1. The number of pairs (*m*, *n*) such that 2*m*−2*n* = 63 in which *m* and *n* are nonnegative integers is

(A) 0

(B) 1

(C) 2

(D) 3

(E) More than 3

2. How many real solutions does the equation have?

(A) 0

(B) 1

(C) 2

(D) 3

(E) 4

3. What is the remainder when *x*51+51 is divided by *x*+1?

(A) 0

(B) 1

(C) 49

(D) 50

(E) 51

4. At a party, each person shakes hands with 5 other people. There are a total of 60 handshakes. How many people are at the party?

(A) 6

(B) 12

(C) 15

(D) 24

(E) 30

5. What is the units digit of 625−324?

(A) 3

(B) 5

(C) 7

(D) 8

(E) None of the previous choices

6. A square is inscribed inside a circle. If *x* is the circumference of the circle and *y* is the perimeter of the inscribed square, then the ratio belongs to the interval

(A)

(B)

(C)

(D)

(E)

7. How many positive integers *x* satisfy the inequality ?

(A) 503

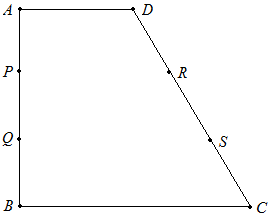
(B) 999

(C) 1005

(D) 1006

(E) 1995

8. Let *ABCD* be a trapezoid with the sides and parallel to each other and perpendicular to . Moreover, we are told that *BC* = 2*AD*. The points *P* and *Q* on the side divide it into three equal segments, and *P* is between *A* and *Q*. Similarly the points *R* and *S* on the side divide it into three equal segments, and *R* is between *D* and *S*. Let be the area of the triangle *AQR*, and let be the area of the triangle *PBS*. Find .



(A)

(B)

(C)

(D)

(E)

9. If and , ﬁnd in terms of *x* and *y*.

(A)

(B)

(C)

(D)

(E)

10. The irrational number can be expressed in the form *a*+*b*, where *a* and *b* are integers and *n* is a positive integer. One possible set of values for the triple (*a*, *b*, *n*) is:

(A) (2, −4, 5)

(B) (−2, 5, 3)

(C) (−3, 7, 2)

(D) (−3, 2, 5)

(E) (3, 4, 5)

11. Each of 10 students has a ticket to one of ten chairs in a row at a theater. How many ways are there to seat the students so that each student sits either in the chair speciﬁed on his/her ticket or in one right next to it? Each chair is to be occupied by exactly one student.

(A) 89

(B) 144

(C) 243

(D) 512

(E) 1024

12. Evaluate the sum .

(A) 0

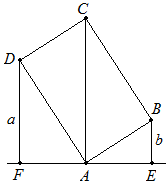
(B) 1

(C) 2

(D)

(E)

13. In the ﬁgure below, *ABCD* is a rectangle. The points *A*, *F*, and *E* lie on a straight line. The segments , , and are all perpendicular to . Denote the length of by *a* and the length of by *b*. Find the length of in terms of *a* and *b*.



(A) *a*+*b*

(B) 2

(C)

(D)

(E) None of the previous choices

14. Let . What is the value of *x*?

(A) 1

(B) 2010

(C) 2011

(D) 2012

(E) None of the previous choices

15. Allan and Bill are walking in the same direction beside a railroad track, and Allan is far behind Bill. Both walk at constant speeds, and Allan walks faster than Bill. A long train traveling at a constant speed in the same direction will take 10 seconds to pass Allan (from the front to the end) and will take 9 seconds to pass Bill. If it will take twenty minutes for the front of the train to travel from Allan to Bill, how many minutes will it take for Allan to catch up to Bill?

(A) 200

(B) 220

(C) 240

(D) 260

(E) 280

16. What is the remainder when 1020 is divided by 1001?

(A) 1

(B) 100

(C) 1000

(D) 999

(E) 10

17. If , which of the following is the largest?

(A) *f*()

(B) *f*(0)

(C) *f*()

(D) *f*()

(E) *f*()

18. When a positive integer *N* having two digits is multiplied by 1111, the answer can have ﬁve digits or six digits. Find the sum of the digits of *N* if *N* is the smallest two digit number with the property that *N*·1111 is a six digit number.

(A) 5

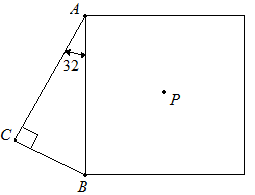
(B) 9

(C) 10

(D) 12

(E) 15

19. Let *ABC* be a right triangle with hypotenuse and with the measure of ∠*BAC* equal to 32. A square with side is placed so that the interior of the square does not overlap with the interior of *ABC*. Let *P* be the center of the square. What is the measure of ∠*PCB*?



(A) 30

(B) 32

(C) 45

(D) 58

(E) 60

20. How many positive integers less than one billion (i.e. 109) are divisible by 9 and have all digits equal?

(A) 10

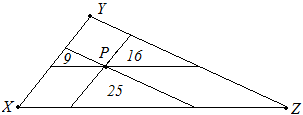
(B) 14

(C) 18

(D) 21

(E) 25

21. Three segments through point *P* parallel to the sides of the triangle *XYZ* divide the triangle into six disjoint subregions. The areas of three of them are shown in the picture. Find the area of ∆*XY Z*.



(A) 50

(B) 97

(C) 100

(D) 121

(E) 144

22. Suppose 6 points are placed at random on a circle of circumference 2. What is the probability that all six can be covered by some arc of length 1?

(A)

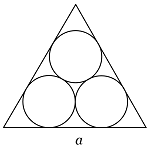
(B)

(C)

(D)

(E)

23. In the ﬁgure below, three congruent circles are tangent to each other and to the sides of an equilateral triangle of side length *a* as shown. What is the radius of the circles?



(A)

(B)

(C)

(D)

(E)

24. Simplify the expression (where *a*, *b*, and *c* are different real numbers)

.

(A) 0

(B) *x*2−(*a*+*b*)*x*+*ab*+1

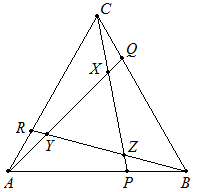
(C)

(D)

(E) 1

25. *ABC* is an equilateral triangle of unit area. Points *P*, *Q*, and *R* are chosen on the sides ,

, and so that . Find the area of the triangle *XYZ*.



(A)

(B)

(C)

(D)

(E)

26. What is the last digit of the sum 1!+2!+3!+...+2010!+2011!?

(A) 0

(B) 4

(C) 8

(D) 3

(E) 7

27. How many perfect squares divide the number 4!·5!·6!?

(A) 22

(B) 10

(C) 120

(D) 36

(E) 45

28. Let *O* be a point inside the square *ABCD* such that its distances to the vertices are *OA* = 10, *OB* = 9, *OC* = 5, *OD* = *x*. What is the value of *x*?

(A)

(B) 6

(C) 7

(D)

(E)

29. Each of the seven vertices of a regular heptagon is colored garnet or black. Two colorings are considered the same if one coloring is a rotation of the other. How many different colorings are possible?

(A) 18

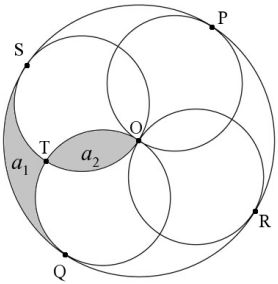
(B) 20

(C) 22

(D) 24

(E) 30

30. In the ﬁgure below the large circle has radius 1 and center *O*. and are its diameters and are perpendicular. , , , and are diameters of the four small circles below. The point *T* is a point of intersection of two of the small circles, as shown. Let be the area of the shaded region between the arcs , , and (see the picture below). Furthermore, let be the area of the shaded region between the two arcs . What is the value of ?



(A)

(B)

(C) 0

(D)

(E)