



Math Wits (8)

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60 minutes, 60 questions

Rules

This test contains 60 questions for you to complete. You have 60 minutes to complete as many problems as you can, but you are not necessarily expected to complete them all. Points are awarded for each correct answer, and no points are docked for incorrect answers. The top 5 individuals will be invited to the Final Round.

*Answers are free response and must be as simplified as possible. Units are **NOT** necessary. All answers are integers, unless the problem specifies otherwise (ex. common fraction, decimal, simplest radical form).*

*Please write all answers onto the **answer sheet**. You may write directly on this test – however **only answers written onto the answer sheet will be graded**. Please write as neatly as possible on the given blanks on the answer sheet. If graders are unable to read the answers, you will not receive credit.*

Name _____

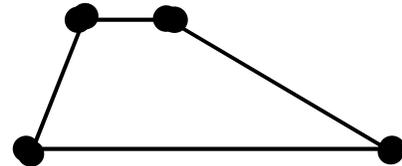
School _____ Grade _____



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- Write 2017 in Roman numerals.
- The Dormouse buys 5 cups of tea for \$1.19 each. As a valued customer, he gets 20% off his purchase. If there is no tax, how much must the Dormouse pay?
- Compute $1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2 + 7^2$.
- On his first four mathematics tests, Bryan scored 91.1%, 92.2%, 93.3% and 94.4%. What is his average test score? Express your answer as a percentage to the nearest tenth.
- A right triangle has legs that measure 8 and 15. What is the value of the hypotenuse?
- Today on Saturday May 27th, 2017, San Diego Middle School Math Field Day turns 48 years old. Write 48 in base 6.
- Solve for x : $5x + 17 = 52$.

- In trapezoid $ABCD$, AB is parallel to CD , $AB = \frac{1}{4}CD$, and point P lies on AB . What is the ratio of the area of triangle DPC to the area of trapezoid $ABCD$? Express your answer as a common fraction.



- The Cheshire Cat has an unlimited number of socks that come in only four colors: purple, pink, black, and white. Early this morning, he picks socks from his drawer without looking. How many socks must the Cheshire Cat pick to guarantee **four** socks of the same color?
- How many factors are there in 2017^{2017} ?
- What is the measure, in degrees, of the smaller angle formed by the hands of a clock at 9:27?
- In Wonderland, someone celebrates an *unbirthday* if they are not born on that day. What is the probability that today (which is not on a leap year) is the *unbirthday* of both the March Hare and the Mad Hatter? Express your answer as a fraction in simplest form. Assume that they have different birthdays and that neither was born on a leap year.



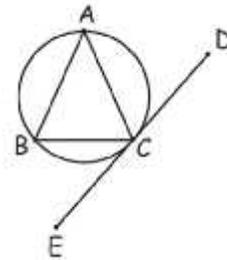
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13. If the side lengths of a triangle are 6 , $2x - 1$, and $x + 4$, then what is the greatest integer value that x can be?
14. Sarah's street has four-digit house numbers. She notices that the sum of the four digits of her house total 34. What is the maximum number of houses that can have this quality?
15. What is the distance between $(-3, 7)$ and $(12, -5)$? Express your answer in simplest radical form.
16. With an 80 kilometer per hour headwind, a plane can fly a certain distance in four hours. Flying in the opposite direction, with the same wind blowing, it can fly that same distance in one hour less. What is the plane's air speed, in kph?
17. Compute $243^{4/5}$.
18. A rhombus has diagonals of lengths 12 and 16 units. What is the perimeter of the rhombus?
19. In mathematics, a palindrome is a number that reads the same backward as forward. How many three-digit palindromes are there?
20. The Mad Hatter is making hats. For the first three hours he makes 20 hats, until he gets tired. Then he makes only 16 hats in the next six hours. What is his average work rate, in hats per hour?
21. The area of a regular hexagon is $24\sqrt{3}$. What is the length of the longest diagonal of the hexagon?
22. What is the tens digit of 2^{1234} ?
23. Solve $\sqrt[3]{\sqrt[4]{3}} * \sqrt[4]{9}$. Write your answer in simplest radical or exponential form.
24. A cone's height is halved and the radius is quadrupled. By what factor did the volume of the cone increase?
25. In Wonderland, a birth occurs on the average every twenty-four minutes, and a death every half hour. A resident moves out of the city every one-and-a-half hours and a new person moves into the city every four-and-a-half hours. How many hours does it take, on the average, for the population to increase by one person?



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26. What is the surface area of a cylinder with radius 4 and height 7? Express your answers in terms of π .
27. In the middle of Wonderland, moonflowers have 7 petals and sunflowers have 13 petals. If Alice sees a garden with 181 petals and 19 flowers in total, how many moonflowers are in the garden?
28. If $a + b = 221$, and $ab = 17$, find the value of $\frac{1}{a} + \frac{1}{b}$.
29. The distance that a body near the earth's surface will fall from rest varies directly as the square of the number of seconds it has been falling. If a boulder falls from a cliff a distance of 176.4 meters in six seconds, approximately how many meters will it fall in four seconds? Round to the nearest tenth.
30. What is the mean of the first 30 terms in the following sequence of numbers:
-1, 2, -3, 4, -5, 6, -7 . . .?
31. The Queen of Hearts draws three cards from a standard deck of 52 cards without replacing. What are the odds that her three cards are hearts?
32. In the diagram at the right, triangle ABC is inscribed in the circle, and $AC = AB$. The measure of angle BAC is 31 degrees and segment ED is tangent to the circle at point C. What is the measure of angle ACD, in degrees?
33. What is the sum of the first three positive integers that are both perfect squares and perfect cubes?
34. The White Rabbit is running late. If he hops at 40 mph, he will be 3 minutes late to his destination. However, if he sprints at 60 mph, he will be 3 minutes early. How fast does the White Rabbit need to travel to get to his destination exactly on time?
35. For what value of k will the three lines $y = \frac{1}{3}x$, $x - 2y = 12$, and $y = kx + 84$ intersect at a single point?
36. The Knave of Hearts wants to make some tarts. If his recipe uses jam and flour in the ratio 6:11, how much jam would he need if he wanted to use 132 grams of flour?





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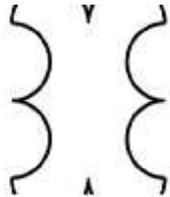
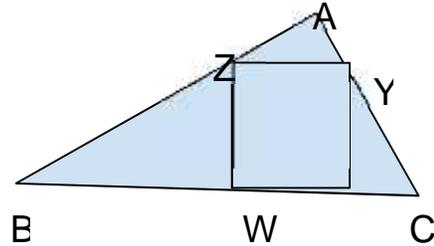
37. A survey of 1000 people found that 70% have a CD player, 85% have a telephone, and 45.2% have a computer. At least how many people have all three devices?
38. Four consecutive numbers are added together. When the sum is squared, the result is 26,244. What is the largest of the four numbers?
39. The Mad Hatter mixes two gallons of tea containing 1% milk and three gallons of tea containing 2% milk. What is the percent of milk in the mixture, expressed to the nearest tenth?
40. When 10 cubic feet of water is poured into an empty fish tank that is a rectangular prism, the tank becomes $\frac{3}{4}$ full. If the tank is 2 feet 8 inches wide and 40 inches long, how tall is the tank in feet and inches?
41. A two digit number leaves a remainder of 3 when divided by 9 and a remainder of 5 when divided by 11. What is the two digit number?
42. There are six players in the Wonderland Chess League. Each player plays each of the other members of the league one time during Chess Season. How many total matches will be played by the Chess League each season?
43. How many positive integers less than 2017 are NOT divisible by 7 or 6?
44. Solve for x : $3^x + 20 - 7 = 0$. Write ALL solutions.
45. If Alice can paint a room in 5 hours, Bill the Lizard can paint a room in 4 hours, and the Caterpillar can paint a room in 20 hours, how long will it take all three of them working together to paint the room?
46. Compute the largest value of a such that 10 divides 71^a !
47. Two circles are drawn in a 12-inch by 14-inch rectangle. Each circle has a diameter of 6 inches. If the circles do not extend beyond the rectangular region, what is the greatest possible distance, in inches, between the centers of the two circles?

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48. The Dodo Bird took a two-digit number and squared it. Then he took his original number, reversed the digits, and squared it. He was amazed to find that the two results had reversed digits as well. How many numbers fit this description that do not have the same number for their units and tens digits?

49. The three sides of a triangle are 13, 20, and 21.
What is the area of the triangle in square units?

50. Square WXYZ is inside right triangle ABC such that W and X are on hypotenuse BC, Y is on AC, and Z is on AB, as shown in the figure. If $AB = 8$ and $BC = 17$, what is AZ ? Express your answer as a common fraction.



51. The boundary of the figure to the left is comprised of eight semicircular arcs, each with a diameter of 6 cm. What is the area of the enclosed region, in square centimeters?

52. Tweedledee and Tweedledum play a game. The winner is the first person who rolls a prime number using a six-sided die numbered from 1 to 6. What is the chance that Tweedledee wins if he rolls first?

53. How many integers satisfy $(n + 3)(n - 7) \leq 0$?

54. What is the distance between the point $(6, 1)$ and the line represented by the equation $y = 2x - 3$? Express your answer in simplest radical form.

55. In Wonderland's Congress, $10/11$ of the politicians use $11/12$ of the seats in a room. What is the least possible number of politicians in Wonderland's Congress?

56. The formula $T = 2\sqrt{\frac{L}{32}}$ is used to find the time, T , in seconds for a pendulum of length L feet to complete one period (back and forth). How many feet long must the pendulum be to have a period of 3.5 seconds? Round your answer to the nearest whole number.

57. A rectangle has a diagonal of length 61 and area of 660. What is its perimeter?



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58. How many digits are in the following set of numbers?

$\{18, 19, 20, \dots, 498, 499, 500\}$

59. The Duchess is playing croquet. The probability that she wins each round is $\frac{1}{4}$. What is the probability that she wins exactly three of the five rounds? Express your answer as a common fraction.

60. What is the largest value for x such that $|x - |x - |x - |2x - 8 ||| = 0$?



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Answers

- | | |
|--------------------------------|---------------------------|
| 1. MMXVII | 31. 11/850 |
| 2. \$4.76 | 32. 74.5° |
| 3. 140 | 33. 794 |
| 4. 92.8 | 34. 48 |
| 5. 17 | 35. -2 |
| 6. 120 | 36. 72 |
| 7. 7 | 37. 0 |
| 8. 4/5 | 38. 42 |
| 9. 13 | 39. 1.6% |
| 10. 2018 | 40. 1 foot 6 inches |
| 11. 121.5° | 41. 93 |
| 12. 363/365 | 42. 15 |
| 13. 10 | 43. 1440 |
| 14. 10 | 44. -7 and $1/3$ |
| 15. $3\sqrt{41}$ | 45. 2 |
| 16. 560 | 46. 16 |
| 17. 81 | 47. 10 |
| 18. 40 | 48. 4 |
| 19. 90 | 49. 126 |
| 20. 4 | 50. 960/409 |
| 21. 8 | 51. 144 |
| 22. 8 | 52. $2/3$ |
| 23. $3^{1/4}$ or $\sqrt[4]{3}$ | 53. 11 |
| 24. 8 | 54. $\frac{8\sqrt{5}}{5}$ |
| 25. 18 | 55. 121 |
| 26. 88 | 56. 10 |
| 27. 11 | 57. 142 |
| 28. 13 | 58. 1367 |
| 29. 78.4 | 59. 45/512 |
| 30. 0.5 | 60. 4 |

Commented [1]: haven't double checked these... let me know if you disagree with any of them

Commented [2]: Also, in the instructions, it says all problems have integer solutions unless specified. However, some of these problems have non-integer solutions that the problem does not specify...

Commented [3]: Sorry I didn't have time to double check that stuff

Commented [4]: do we only include the integer solution?

Commented [5]: include both