For all questions, answer choice "E) NOTA" means none of the above answers is correct.

1. A regular octagon is inscribed in a circle. How many of the octagon's diagonals do not pass through the center of the circle?

A) 12 B) 16 C) 20 D) 24 E) NOTA

2. Anshu has 8 clean shirts, 6 clean pairs of pants, and 10 clean pairs of socks. Assuming that Anshu does not want to mix up socks from the 10 clean pairs, in how many ways can Anshu select one clean shirt, a clean pair of pants, and one clean pair of socks to get dressed to go take his topic test?

A) 120 B) 240 C) 360 D) 480 E) NOTA

3. Anshu has 8 clean shirts, 6 clean pairs of pants, and 10 clean pairs of socks. It's cold outside, so Anshu wants to wear two of the clean shirts, one pairs of pants, and one clean pair of socks. Assuming Anshu does not mix socks from different pairs, in how many ways can he select his outfit from those articles of clothes? Note that an outfit is the same regardless of the way in which it gets worn.

A) 840 B) 1680 C) 1920 D) 3360 E) NOTA

4. Among a flock of birds, 60 have blue feathers, 60 have red feathers, 75 have black feathers, 15 have both blue and red feathers, 20 have both blue and black feathers, 25 have both red and black feathers, and 5 have feathers of all three colors. If all these birds have feathers of at least one of these three colors, how many birds are in the flock?

A) 120 B) 130 C) 140 D) 150 E) NOTA

5. The letters in the word TURING are written on tiles, one letter per tile. The six tiles are then placed in a bag. Two letters are drawn back-to-back at random and without replacement. Find the probability that the letter on the first tile is a consonant and the letter on the second tile is a vowel.

A) $\frac{2}{9}$ B) $\frac{4}{15}$ C) $\frac{4}{9}$ D) $\frac{8}{15}$ E) NOTA

6. How many perfect cubes are between 2011 and 63000?

A) 27 B) 28 C) 66 D) 67 E) NOTA

7. Let n be an integer such that 80^n evenly divides the amount 2011!. Find the largest value of n.

A) 499 B) 500 C) 501 D) 502 E) NOTA

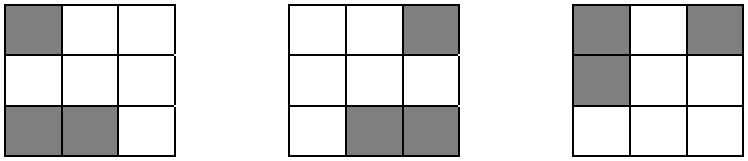
8. A regular icosahedron has 20 faces. Each face is an equilateral triangle, and five such triangles come together at each vertex of the icosahedron. How many vertices does a regular icosahedron have?

A) 8 B) 10 C) 12 D) 20 E) NOTA

9. Let A_1, A_2, ..., A_{20} be the three-element subsets of $\{1,2,3,4,5,6\}$, and let $\min(A_k)$ be the smallest of the three elements of A_k. Find the value of $\sum_{k=1}^{20} \min(A_k)$

A) 35 B) 40 C) 42 D) 70 E) NOTA

10. Find the number of distinct patterns that can be formed from shading three of the nine squares in a 3×3 grid like the ones below. Two patterns are not considered distinct if one can be obtained from the other through a series of flips about an axis of symmetry of the squares and/or rotations about the center of the grid. For instance, the three patterns below are considered the same pattern.



A) 10 B) 12 C) 14 D) 16 E) NOTA

11. Call a positive integer "stair-like" if its digits form an arithmetic sequence in the order in which they appear. For instance, 123, 9753, and 44444 are stair-like, but 312 and 9375 are not. Find the number of positive, four-digit integers that are stair-like.

A) 12 B) 20 C) 24 D) 30 E) NOTA

12. Michael has a fair die shaped like an octahedron with faces numbered 1 through 8. If he rolls this die three times, find the probability that the sum of the three rolls is 22.

A) $3/512$ B) $1/128$ C) $3/256$ D) $1/64$ E) NOTA

13. How many of the positive integral divisors of 500 are also divisors of 1200?

A) 6 B) 8 C) 9 D) 10 E) NOTA

14. How many prime numbers between 1 and 20 are divisors of $\binom{25}{12}$?

A) 3 B) 4 C) 5 D) 6 E) NOTA

15. Two regular, fair, 20-sided dice are rolled. Each has faces numbered from 1 to 20 inclusive (all of these numbers are used on both dice). Once rolled, 38 of the 40 faces of the dice can be observed. Find the probability that the sum of the numbers showing on these 38 faces is a multiple of 3.

A) $63/190$ B) $127/380$ C) $133/400$ D) $67/200$ E) NOTA

16. A flood is coming, and Noah builds a large raft. He tells his seven friends that if they need to escape on the raft, they are invited. How many subsets of Noah and his friends can escape on the raft if Noah's friends Richard Dawkins and Jerry Falwell refuse to get on the raft together regardless of the conditions, and Noah necessarily escapes on the raft?

A) 64 B) 96 C) 112 D) 224 E) NOTA

17. Professor Bulbousnose drove a car load of law review journals to the university library. He needs at least four student helpers to carry the boxes into the library in just one trip. He finds seven of his students studying in the library. In how many ways can the professor select at least four of the students to help carry the boxes of law journals?

A) 64 B) 72 C) 84 D) 120 E) NOTA

18. Evaluate: $\binom{15}{0}+3\binom{15}{1}+5\binom{15}{2}+\ldots+(2n+1)\binom{15}{n}+\ldots+31\binom{15}{15}$

A) 2^{15} B) 2^{16} C) 2^{19} D) 2^{31} E) NOTA

19. How many six-digit numbers with six distinct digits are multiples of 9?

A) 13400 B) 15360 C) 15600 D) 16800 E) NOTA

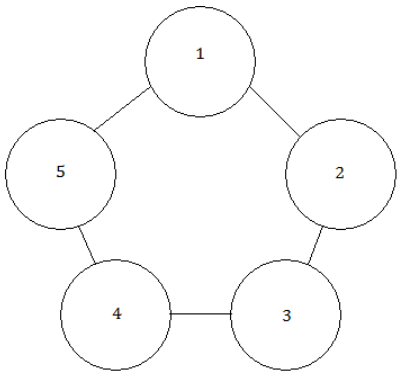
20. Hedley picks up a piece of paper off the ground. There are 15 line segments of equal length on it, no two of which occupy the same space. Find the greatest possible number of rectangles that could be formed from those line segments.

A) 105 B) 315 C) 588 D) 32768 E) NOTA

21. When $\left(x^2+x+y^2+y\right)^{10}$ is expanded and like terms are combined, what is the number of distinct terms in the resulting expression?

A) 155 B) 165 C) 200 D) 220 E) NOTA

22. In the diagram below, each circle will be painted one of five different colors. If no two connected circles can be painted the same color, how many distinct colorings are possible? The circles are numbered, so it is possible that a rotation of one coloring does produce a distinct coloring.



A) 120 B) 600 C) 660 D) 1020 E) NOTA

23. A positive integer n has exactly 4 positive integral divisors that are perfect fifth powers, exactly 6 positive integral divisors that are perfect cubes, and exactly 12 positive integral divisors that are perfect squares. Find the least possible number of positive integral divisors of n.

A) 35 B) 42 C) 48 D) 60 E) NOTA

24. Asfaneh has a pair of fair, six-sided dice. The faces of each die are numbered 1 through 6. Asfaneh rolls the dice, and the sum of the two sides rolled is 8. Find the probability that Asfaneh rolled doubles (the same number on both dice).

A) $\frac{1}{4}$ B) $\frac{1}{5}$ C) $\frac{1}{6}$ D) $\frac{2}{9}$ E) NOTA

25. A plane contains the points $(7,17,77)$, $(0,0,101)$, and $(33,34,34)$. Find the number of points (a,b,c) on this plane such that a, b, and c are positive integers.

A) $\binom{100}{2}$ B) $\binom{100}{3}$ C) $\binom{101}{2}$ D) $\binom{101}{3}$ E) NOTA

26. Find the number of ordered triples of positive integers that satisfy the equation $a+b+2c=35$.

A) 256 B) 272 C) 5984 D) 8436 E) NOTA

27. Edward places 7 beads on a bracelet chain, then tied the ends together. The beads are identical except for color. If 3 of the beads are red, 2 are green, and 2 are blue, how many distinct bracelets are possible? Two bracelets are identical if one can be rotated and/or flipped to produce the other. Also, beads may pass over the knot created by tying the two ends together.

A) 8 B) 12 C) 18 D) 30 E) NOTA

28. At the Ultimate Thumbwrestling Championship (UTC), bouts occur between two contestants at a time while all of the other 10 contestants watch. If each contestant watches 35 bouts (not including bouts in which the contestant takes place), and no two contestants compete against one another twice, how many bouts take place at the UTC?

A) 42 B) 46 C) 66 D) 132 E) NOTA

29. A regular heptagon is inscribed in a circle. Three of the vertices of the regular heptagon are selected at random, with each vertex being equally likely to be chosen. Find the probability that the center of the circle lies in the interior of the triangle formed by those three vertices.

A) $1/5$ B) $2/5$ C) $3/5$ D) $4/5$ E) NOTA

30. Nick has a pair of fair, 8-sided dice with faces numbered 1-8 on each die. Bill has a pair of fair, 8-sided dice with faces numbered with positive integers in such a way that when his pair of dice is rolled, the probability of any particular sum occurring is the same as when Nick rolls his dice. The largest number on a face of one of Bill's dice is 11. Of Bill's two dice, find the sum of the numbers on the faces of the die whose sum is smaller.

A) 24 B) 27 C) 28 D) 32 E) NOTA