1. How many lines of symmetry does a regular octagon have?

2. Evaluate $164 \div 4$.

3. Simplify the sum $\dfrac{3}{7} + \dfrac{7}{3}$.

4. There are 6 chairs, each of which has 4 legs. There are 4 tables, each of which has 3 legs. How many legs are there if we put all the chairs and tables together?

5. Tom is chasing Jerry. If Jerry is 100 meters ahead but Tom runs 25 m/s faster than Jerry, how many <u>minutes</u> will it take Tom to catch Jerry?

6. The number 1126 can be factored as the product of two primes. Find their sum.

7. In the final exam, Licheng scored 60 points in math, 95 points in English, and 94 points in history. What is the average of his three scores?

8. Compute 111111^2.

9. Chester, Ryan, Dominic, and Kevin take the Joe Holbrook Memorial Math Competition, and each of them finishes in the top 4. Given that both Kevin and Chester place higher than Dominic, and Ryan does not finish in the bottom 2, who comes in 4th?

10. If $x + y = 37$, and $3x - y = 19$, find x.

11. There are 240 people total at Sky High. The school offers two language classes, Arabic and Swahili. If there are 170 people taking Arabic, and 120 people taking Swahili and every student must take at least one language, then how many people are taking both classes?

12. 17 consecutive integers sum to 0. What is the smallest of these integers?

13. If 2 apples weigh as much as 3 bananas, and 7 bananas weigh as much as 5 pears, how many apples weigh as much as 90 bananas and 90 pears?

14. A rectangle has integer side lengths and perimeter 30. What is the maximum possible area?

15. Bill the Builder lays 100 bricks an hour, while his dog knocks down 10 bricks every <u>half hour</u>. How long will it take for him to build a 960 brick dog house?

16. Two whole numbers that sum to 21 have a greatest common divisor of 3 and a least common multiple of 36. What is their product?

17. ABCD is a quadrilateral with right angles at B and D, $AB = 7$, $BC = 24$, $CD = 20$, and $DA = 15$. What is the area of this quadrilateral?

18. How many factors does 2013 have?

For problems 19 through 22, fill in the following crossword puzzle, putting a single digit in each box.
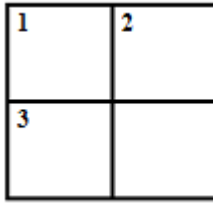
19. (1 across) A perfect cube

20. (1 down) A perfect square

21. (2 down) A multiple of 8

22. (3 across) A multiple of 13

23. $a\#b = a \cdot b - a$. For example, $5\#7 = 5 \cdot 7 - 5 = 35 - 5 = 30$. What is $(((25\#16)\#9)\#4)\#1$?

24. Sally only likes to sort the stamps in her collection in groups of 2 or 5. How many numbers of stamps exist that could not be sorted in this manner?

25. If the sum of all the positive integers from 3 to n inclusive is 1323, what is the value of n?

26. Steven is very friendly. On his first day of school, he meets one new person. On the second day of school, he meets two new people. On the third day, he meets three new people. If this pattern continues, on which day of school will the total number of people Steven has met be a multiple of 32?

27. The values of a, b, c, and d are chosen without replacement from the numbers $-3, -2, -1, 0, 1, 2, 3$. What is the largest possible value of $(a^b) - cd$?

28. Ash Ketchum takes care of two types of Pokmon: Doduos, which have 2 heads and 2 legs, and Dodrios, which have 3 heads and 2 legs. One day, Ash counts 291 heads and 222 feet on all of his Pokmon. How many Doduos does he have?

29. How many positive integers less than 48 are relatively prime to 48? Note that two integers are relatively prime if their greatest common divisor is 1.

30. A fraction in simplest form has its numerator increased by 27 and its denominator increased by 36. Amazingly, the new fraction is still numerically equal to the old one! What is this fraction, in simplest form?

31. Izzy is thinking of a 3-digit number with all non-zero digits. When she squares each of its digits and adds them up, she gets exactly twice the sum of the digits. What is the number?

32. A random number n is chosen from the set of $\{1, 2, 3..., 9\}$. What is the probability that the

2
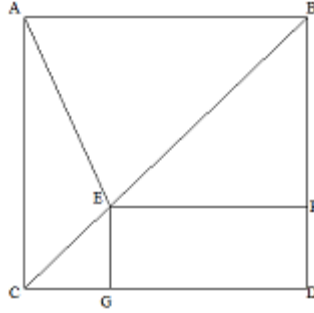
one's digit of n^n is equal to n?

33. In the diagram above, $ABCD$ is a square with side length 12, $EF = 2 \cdot EG$. What is the area of $\triangle AEC$?

34. What is the smallest number with exactly 12 positive integer divisors?

35. What is the maximum number of intersection points that can occur between 10 circles and 2 lines?

36. If the infinite geometric sum $\dfrac{1}{a} + \dfrac{1}{a^2} + \dfrac{1}{a^3} + \cdots$ equals $\dfrac{4}{5}$, then what is the value of $\dfrac{1}{a^2} + \dfrac{1}{a^4} + \dfrac{1}{a^6} + \cdots$?

37. Triangle ABC has side lengths $AB = 5$, $BC = 6$, and $AC = 7$. The bisector of angle A intersects $\overline{BC}$ at point D. Determine the length of BD.

38. How many of the first 50 positive integers have the property that when its reciprocal is written out in decimal form, it does not terminate?

39. What is the greatest integer that must always divide a product of five consecutive positive even integers?

40. If $a + b = 5$ and $ab = 7$, what is the value of $a^4 + b^4$?

41. What is the smallest positive integer that leaves a remainder of 1 when divided by 3, 1 when divided by 5, and 0 when divided by 7?

42. Call a number "pretty good" if the number of factors it has is prime. How many "pretty good" numbers are between 1 and 100, inclusive?

43. What is the remainder when 3^{2013} is divided by 16?

44. James flips a fair coin 7 times. What is the probability that James gets more heads than tails?

45. $ABCD$ is a parallelogram with $AB = 6$. Let DE be perpendicular to BC. Extend AB and DE to intersect at F. If $BF = 24$, what is the ratio of the areas of triangles BFE and CDE?

46. Compute the area of the region in which all points (x, y) satisfy the following inequalities: $y \geq |x + 4| + |x - 2|$ and $y \leq 8$.

47. A certain solid has 8 triangular faces and 6 octagonal faces. How many edges does it have?

48. The product of two consecutive, positive even numbers is 28 more than a perfect square. What is the smaller of the two numbers?

3

49. Paul makes a regular tetrahedron out of clay with side length $\sqrt{2}$. He then turns the tetrahedron into a cube without removing or adding clay. What is the side length of the cube?

50. Quadrilateral ABCD has $\angle A = \angle B = 60°$, $\angle C = 150°$, $AB = 8$, and $CD = 3$. The perpendicular bisector of AB meets AB at X and CD at Y. Find XY.