1. If the width of a particular rectangle is doubled and the length is increased by 3, then the area is tripled. What is the length of the rectangle?

(A) 1

(B) 2

(C) 3

(D) 6

(E) 9

2. Suppose the operation # is defined by *a*#*b* = *a*+*b*+*ab*. If 3#*x* = 23, then *x* =

(A) 2

(B) 3

(C) 4

(D) 5

(E) 6

3. If 3 circles of radius 1 are mutually tangent as shown, what is the area of the gap they enclose?



(A)

(B)

(C)

(D)

(E)

4. If (1+*i*)100 is expanded and written in the form *a*+*bi* where *a* and *b* are real numbers, then *a* =

(A) -250

(B) 2050

(C)

(D)

(E) 0

5. Suppose that *f* is a function with the property that for all *x* and *y*, *f*(*x*+*y*) = *f*(*x*)+*f*(*y*)+1 and *f*(1) = 2. What is the value of *f*(3)?

(A) 4

(B) 5

(C) 6

(D) 7

(E) 8

6. After a *p*% price reduction, what increase does it take to restore the original price?

(A) *p*%

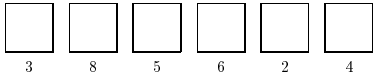
(B)

(C)

(D)

(E)

7. Each card below covers up a number. The number written below each card is the sum of all the numbers covered by all of the other cards. What is the sum of all of the hidden numbers?



(A) 4.2

(B) 5

(C) 5.6

(D) 6.2

(E) 6.8

8. What is the coefficient of *x*3 in the expansion of ?

(A) 40

(B) 48

(C) 56

(D) 62

(E) 64

9. Suppose that *x* and *y* are integers such that *y* > *x* > 1 and *y*2-*x*2 = 187 .Then one possible value of *xy* is

(A) 30

(B) 36

(C) 40

(D) 42

(E) 54

10.

(A) π

(B)

(C)

(D)

(E)

11. Suppose that 4 cards labeled 1 to 4 are placed randomly into 4 boxes also labeled 1 to 4, one card per box. What is the probability that no card gets placed into a box having the same label as the card?

(A)

(B)

(C)

(D)

(E)

12. If the equations (1) *x*2+*ax*+*b* = 0 and (2) *x*2+*cx*+*d* = 0 have exactly one root in common, and *abcd* ≠ 0, then the other root of equation (2) is

(A)

(B)

(C)

(D)

(E)

13. Suppose that *x* and *y* are numbers such that sin(*x*+*y*) = 0.3 and sin(*x*-*y*) = 0.5. Then sin(*x*)cos(*y*) =

(A) 0.1

(B) 0.3

(C) 0.4

(D) 0.5

(E) 0.8

14. How many permutations of 1, 2, 3, 4, 5, 6, 7, 8, 9 have:

1 appearing somewhere to the left of 2,

3 somewhere to the left of 4, and

5 somewhere to the left of 6?

For example, 815723946 would be such a permutation.

(A) 9∙7!

(B) 8!

(C) 5!4!

(D) 8!4!

(E) 8!+6!+4!

15. If we express the sum as a rational number in reduced form, then the denominator will be

(A) 15015

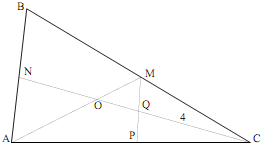
(B) 5005

(C) 455

(D) 385

(E) 91

16. In the triangle below, *M*, *N*, and *P* are the midpoints of *BC*, *AB*, and *AC* respectively. *CN* and *AM* intersect at *O*. If the length of *CQ* is 4, then what is the length of *OQ*?



(A) 1

(B)

(C)

(D)

(E) 2

17. Let [*x*] represent the greatest integer that is less than or equal to *x*. Fox example, [2.769] = 2 and [*π*] = 3. Then what is the value of ?

(A) 480

(B) 481

(C) 482

(D) 483

(E) 484

18. The minimum value of the function as *x* varies over all numbers in the largest possible domain of *f*, is

(A) -4

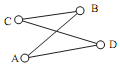
(B) -2

(C) 0

(D) 2

(E) 4

19. In the figure below, there are 4 distinct dots *A*, *B*, *C*, and *D*, joined by edges. Each dot is to be colored either red, blue, green, or yellow. No two dots joined by an edge are to be colored with the same color. How many completed colorings are possible?



(A) 24

(B) 72

(C) 84

(D) 96

(E) 108

20. Let *A*1, *A*2, …, *A*63 be the 63 nonempty subsets off {1, 2, 3, 4, 5, 6}. For each of these sets *Ai*, let *π*(*Ai*) denote the product of all the elements in *Ai*. Then what is thevalue of *π*(*A*1)+*π*(*A*2)+…+*π*(*A*63)?

(A) 5003

(B) 5012

(C) 5039

(D) 5057

(E) 5093

21. Suppose that each pair of eight tennis players either played exactly one game last week or did not play at all. Each player participated in all but 12 games. How many games were played among the eight players?

(A) 10

(B) 12

(C) 14

(D) 16

(E) 18

22. Let ,

, and

. Then which of the following inequalities is true?

(A) *A* > *B* > *C*

(B) *B* > *A* > *C*

(C) *C* > *B* > *A*

(D) *C* > *A* > *B*

(E) *B* > *C* > *A*

23. The relation between the sets and

is

(A)

(B)

(C)

(D) 60244 is in *M* but not in *N*

(E) *M* = *N*

24. If , *f*1(*x*) = *f*(*f*(*x*)), *f*2(*x*) = *f*(*f*1(*x*)), and in general *fn*(*x*) = *f*(*fn*-1(*x*)), then *f*1993(3) =

(A) 3

(B) 1993

(C)

(D)

(E) -2-1993

25. What is the center of the circle passing through the point (6, 0) and tangenttothe circle *x*2+*y*2 = 4 at (0, 2)? (Two circles are tangentata point *P* if they intersect at *P* and at no other point.)

(A) (0, -6)

(B) (1, -9)

(C) (-1, -9)

(D) (0, -9)

(E) None of these

26. Let *n* = 1667. Then the first nonzero digit in the decimal expansion of is

(A) 1

(B) 2

(C) 3

(D) 4

(E) 5

27. Suppose *ABC* is a triangle with area 24 and that there is a point *P* inside *ABC* which is distance 2 from each of the sides of *ABC*. What is the perimeter of *ABC*?

(A) 12

(B) 24

(C) 36

(D) 12

(E) 12

28. Suppose *ABC* is a triangle with 3 acute angles *A*, *B*, and *C*. Then the point (cos*B*-sin*A*, sin*B*-cos*A*)

(A) Can be in the 1st quadrant and can be in the 2nd quadrant only

(B) Can be in the 3rd quadrant and can be in the 4th quadrant only

(C) Can be in the 2nd quadrant and can be in the 3rd quadrant only

(D) Can be in the 2nd quadrant only

(E) Can be in any of the 4 quadrants

29. If the sides of a triangle have lengths 2, 3, and 4, what is the radius of the circle circumscribing the triangle?

(A) 2

(B)

(C)

(D)

(E)

30.

(A)

(B)

(C)

(D)

(E)