.5}$ points.

Sprint 13

$1\frac{3}{4} = \frac{7}{4}$ cups are required for 24 cookies, so for 18 cookies: $\frac{18}{24}\left(\frac{7}{4}\right) = \frac{3}{4}\left(\frac{7}{4}\right) = \frac{21}{16} = \mathbf{1\frac{5}{16}}$ cups.

Sprint 14

With a rectangle, two vertices may be the endpoints of a short side, of a long side, or of a diagonal. Given two such lengths, the shorter must be a side, while the longer may be a side or a diagonal. If the 5 meters is a diagonal, then we have a 3-4-5 right triangle and the unknown length is the second side, which must be 4 meters. If the 5 meters is the longer side, the unknown length is the diagonal, even longer than the 5 meters. Thus, the minimum possible distance in question is $\mathbf{4}$ meters.

Sprint 15

Of the 64×144 calculators in the lot, 64×12 were tested. Therefore, the fraction tested is $\frac{\cancel{64} \times 12}{\cancel{64} \times 144} = \frac{1}{12}$. If 12 times as many calculators are tested, we expect 12 times as many failures, thus $12 \times 2 = \mathbf{24}$ calculators.

Sprint 16

This problem involves a weighted average with the \$30 value weighted as $75\% = \frac{3}{4}$ and the \$10 value weighted as $25\% = \frac{1}{4}$. So, $\frac{3}{4}(30) + \frac{1}{4}(10) = \frac{90+10}{4} = \frac{100}{4} = \$\mathbf{25}$ or $\mathbf{\$25.00}$.

Sprint 17

$\left(11 + \frac{1}{2}\right) \times \left(12 + \frac{5}{12}\right) = \left(11 \times 12 + 11 \times \frac{5}{12} + \frac{1}{2} \times 12 + \frac{1}{2} \times \frac{5}{12}\right) = \left(132 + \frac{55}{12} + 6 + \frac{5}{24}\right) = \left(132 + 6 + \frac{2 \times 55 + 5}{24}\right) = \left(138 + \frac{115}{24}\right) = 142\frac{19}{24}$ ft^2, which rounds to $\mathbf{143}$ ft^2.

Sprint 18

The length l and width w are related as $w = l - 50$. Therefore, the perimeter is given by $500 = 2(l + w) = 2(l + l - 50) = 4l - 100$, so $l = \frac{500 + 100}{4} = 150$ ft. The enclosed area is given by $lw = l(l - 50) = 150 \times 100 = \mathbf{15{,}000}$ ft^2.

Sprint 19

We need to determine the estimated arrival time down to the minute, so we need to determine the remaining travel time, distance divided by speed, in terms of minutes: $\frac{60 \cancel{\text{ mi}}}{75 \frac{\cancel{\text{mi}}}{\cancel{\text{hour}}}} \times \frac{60 \text{ minutes}}{\cancel{1 \text{ hour}}} = \frac{4}{5} \times 60$ minutes $=$ 48 minutes, which is 12 minutes short of 1 hour. Therefore, starting at 10:32, add 1 hour to get 11:32, and then subtract 12 minutes to result in **11:20** a.m.

Sprint 20

Based on the inforamtion given, we have $x^5 = \frac{2}{3}x^4$, so $x^4\left(x - \frac{2}{3}\right) = 0$. Therefore, $x = 0$ or $x = \frac{2}{3}$, but it must be the latter value because 0 does not satisfy the positivity requirement. Thus, $\frac{x^{10}}{x^8} = x^2 = \left(\frac{2}{3}\right)^2 = \mathbf{\frac{4}{9}}$.

Sprint 21

If the two bread slices are selected to be the same, then there are 3 flavor choices. If they are selected to be different, then there are ${}_3\text{C}_2 = \frac{3!}{2!\,1!} = 3$ choices, totaling 6 choices for the bread. For each of these, there are 3 choices of filling (ham only, cheese only, both). So, James can make $6 \times 3 = \mathbf{18}$ different sandwiches.

Sprint 22

Let N be the total number of students in Mr. Short's homeroom. Then working backward, we see that $6 = \frac{1}{4}\left(1 - \frac{1}{3}\right)N = \frac{1}{4}\left(\frac{2}{3}\right)N = \frac{1}{6}N$, so $N = 6 \times 6 = \mathbf{36}$ students.

Sprint 23

We need meters per second, not centimeters per second, so convert the stride of 140 cm to meters: $140 \cancel{\text{ cm}} \times \frac{1 \text{ m}}{100 \cancel{\text{ cm}}} = 1.4$ meters. The number of pulses going above the dashed line for the 3 g threshold to count as strides is 19. Therefore, a total assumed distance of 19×1.4 meters [do *not* calculate that yet] is covered in 20 seconds, making the average speed $\frac{19 \times 1.4}{20} = 19 \times 0.07 = \mathbf{1.33}$ m/s. [Notice that waiting so we could do the very easy division first made for a simpler multiplication later, which can be important for the Sprint Round as a speed round without support of electronic calculators.]

Sprint 24

The triangle inequality property tells us $3 = 5 - 2 < x < 5 + 2 = 7$, so x as an integer must be 4, 5 or 6. The median is the middle value, **5**.

Sprint 25

\$150 each year averages to $\frac{\$150/\cancel{\text{yr}}}{12 \frac{\text{mo}}{\cancel{\text{yr}}}} = \frac{\cancel{6} \times \$25}{\cancel{6} \times 2 \text{ mo}} = \$12.50/\text{mo}$. So, $\$5.95N > \$12.50/\text{mo} + \$3.95N$, where N is the number of movies rented per month. Thus, $\$2N > \$12.50/\text{mo}$, making $N > \frac{\cancel{\$}12.50/\text{mo}}{\cancel{\$}2} = 6.25/\text{mo}$. The least such integer is **7** movies per month.

Sprint 26

Note that $345{,}600 = 3456 \times (2 \times 5)^2$. The sum of the digits of 3456 is 18, which is divisible by 9, so 3456 is likewise divisible by $9 = 3^2$, leaving a quotient of 384. The sum of the digits of 384 is divible by 3 but not by 9, so that is the case with $384 = 3 \times 128 = 3 \times 2^7$. Combining all this yields $345{,}600 = 2^9 \times 3^3 \times 5^2 = 2^6 \times (2^3 \times 3^3) \times 5^2 = 4^{6/2} \times 6^3 \times 5^2 = 6^3 \times 5^2 \times 4^3$. The product of the exponents is $abc = 3 \times 2 \times 3 = \mathbf{18}$.

Sprint 27

Of 12 flowers, 6 are required to be orchids, leaving flexibility for the remaining 6 to be any mix of 4 kinds of flowers, including possibly more orchids. Let's use what I call the bars and blanks method. [A variety of names are given to this method.] We have 12 blanks, each representing one flower, with O (for orchid) in the last 6 since we require a minimum of 6 orchids; we have 3 bars to intersperse among the empty blanks to separate the roses from the lilies, the lilies from the violets, and the violets from the extra orchids. For example: | ___ ___ ___ ___ || ___ ___ O O O O O O would indicate 0 roses (because of 0 blanks to the left of the first bar), 4 lilies (because of 4 blanks between the first and second bars), 0 violets (because of 0 blanks between the second and third bars) and 2 extra orchids (because of two empty blanks to the right of the last bar, for a total of 8 orchids). The number of possible distinct bouquets is the number of orderings of the 3 bars and the 6 empty blanks, which is ${}_{6+3}C_6 = \frac{9!}{6!\,3!} = \frac{9\times8\times7}{3\times2\times1} = \frac{72\times7}{6} = 12 \times 7 = 84$. So, that's **84** groups of a dozen flowers.

Sprint 28

Cross-multiplying yields $(x + 2)(y + 3) = 6$. The only ways to factor 6 into the product of two integers is $(1)(6)$, $(2)(3)$, $(-1)(-6)$ and $(-2)(-3)$—each of which can go in either order as to which factor is $(x + 2)$ and which is $(y + 3)$. The 8 factors for $(x + 2)$ occur in 4 pairs, each pair having one positive value and one counterpart equal-magnitude negative value, with the sums canceling each other to 0, so the sum of all eight $(x + 2)$ factors is 0. To get the sum of all eight corresponding x values, subtract 2 for each of the 8 factors to end up with $0 - 8 \times 2 = \mathbf{-16}$.

Sprint 29

$a_0 = 4$;
$a_1 = a_1$; [an as yet unknown value]
$a_2 = a_1 + 2a_0 = a_1 + 8$;
$a_3 = a_2 + 2a_1 = a_1 + 8 + 2a_1 = 3a_1 + 8$;
$a_4 = a_3 + 2a_2 = 3a_1 + 8 + 2(a_1 + 8) = 5a_1 + 24 = 26$, so $a_1 = \frac{26-24}{5} = \frac{2}{5}$ and $a_3 = \frac{6}{5} + 8 = \frac{46}{5}$;
$a_5 = a_4 + 2a_3 = 26 + 2 \times \frac{46}{5} = \frac{130+92}{5} = \mathbf{\frac{222}{5}}$.

Sprint 30

Each of the 8 vertex blocks has 3 sides painted, thus probability $\frac{1}{2}$ coming up unpainted. The 12 edge blocks except vertex blocks total $12 \times 8 = 96$ blocks, each having 2 sides painted, thus probability $\frac{2}{3}$ coming up unpainted. The 6 face blocks except the edge and vertex blocks total $6 \times 8 \times 8 = 384$ blocks, each having 1 side painted, thus probability $\frac{5}{6}$ coming up unpainted. Each of the remaining blocks, the interior $8 \times 8 \times 8 = 512$ blocks, has 0 sides painted, thus probability 1 coming up unpainted. Therefore, the overall probability of all blocks rolling with the upward facing side being unpainted is given by $\left(\frac{1}{2}\right)^8 \left(\frac{2}{3}\right)^{96} \left(\frac{5}{6}\right)^{384} 1^{512} = \frac{2^{96}\times5^{384}}{2^8\times3^{96}\times2^{384}\times3^{384}} = 2^{-296} \times 3^{-480} \times 5^{384}$, so the desired answer is the sum of the exponents, $-296 - 480 + 384 = \mathbf{-392}$.

Target 1

The excluded value is the product of all 6 values divided by the given product of all included values: $\frac{1\times4\times6\times9\times15\times17}{3240} = \frac{55{,}080}{3240} = \mathbf{17}$.

Target 2

$\frac{1\times8 + 1\times11 + 2\times12 + 4\times14 + 6\times15 + 7\times16 + 2\times17 + 3\times18 + 4\times20}{1+1+2+4+6+7+2+3+4} = \frac{8+11+24+56+90+112+34+54+80}{30} = \frac{469}{30} = 15.63\ldots$, which rounds to the nearest tenth as **15.6** points.

Target 3

$\frac{88 \cancel{\text{measure}} \times 16 \frac{\cancel{\text{notes}}}{\cancel{\text{measure}}}}{432 \frac{\cancel{\text{notes}}}{\cancel{\text{min}}}} \times \frac{60 \text{ seconds}}{1 \cancel{\text{min}}} = \frac{84{,}480}{432} \approx \mathbf{196}$ seconds.

Target 4

Because the diameter of the circle is 8, radii OA, OB and OC have length 4. Given $BC = 4\sqrt{2}$, we have $(OB)^2 + (OC)^2 = 32 = (BC)^2$, which, according to the Pythagorean theorem, means that $\triangle BCO$ is a right triangle with angle BOC being the right angle and the two radii being the legs. Therefore, the area enclosed by triangle BOC is $\frac{1}{2} \times 4 \times 4 = 8$. Angles BOC and AOC are supplementary, so angle AOC is a right angle as well, and the sector formed by minor arc AC and radii OA and OC is one quadrant of the circle. Therefore, the area enclosed by the sector is $\frac{1}{4}\pi(4^2) = 4\pi$. The total area of the shaded area is $8 + 4\pi$. So, $a = 8$, $b = 4$, and $ab = 8 \times 4 = \mathbf{32}$.

Target 5

$\frac{90^2}{43{,}560} \times 100\% = \frac{810{,}000}{43{,}560}\% \approx \mathbf{18.6}\%$.

Target 6

Both PQ and PR are the hypotenuse of $2 \times$ 3-4-5 right triangles. By properties of 45-45-90 right triangles, QR = $6\sqrt{2}$. Thus, triangle PQR is an isosceles triangle with side lengths 10, 10 and $6\sqrt{2}$. To find the enclosed area, we can easily split the triangle into two congruent right triangles with hypotenuse 10 and one leg of length $\frac{1}{2} \times 6\sqrt{2} = 3\sqrt{2}$, so the other leg is $\sqrt{10^2 - \left(3\sqrt{2}\right)^2} = \sqrt{100 - 18} = \sqrt{82}$ and the enclosed area is $\cancel{2} \times \frac{1}{\cancel{2}} \times 3\sqrt{2} \times \sqrt{82} = \mathbf{6\sqrt{41}}$ units^2.

Target 7

$8 \times (22 \times 16 + 14 \times 4) \times 54 = 8 \times (352 + 56) \times 54 = 408 \times 432 = 176\,256$, which when rounded to the nearest thousand is **176,000** books.

Target 8

To have the product of the 4 digits be divisible by 14, the digit 7 must be chosen at least once, and one or more of the digits 2, 4, 6 and 8 must be chosen at least once. This is the complement of never choosing 7, which has probability $\left(\frac{8}{9}\right)^4 = \frac{4096}{6561}$ or never choosing an even digit, which has probability $\left(\frac{5}{9}\right)^4 = \frac{625}{6561}$. However, these two cases overlap (choosing 1, 3, 5 or 9 every time), which has probability $\left(\frac{4}{9}\right)^4 = \frac{256}{6561}$. Thus, the answer is $1 - \left(\frac{4096}{6561} + \frac{625}{6561} - \frac{256}{6561}\right) = \mathbf{\frac{2096}{6561}}$.

Team 1

$75\% = 0.75 = \frac{3}{4}$. Now, $\frac{2}{3} \times 75\% \times 0.85x = \frac{2}{3} \times \frac{3}{4} \times 0.85x = \frac{1}{2} \times 0.85x = 0.425x = 100$, so $\frac{4}{5} \times 70\% \times 0.75x = \frac{\cancel{4}}{5} \times \frac{7}{10} \times \frac{3}{\cancel{4}}x = \frac{21}{50}x = 0.42x = 0.42 \times \frac{0.425}{0.425}x = \frac{0.420}{0.425} \times 0.425x = \frac{420}{425} \times 100 = 98.82\ldots$, which rounds to the nearest tenth as **98.8**.

Team 2

The count in the category "Insects" is 3252; the count in all other categories combined, 1892, is less than for the one "Insects" category. Whenever one category has a count that is more than half the total count (that is, the one category has a greater count than all other categories combined), the median value is guaranteed to occur in that one category. All members of that one category in this case have a value of 6, so the median number of legs is **6** legs.

Team 3

The number being divisible by both 2 and 5 means the ones digit must be 0. To be divisible by 3, the sum of the digits must be divisible by 3: $2 + 3 + 4 + h + 6 + 0 = 15 + h$, so the hundreds digit must be divisible by 3, thus 0, 3, 6 or 9. The largest of these, 9, yields the greatest possible overall value for the original number, **234960**.

Team 4

Ailey, and therefore Zander, earn $\frac{47.25}{3}$, which is \$15.75 per hour, so Liz earns $\frac{4}{5} \times 15.75 = \$12.60$ *per* hour. Ailey and Zander worked a combined $3 + 5 = 8$ hours, while Liz worked 12 hours. Therefore, the combined earnings are $8 \cancel{\text{hours}} \times \frac{\$15.75}{\cancel{\text{hour}}} + 12 \cancel{\text{hours}} \times \frac{\$12.60}{\cancel{\text{hour}}} = \$126 + \$151.20 = \$277.20$. Of that, $5\% = \frac{1}{20}$ went back into the business, thus $\frac{277.20}{20} = \$\mathbf{13.86}$.

Team 5

Each side of the triangle is the sum of the two radii of the circles forming the side: $1 + 2 = 3$ meters; $1 + 3 = 4$ meters; $2 + 3 = 5$ meters. Therefore, we have a 3-4-5 right triangle whose enclosed area is half the product of the two shorter sides: $\frac{1}{2} \times 3 \times 4 = \mathbf{6}$ m^2.

Team 6

For a page number $100h + 10t + u \leq 280$, h, t and u represent the hundreds, tens, and units or ones digits, respectively, each at least 0 and at most 9, subject to further constraints, two of which are $h + t + u = 16$ and $h \leq 2$. When $h = 0$, $t + u = 16$, so t can range from 7 up to 9, while u ranges from 9 down to 7—making 3 options. When $h = 1$, $t + u = 15$, so t can range from 6 up to 9, while u ranges from 9 down to 6—making 4 options. Careful now: When $h = 2$, $t + u = 14$, so t can range from 5 up to only 7 [due to a page number being at most 280], while u ranges from 9 down to 7—making 3 options. Therefore, the total number of words written is $3 + 4 + 3 = \mathbf{10}$ words.

Team 7

There are $5! = 120$ permutations of the five digits. Each digit value occurs $\frac{1}{5}$ of the time in each digit place. Therefore, each of 1, 2, 3, 4 and 5 occurs 24 times in each digit place, so the sum of the digit values in any one digit-place column is $24(1 + 2 + 3 + 4 + 5) = 24 \times 15 = 360$. To account for the 10,000s place, the 1000s place, the 100s place, the 10s place and the 1s place, we need to multiply the 360 by $10{,}000 + 1000 + 100 + 10 + 1 = 11{,}111$ to end up with the answer $11{,}111 \times 360 = \mathbf{3{,}999{,}960}$.

Team 8

For a regular n-gon, there are always $\frac{n(n-3)}{2}$ diagonals, so for $n = 20$, there are 170 diagonals. When n is even, the longest diagonals go straight across passing through the center to the opposite vertex, and there are 10 such distinct pairings of vertices. The shortest diagonals are obtained by taking any vertex; that vertex is adjacent to two other vertices, and the diagonal joining those two other vertices has the shortest possible length—there are 20 such vertices and 20 such diagonals. Therefore, of the 170 diagonals, we are rejecting $10 + 20 = 30$ and thus keeping 140. The probability is, therefore, $\frac{140}{170} = \mathbf{\frac{14}{17}}$.

Team 9

Line 1: either '2' or '3' first, so 2 orderings; 4 choices for the '2'; 3 choices for the '3';
thus, $2 \times 4 \times 3 = 24$ distinct lines.

Line 2: '3' in any of 3 positions, so 3 orderings; 3×2 choices for the '2's; 2 choices for the '3';
thus, $3 \times 3 \times 2 \times 2 = 36$ distinct lines.

Line 3: either '2' or '3' first, so 2 orderings; 1 choice left for the '2'; 1 choice left for the '3';
thus, $2 \times 1 \times 1 = 2$ distinct lines.

Putting the options together for all three lines: $24 \times 36 \times 2 = \mathbf{1728}$ haiku.

Team 10

The square root causes major difficulties for having an integer result. It is necessary to have $\sqrt{ab} = \sqrt{40b} = 2\sqrt{10b}$ be an integer, so $10b$ must be a perfect square, so it must be that $b = 10n^2$ for some integer $n > 2$. If n is divisible by 3, then the second and third terms in the numerator $40 + 20n + 10n^2$ are divisible by 3 but the first term is not, so the numerator cannot be divisible by 3. We can crank a few cases quickly, so let's not analyze more. Because $n > 3$, first try $n = 4$: $40 + 80 + 160 = 280$—not divisible by 3. Next try $n = 5$: $40 + 100 + 250 = 390$—yes, divisible by 3. Therefore, the least $b > 2$ is $b = 10 \times 5^2 = \mathbf{250}$.

MATHCOUNTS®

2022 Chapter Competition

Team Round Problems 1–10

School _____

Team Members _____, Captain

_____

_____

_____

DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.

This section of the competition consists of 10 problems which the team has 20 minutes to complete. Team members may work together in any way to solve the problems. Team members may talk to each other during this section of the competition. This round assumes the use of calculators, and calculations also may be done on scratch paper, but no other aids are allowed. All answers must be complete, legible and simplified to lowest terms. The team captain must record the team's official answers on his/her own competition booklet, which is the only booklet that will be scored. If the team completes the problems before time is called, use the remaining time to check your answers.

Total Correct	Scorer's Initials

1. _____ If $\frac{2}{3}$ of 75% of $0.85x$ is equal to 100, what is $\frac{4}{5}$ of 70% of $0.75x$? Express your answer as a decimal to the nearest tenth.

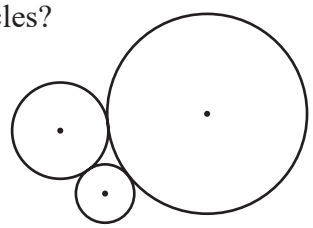
2. _____ legs This chart shows the number of each type of organism collected by a team of entomologists. Insects always have six legs and worms always have zero legs. Arachnids usually have eight legs, but occasionally there are arachnids with six legs. A millipede has between 34 and 750 legs and a centipede has between 30 and 354 legs. What is the median number of legs of the organisms collected?

Insects	3252
Arachnids	1542
Worms	317
Millipedes	17
Centipedes	16

3. _____ Phil wrote down a six-digit number on the board, and then Caleb erased two of the digits. What remains on the board is 234__6__. Phil remembers that the original number is divisible by 2, 3 and 5. What is the greatest possible value of Phil's original number?

4. $ _____ Zander, Ailey and Liz are partners in a babysitting business. Zander and Ailey, the elder two, charge $1\frac{1}{4}$ times as much as Liz, the youngest. Each of the partners in the business puts 5% of their earnings into the business for expenses. Last week, Ailey worked 3 hours and earned $47.25 before putting any money into the business. Zander worked 5 hours and Liz worked 12 hours. How much money went into the business last week? Express your answer in dollars to the nearest cent.

5. _____ m^2 Three circles are pairwise externally tangent, as shown below. The circles have radii of 1 meter, 2 meters and 3 meters. In square meters, what is the area of the polygon formed by connecting the centers of the circles?



6. _____ words

For her 16th birthday, Kate receives a book. On each page whose digits sum to 16, there is one word of a secret birthday message written in the margin. If the book is 280 pages, how many words are in the secret birthday message?

7. _____

What is the sum of all the five-digit positive integers in which each of the digits 1, 2, 3, 4 and 5 appear exactly once?

8. _____

In a regular icosagon (20-sided polygon), all the diagonals are drawn. If a diagonal is selected at random, what is the probability of selecting a diagonal that is neither the shortest possible length nor the longest possible length? Express your answer as a common fraction.

9. _____ haiku

A *haiku* is a poem with three lines: the first line contains 5 syllables, the second line 7 syllables, and the last line 5 syllables. If each word in each list shown is used at most once, how many different haiku can be made with these words?

2-syllable	**3-syllable**
UNKNOWN	ALGEBRA
MEASURE	TRIANGLE
COUNTING	REASONING
LOGIC	

10. _____

The Heronian mean H(a, b) is defined as H(a, b) = $\frac{a+\sqrt{ab}+b}{3}$. What is the least positive integer $b > 40$ such that H(40, b) is also a positive integer?

MATHCOUNTS®

2022 Chapter Competition

Target Round Problems 1–8

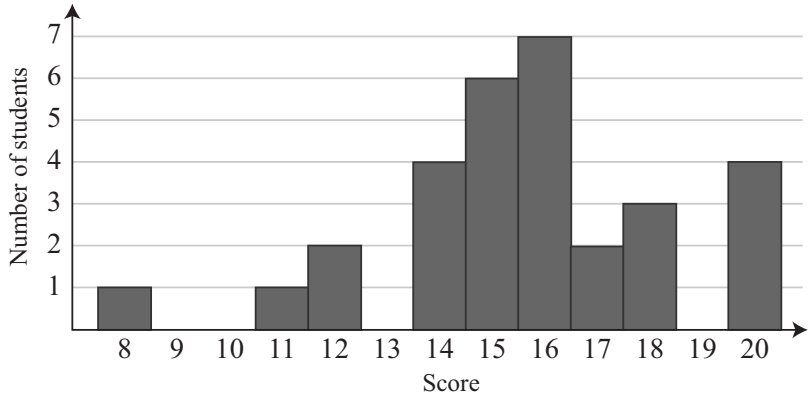
Name _____

DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.

This section of the competition consists of eight problems, which will be presented in pairs. Work on one pair of problems will be completed and answers will be collected before the next pair is distributed. The time limit for each pair of problems is six minutes. The first pair of problems is on the other side of this sheet. When told to do so, turn the page over and begin working. This round assumes the use of calculators, and calculations also may be done on scratch paper, but no other aids are allowed. All answers must be complete, legible and simplified to lowest terms. Record only final answers in the blanks in the left-hand column of the problem sheets. If you complete the problems before time is called, use the time remaining to check your answers.

1. _____ Alec multiplied five of the six numbers 1, 4, 6, 9, 15 and 17 and obtained a product of 3240. Which of these six numbers was not included in the numbers he multiplied?

2. _____ points This histogram shows the numbers of students who received each score on a 20-point quiz. What was the mean quiz score? Express your answer as a decimal to the nearest tenth.

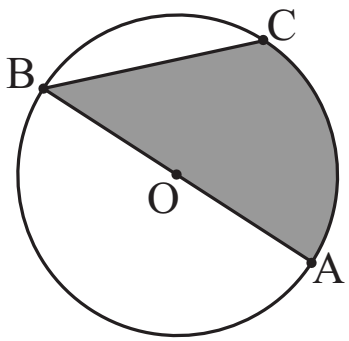


3. _____ seconds

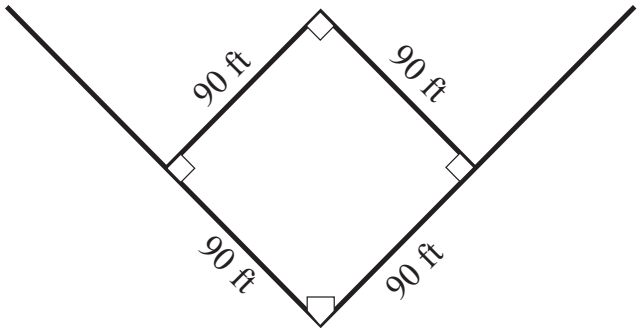
J. S. Bach's Prelude No. 2 in C Minor consists of 88 measures with each measure containing 16 notes. In a typical performance, 432 notes are played every minute. How many seconds does it take to perform the entire Prelude? Express your answer to the nearest second.

4. _____

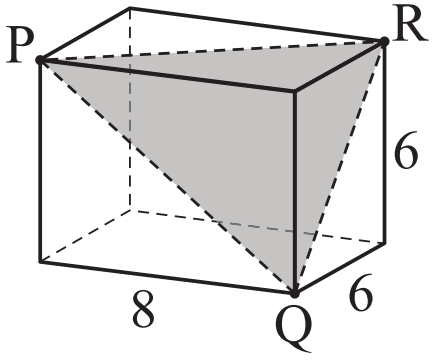
The figure shows circle O with diameter AB and inscribed angle ABC with AB = 8 and BC = $4\sqrt{2}$. When the area of the shaded region, in square units, is expressed in the form $a + b\pi$, what is the value of ab?



5. _____ % A baseball diamond is a square with 90-foot sides. An acre of land is a region containing 43,560 square feet. What percent of an acre is enclosed within a baseball diamond? Express your answer as a decimal to the nearest tenth.



6. _____ units^2 The three-dimensional figure shown is a right rectangular prism. What is the area of ΔPQR? Express your answer in simplest radical form.



7. _____ books

Padraig is estimating the number of books in a library. The library has 8 floors, each of which has 22 large bookshelves and 14 small bookshelves. Each large bookshelf has 16 rows of books, and each small bookshelf has 4 rows of books. If each row of books contains 54 books on average, how many books are in the library? Express your answer to the nearest thousand.

8. _____

A machine randomly generates one of the nine numbers 1, 2, 3, … , 9 with equal likelihood. What is the probability that when Tsuni uses this machine to generate four numbers their product is divisible by 14? Express your answer as a common fraction.

MATHCOUNTS®

2022 Chapter Competition

Sprint Round Problems 1–30

HONOR PLEDGE

I pledge to uphold the highest principles of honesty and integrity as a Mathlete®. I will neither give nor accept unauthorized assistance of any kind. I will not copy another's work and submit it as my own. I understand that any competitor found to be in violation of this honor pledge is subject to disqualification.

Signature _____ Date _____

Printed Name _____

School _____

DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.

This section of the competition consists of 30 problems. You will have 40 minutes to complete all the problems. You are not allowed to use calculators, books or other aids during this round. Calculations may be done on scratch paper. All answers must be complete, legible and simplified to lowest terms. Record only final answers in the blanks in the left-hand column of the competition booklet. If you complete the problems before time is called, use the remaining time to check your answers.

In each written round of the competition, the required unit for the answer is included in the answer blank. The plural form of the unit is always used, even if the answer appears to require the singular form of the unit. The unit provided in the answer blank is the only form of the answer that will be accepted.

Total Correct	Scorer's Initials

1. _____ What is the value of $3^4 - 2 \times 4^2$?

2. _____ What is the value of the result when four million three hundred twenty-five thousand one hundred thirty-one is subtracted from four million three hundred twenty-six thousand fifty-two?

3. _____ What is the median of the data set {4, 16, 0, 8, 3, 11, 7}?

4. _____ pieces Parker and his three friends went trick-or-treating together. If Parker got 11 pieces of candy, and each of his friends got twice as much candy as he did, how many pieces of candy did Parker and his friends get in all?

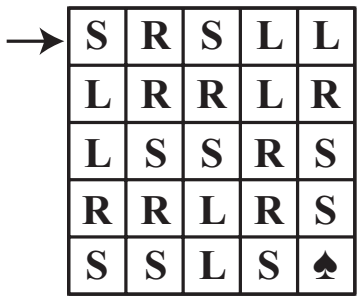
5. _____ Follow these steps:

1. Choose a two-digit positive integer.
2. Multiply it by 153.
3. Add the digits of the number obtained.
4. If the sum resulting from step 3 has more than one digit, repeat step 3. If the sum resulting from step 3 has one digit, stop.

What number is the result of following this algorithm?

6. _____ rooms

The 5 × 5 grid pictured represents 25 rooms. Annie walks into the top left room, and the direction she is facing as she enters the room is indicated by the arrow. In each room, she is instructed to either walk straight (S), make a right turn (R), or make a left turn (L). The instructions always indicate movement relative to the direction she is facing as she physically walks through the grid of rooms. She keeps going until she reaches the room with the ♠. Including the room into which she enters, and the room with the ♠, how many total rooms does Annie visit during this walk?



7. _____

The sum of the integer n and eighteen is equal to the product of four and five. What is the value of n?

8. _____ students

More than 100 students signed up to participate in the Geography Bowl competition. If teams of 2 could be made with no students left out, and teams of 3 could also be made with no students left out, what is the fewest number of students who could have signed up for the Geography Bowl?

9. _____ colors

Manuel wishes to paint each face of his rectangular prism such that no two adjacent faces of his prism are the same color. What is the minimum number of unique paint colors he needs to achieve this?

10. _____ feet

The width of a rectangle is 1 foot longer than its length, and the area of the rectangle is 72 ft^2. In feet, what is the rectangle's perimeter?

11. _____ chickens

A nonzero number of goats, each with four legs, and a nonzero number of chickens, each with two legs, are living on a farm. Between all the animals, there are $\frac{3}{8}$ as many heads as there are legs. Assuming that all animals have all of their limbs, what is the fewest possible number of chickens on the farm?

12. _____ points

In Olympic diving, there are seven judges who rate the performance of each dive on a scale from 0 to 10, using half-point increments, where 0 is a failed attempt and 10 is excellent. After each of the seven judges has scored the dive, the two highest scores and the two lowest scores are discarded. The remaining three scores are then added together and the sum is multiplied by the degree of difficulty of the dive. This degree of difficulty is a number between 1.2 and 3.6. A famous Olympian diver completed a dive with degree of difficulty 3.5 and received the following seven performance scores from the judges: 8.0, 7.0, 8.5, 7.5, 7.5, 8.0, 7.0. What was the final number of points that the Olympian received on this dive? Express your answer as a decimal to the nearest tenth.

13. _____ cups

Michael is baking cookies. His cookie recipe calls for $1\frac{3}{4}$ cups sugar and makes 24 cookies. If he wants to scale the recipe to make exactly 18 cookies, how many cups of sugar will he need? Express your answer as a mixed number.

14. _____ meters

Fyodor and his three sons, Ivan, Dmitri and Alyosha, are standing exactly on the corners of a rectangular room. Fyodor is 3 meters from Dmitri and 5 meters from Ivan. What is the minimum possible distance that Fyodor could be from Alyosha?

15. _____ calculators

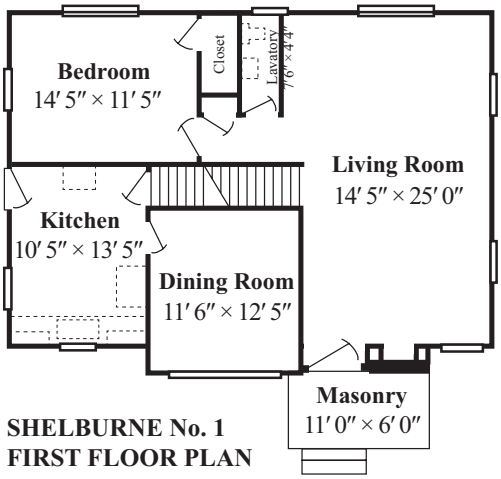
The Ten Finger calculator company periodically checks random calculators before shipping crates out to customers. On Wednesday, 12 calculators from each of 64 crates of 144 calculators were tested. Two of the tested calculators were found to be defective. Based on this rate of defect, how many total calculators are expected to be defective?

16. $\_\_\_\_\_$

At a concert for the band Algal Rhythms, 75% of the tickets were sold at the full price of \$30. The remaining 25% of tickets were sold at a discounted price of \$10. What was the average selling price of a ticket at the Algal Rhythms concert? Express your answer in dollars, rounded to the nearest cent.

17. $\_\_\_\_\_$ ft^2

From 1908 to 1940, a house could be mail-ordered from the Sears catalog. Shown here is a floor plan for the Shelburne No. 1 model which was sold during the 1920s. The dimensions of each room are given in feet and inches, and adjacent walls meet at right angles. In square feet, what is the area of the dining room of the Shelburne No. 1 model? Express your answer to the nearest square foot.



SHELBURNE No. 1
FIRST FLOOR PLAN

18. $\_\_\_\_\_$ ft^2

A gardener uses exactly 500 feet of fencing to completely enclose a rectangular area in her backyard. If the width of her garden is 50 feet less than the length, what will be the area of her garden?

19. $\_\_\_\_\_$: $\_\_\_\_\_$ a.m.

Joe left home traveling to Agora. At 10:32 a.m., Joe's speedometer showed that he was going 75 mi/h, and Joe knew that he had 60 miles left to travel. Assuming Joe maintains an average speed of 75 mi/h, what time will it be when he arrives in Agora? Express your answer in the form HH:MM, where HH represents the two-digit hour and MM represents the two-digit minute.

20. $\_\_\_\_\_$

The 5th power of a positive number is equal to the product of $\frac{2}{3}$ and the 4th power of the number. What is the ratio of this number's 10th power to its 8th power? Express your answer as a common fraction.

21. _____ sandwiches

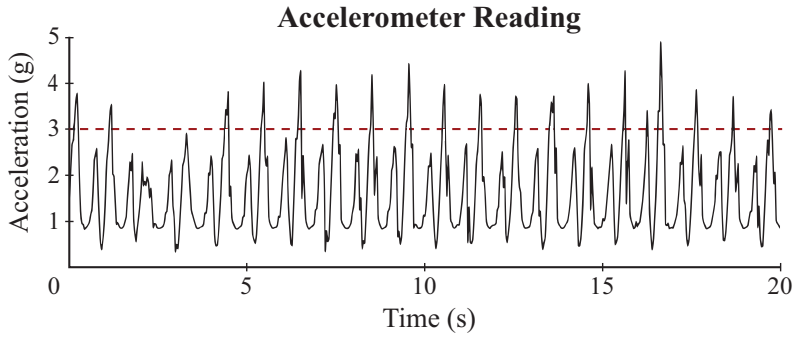
James is making a sandwich with two slices of bread chosen from rye, wheat and white, and filled with either ham or cheese, or both. If his sandwich can have one or two types of bread and the order of the ingredients doesn't matter, how many different sandwiches can James make?

22. _____ students

On Wednesday, $\frac{1}{3}$ of the students in Mr. Short's homeroom had drama practice, and $\frac{1}{4}$ of his other homeroom students had band practice. If 6 students had band practice, how many students are in Mr. Short's homeroom?

23. _____ m/s

Jen's phone uses a simple algorithm to count the number of strides she takes. The algorithm looks at the phone's accelerometer measurements, and counts a stride each time the acceleration goes from below to above 3 g. Based on the number of strides counted in the 20-second window shown here, and assuming that Jen travels 140 cm per stride, what was Jen's average walking speed, in meters per second, over the 20-second window? Express your answer as a decimal to the nearest hundredth.



24. _____

A triangle has integer side lengths 2, 5 and x. What is the median of all possible values of x?

25. _____ movies per month

Pixflix online video charges \$5.95 to view a movie. Movie Prime video service charges \$150 per year membership and \$3.95 per movie. Assuming Minda views the same number of movies each month, what is the fewest number of movies per month Minda must view to make Movie Prime the better deal?

26. _____ The number 345,600 can be expressed as $6^a5^b4^c$ for integers a, b and c. What is the value of the product abc?

27. _____ groups Kurt is creating a bouquet of flowers for his mother. He has a selection of roses, lilies, orchids and violets from which to create a bouquet of a dozen flowers. Kurt's mother loves orchids, so his bouquet will have at least six orchids. How many different groups of a dozen flowers can Kurt use to make a bouquet?

28. _____ If $\frac{3}{x+2} = \frac{y+3}{2}$ and x and y are integers, what is the sum of all possible values of x?

29. _____ The sequence a_n has the property that $a_n = a_{n-1} + 2a_{n-2}$ for $n \geq 2$. It is also true that $a_0 = 4$ and $a_4 = 26$. What is the value of a_5? Express your answer as a common fraction.

30. _____ Jaylin has a wooden cube which is painted blue on the outside. She cuts the cube into 1000 identical cubes, some of which have some sides painted blue, then rolls the resulting cubes like dice. The probability that no blue faces land up after Jaylin rolls the 1000 cubes can be expressed as $2^a \times 3^b \times 5^c$ where a, b and c are integers. What is the value of $a + b + c$?

Division **M** | *Mathematical Olympiads* **December 13, 2017** *for Elementary & Middle Schools* | Contest **2**

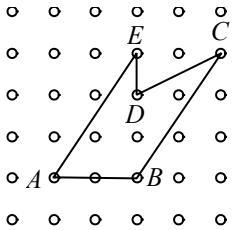
Directions to Students: After all questions have been read by your PICO, you will have 30 minutes to complete this contest. You may not have a pen or pencil in your hand while the PICO reads the set of questions to the class. Calculators are not permitted. All work is to be done on the pages provided. No additional scrap paper is to be used. Answers must be placed in the corresponding boxes in the answer column.

Name: _____

2A Reduce the complex fraction to a common fraction in lowest terms: $\dfrac{2}{3+\dfrac{4}{1-\dfrac{1}{5}}}$. [Hint: Start with $1-\frac{1}{5}$]

2B A palindrome reads the same forwards and backwards. The number 2017102 is a 7-digit palindrome. Let *A* represent the least palindrome greater than 2017102. Let *B* represent the greatest palindrome less than 2017102. Find *A* – *B*.

2C Thirty-six points are arranged in a unit-square array as shown. Figure *ABCDE* is composed entirely of straight-line segments with vertices *A*, *B*, *C*, *D*, and *E*.



Find the number of degrees in the sum of the interior angles of figure *ABCDE*. [*The interior angle at D is a reflex angle whose measure is greater than 180°.*]

Name: _____

Answer Column
2A
2B
2C
2D
2E
Do Not Write in this Space. *For PICO's Use Only.* *SCORE:*

– Page may be folded along dotted line. –

2D Alexi opens his favorite mathematics puzzle book and notes that the product of the page numbers facing him is 1,332. Find the sum of these two page numbers. [Note: All pages are numbered consecutively.]

– Page may be folded along dotted line. –

2E What is the greatest whole number less than 1000 that:
(1) can be expressed as the sum of two consecutive whole numbers, and
(2) can be expressed as the sum of three consecutive whole numbers, and
(3) can be expressed as the sum of five consecutive whole numbers?

Division M — Mathematical Olympiads for Elementary & Middle Schools — December 13, 2017 — Contest 2

SOLUTIONS AND ANSWERS

2A 1/4

2B 2000

2C 540°

2D 73

2E 975

2A **METHOD 1** *Strategy: Combine numbers starting at the bottom.*

Start with $1-\frac{1}{5}=\frac{4}{5}$. Then $\frac{4}{4/5}=4\times\frac{5}{4}=5$. Next, 3 + 5 = 8 and $\frac{2}{8}=\frac{1}{4}$.

METHOD 2 *Strategy: Use multiplication to simplify the complex fraction.*

Multiply $\frac{4}{1-\frac{1}{5}}$ by the number 1 in the form of $\frac{5}{5}$ to get $\frac{20}{5-1}$ = 5.

Then $\frac{2}{3+5}=\frac{2}{8}=\frac{1}{4}$.

FOLLOW UP: Solve for N: $\frac{1}{1-\frac{1}{N}}=3$. [3/2]

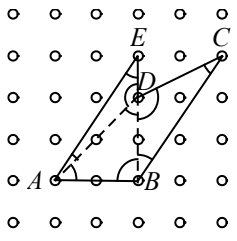
2B *Strategy: Reason using place value.*

Changing the digit in the units column forces the digit in the millions column to change. Likewise, changing the digits in the tens or hundreds columns changes the digits in the hundred-thousands or ten-thousands columns. Each of these changes would bring the result further from the original number than changing the number in the thousands column. Thus the two closest palindromes to 2017102 would be 2018102 and 2016102. These numbers are **2000** apart.

FOLLOW UPS: (1) How many 4-digit palindromes are there between 2017 and 3017? [10] *(2) Consider using letters instead of numbers to form a 3 letter "word" that is a palindrome (e.g. BQB). If a word consists of only the vowels A,E,I,O,U, how many 3-letter palindromes can be formed?* [25]

2C **METHOD 1** *Strategy: Dissect the figure into triangles.*

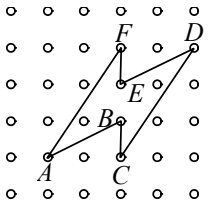
Draw $\overline{AD}$ and $\overline{BD}$ to form three triangles. The sum of the angles in the three triangles equals the sum of the five angles in *ABCDE*. The sum of the angles in any triangle is 180°, so the sum of the interior angles in *ABCDE* is 3(180°) = **540°**.



METHOD 2 *Strategy: Dissect the figure into 2 triangles.*

Draw $\overline{BD}$ creating ΔAEB and ΔDBC. The sum of the angles in the two triangles is 2(180°) = 360°. Then add the measure of straight $\angle EDB$ (180°), which is part of reflex $\angle EDC$, to get the total for the sum of the interior angles for *ABCDE* to equal 360 + 180 = 540°.

FOLLOW UP: Find the number of degrees in the sum of the interior angles of figure ABCDEF. [720°]



2D **METHOD 1** *Strategy: Use the idea that the square root will be close to the answer .*
The two page numbers will be consecutive with one slightly less than the square root and the other slightly larger. Using any convenient method, determine that the square root of 1332 is slightly larger than 36. The two page numbers are 36 and 37. The sum of these numbers is 36 + 37 = **73**.

METHOD 2 *Strategy: Find two consecutive numbers whose product has a units digit of 2.*
Determine by approximation that the pages are in the 30's. Consecutive numbers whose product ends in 2 are 3 × 4 and 6 × 7. The possible products are 33 × 34 = 1122 and 36 × 37 = 1332. The sum 36 + 37 = 73.

FOLLOW UPS: (1) If the sum of the last 4 pages in the puzzle book is 786, find the last page number. [198]
(2) The sum of two non-consecutive page numbers is 45, and their difference is 27. Find their product. [324]

2E *Strategy: Consider the properties of sums.*

The sum of two consecutive numbers must be odd. The sums of three consecutive numbers and of five consecutive numbers must be multiples of 3 and of 5 respectively. (Consider the 3 consecutive numbers n, $n + 1$, and $n + 2$. Their sum is $3n + 3$, which is a multiple of 3. A similar conclusion can be drawn for five numbers.) The number we want is the greatest odd multiple of both 3 and 5 (i.e. an odd multiple of 15) smaller than 1000. Odd multiples of 5 end in a 5. Look at 995 (not a multiple of 3), 985 (not a multiple of 3), and 975 (a multiple of 3). Since **975** is also a multiple of 3 and 5 it is the greatest number less than 1000 that satisfies all three conditions.

Verify: **975** = 487 + 488 and **975** = 324 + 325 + 326 and **975** = 193 + 194 + 195 + 196 + 197.

NOTE: *Other FOLLOW UP problems related to some of the above can be found in our three contest problem books and in "Creative Problem Solving in School Mathematics." Visit www.moems.org for details and to order.*

Venn Perplexors

The Story: Missouri

In Missouri the group of 24 students visited Hannibal, the home of Mark Twain.

The Clues

11 of the students had read Twain's book *The Adventures of Tom Sawyer.*

7 had read his book *The Adventures of Huckleberry Finn.*

10 had read his book *The Prince and the Pauper.*

3 had read both *The Adventures of Huckleberry Finn* and *The Adventures of Tom Sawyer.*

4 had read both *The Adventures of Tom Sawyer* and *The Prince and the Pauper.*

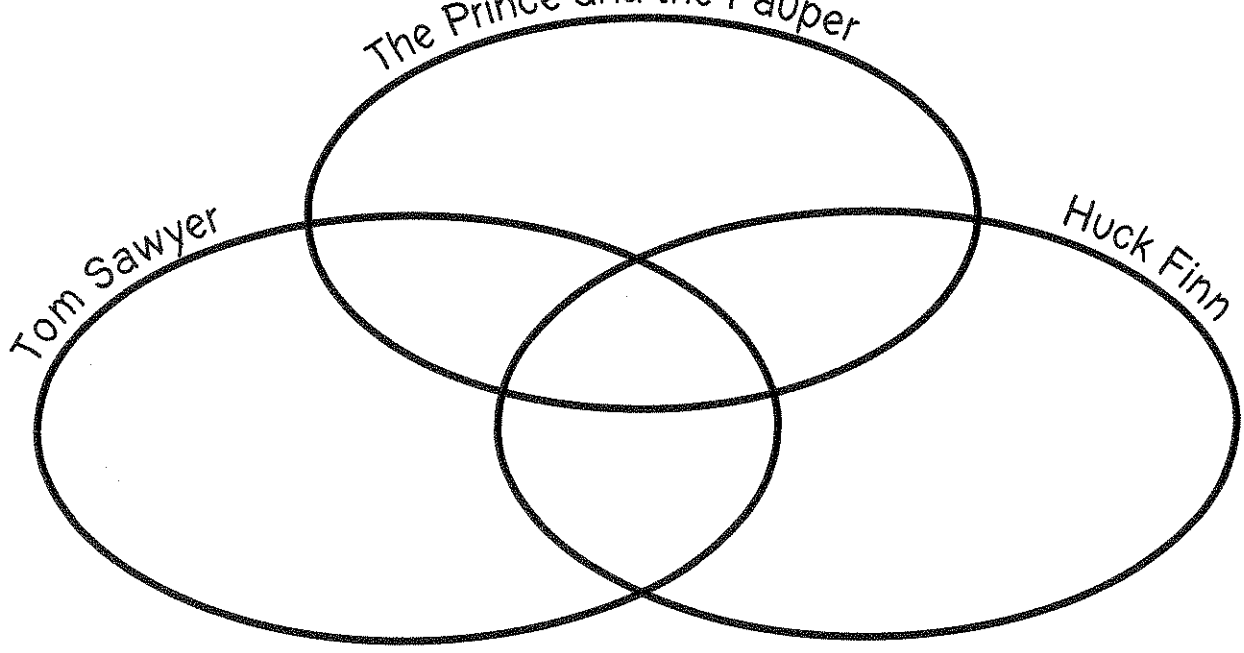
1 had read both *The Prince and the Pauper* and *The Adventures of Huckleberry Finn.*

1 had read all 3 stories.

Puzzle #2

___ students

___ had read none



How many had read none of the 3 books by Twain? ____

4 SNOWY DAY ACTIVITIES

by Diane C. Baldwin

On the first snowy day of winter, Dirk and his brother and sisters (ages 6, 8, 10, and 12) bundle up and rush outside, where each begins a different activity. Their mother, watching out the kitchen window, can easily tell them apart, since each has a different color jacket (one is green). From the clues supplied, can you, too, identify each child by age, activity, and jacket?

1. The oldest child isn't Zoe or the boy who is building the snow fort.
2. The child making the snowman is older than the child in the blue jacket and younger than Rhett.
3. Lana isn't wearing the red jacket; the boy who is shoveling is not the oldest.
4. The child who is sledding is two years older than the one in the yellow jacket, who isn't shoveling snow.

The solution is on page 135.

	shoveling	sledding	snow fort	snowman	blue	green	red	yellow	6	8	10	12
Dirk												
Lana												
Rhett												
Zoe												
6												
8												
10												
12												
blue												
green												
red												
yellow												

14 HOUSE OF GARDENS

Each of the five Garden children has his or her own room, which is painted a different color than the rooms of his or her siblings. Each child has a different poster hanging in his or her room (one features Cricketman), and each also has a different collection on display (one girl collects picture postcards). From the information given below, determine the color of each child's room, and the poster and collection each child keeps.

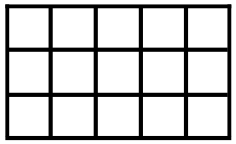
1. Flora does not collect butterflies or teddy bears.
2. The child who lives in the blue room (who is not the oldest) is older than both the child who has the poster of Scarfield the Cat and the one who collects comic books.
3. Herb has two older sisters—one lives in the lavender room and the other has the poster of singer Whitney Dallas.
4. The youngest (who does not collect stamps or teddy bears) has the poster of rock star Alton Jon in her room, which is not painted yellow.
5. Basil does not collect teddy bears or butterflies, and does not live in the green room.
6. Daisy is older than both the comic book collector and Violet, but younger than one of her brothers (who does not have the He-Boy poster in his room).
7. Neither of the boys lives in the pink or yellow room.

The solution is on page 138.

	blue	green	lavender	pink	yellow	Cricket	Cat	Dallas	He-Boy	Jon	butter.	comics	postc.	stamps	teddys
Basil															
Daisy															
Flora															
Herb															
Violet															
butter.															
comics															
postcards															
stamps															
teddys															
Cricket															
Cat															
Dallas															
He-Boy															
Jon															

PENTOMINO CHALLENGE 1

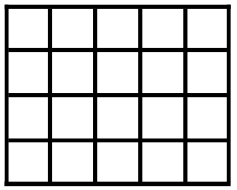
Use three pentominoes to form a 3 x 5 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 2

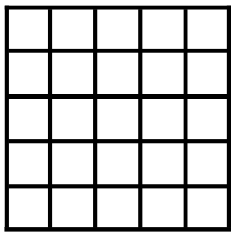
Use four pentominoes to form a 4 x 5 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 3

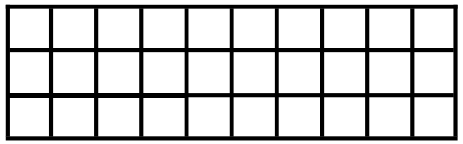
Use five pentominoes to form a 5 x 5 square.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 4

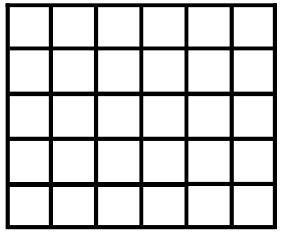
Use six pentominoes to form a 3 x 10 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 5

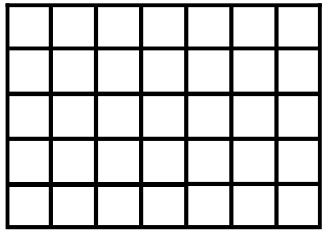
Use six pentominoes to form a 5 x 6 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 6

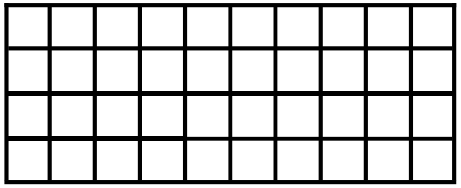
Use seven pentominoes to form a 5 x 7 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 7

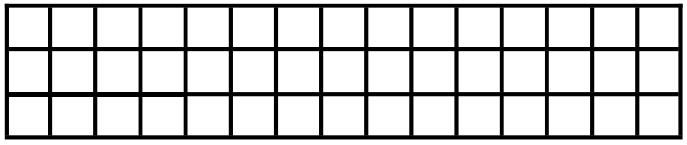
Use eight pentominoes to form a 4 x 10 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 8

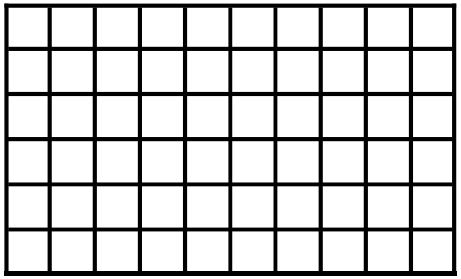
Use nine pentominoes to form a 3 x 15 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 9

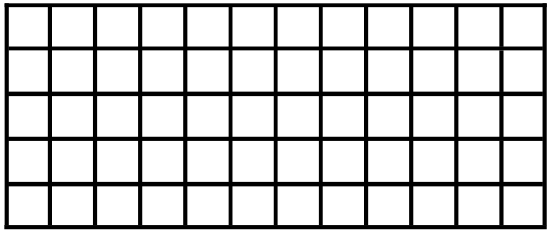
Use all twelve pentominoes to form a 6 x 10 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 10

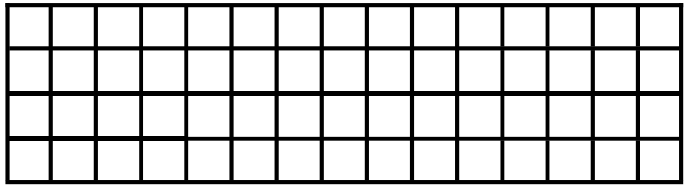
Use all twelve pentominoes to form a 5 x 12 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 11

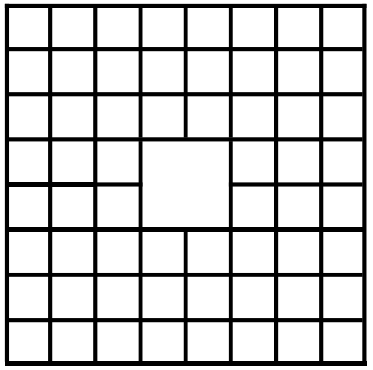
Use all twelve pentominoes to form a 4 x 15 rectangle.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 12

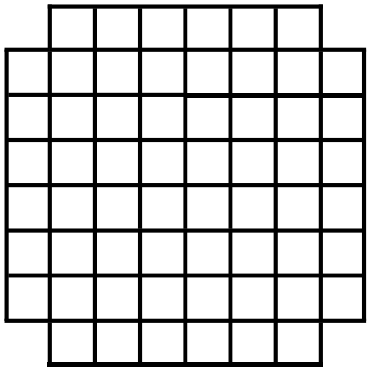
Use all twelve pentominoes to form an 8 x 8 square with a 2 x 2 hole in the center.



Source: *The Complete Puzzler* by Gyles Brandeth

PENTOMINO CHALLENGE 13

Use all twelve pentominoes to form an 8 x 8 square with the four corners missing.



Source: *The Complete Puzzler* by Gyles Brandeth