College of Charleston
Math Meet 2025
Written Test – Level 2

1. Write the complex number $\dfrac{1-3i}{1+3i}$ in the form $a+bi$ where a and b are real numbers.

   (A) $1+6i$ (B) $-0.8-0.6i$ (C) $8-6i$

   (D) $0.8+0.6i$ (E) None of the above

2. Which geometric description best fits the set of points S?

$$S=\{(x,y)\mid x\geq 0,\ y\geq 0,\ x+4y\leq 500\}$$

   (A) a connected set of line segments

   (B) a circular region

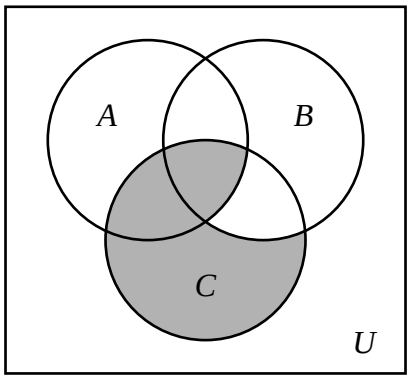
   (C) a triangular region

   (D) a square region

   (E) a rectangular region with two short and two long sides

3. If A, B, and C are subsets of the set U, then
   - $A\cap B$ is the set of all elements that belong to both A **and** B,
   - $A\cup B$ is the set of all elements that belong to A **or** B (or both), and
   - A^c is the set of all elements of U that are **not** in A.

   In the diagram, A, B and C are represented by circles and U is represented by a square.
   Which of the following expressions describes the region shaded in the diagram?



   (A) $(A\cup B^c)\cap C$ (B) $(A\cup B)\cup C^c$ (C) $(A^c\cap B^c)\cup C$

   (D) $(A\cap B)\cap C$ (E) $(A^c\cup B)\cup C^c$

4. Let S be the set of all numbers which are the sum of the squares of three consecutive integers. Then we can say that

   (A) No member of S is divisible by 2

   (B) No member of S is divisible by 3

   (C) No member of S is divisible by 5

   (D) No member of S is divisible by 7

   (E) For any prime number N there is an element of S divisible by N

5. Triangle ABC has area 12. If side AB has length 6 and side BC has length 5, what must be the length of side AC?

(A) 5

(B) $\sqrt{37}$

(C) $\sqrt{97}$

(D) $\sqrt{109}$

(E) More than one answer is possible with the given information.

6. What is the remainder when $18!$ is divided by 19?

(A) 1 (B) 4 (C) 13

(D) 18 (E) None of these

7. If we reflect the line $y = x$ through the line $y = 3x$, what do we get?

(A) $y = 5x$ (B) $y = -7x$ (C) $y = 8x$

(D) $y = 9x$ (E) None of these

8. Which of the functions $\sin(x), \cos(x), \tan(x), \sec(x)$ is largest on the interval $\left[\frac{7\pi}{15}, \frac{\pi}{2}\right)$?

(A) $\sin(x)$

(B) $\cos(x)$

(C) $\tan(x)$

(D) $\sec(x)$

(E) which one is largest varies over the interval

9. For an integer $n \geq 3$, a regular n-gon is inscribed in a unit circle. What is the area of the n-gon?

(A) $n^2 \sin\left(\frac{\pi}{n}\right)$ (B) $n \sin\left(\frac{\pi}{n}\right)$ (C) $n \sin\left(\frac{\pi}{2n}\right)$

(D) $\frac{n}{2} \sin\left(\frac{2\pi}{n}\right)$ (E) none of these

10. Circle C_1 has center P_1 and radius 30. Circle C_2 has center P_2 and radius 25. The circles intersect at two points A and B. Angle $\angle AP_1B$ is half the size of $\angle AP_2B$. What is the area of triangle ΔAP_1B?

(A) 288 (B) 375 (C) 432

(D) 450 (E) None of these

11. How many nonconstant linear functions $f(x) = ax + b$ satisfy $f \circ f \circ f = f$?

(A) none do (B) one (C) two

(D) three (E) infinitely many

12. Which of the following is equal to $\log_{\sqrt{2}} 27$?

(A) $\log_8 \sqrt{3}$ (B) $\log_{\sqrt{3}} 8$ (C) $\log_2 54$

(D) $\log_{\sqrt[3]{2}} 9$ (E) None of these

13. Which of the following is a solution to

$$\log_2(x+1)+\log_2(x^2+1)+\log_2(x^4+1)+\log_2(x^8+1)=3-\log_2(x-1)$$

(A) $\sqrt[16]{7}$ (B) $\sqrt[8]{2}$ (C) $\sqrt[8]{3}$

(D) $\sqrt[16]{5}$ (E) None of these

14. What is the area of the largest rectangle that can be inscribed in the triangle formed by the coordinate axes and the line $4x+3y=12$?

(A) $3/2$ (B) 2 (C) 3

(D) 6 (E) none of these

15. Identical squares are arranged in a grid 2 squares high by n squares wide. If 2 out of these $2n$ squares are chosen at random, let p be the probability that they form a rectangle. What is the smallest value of n for which $p<1/3$?

(A) 3 (B) 4 (C) 5

(D) 6 (E) none of these

16. If you throw a dart at square $ABCD$, and it lands at point P, what is the probability that $\angle APB$ is acute? Round your answer to the nearest percentage.

(A) 22% (B) 39% (C) 50% (D) 61% (E) 90%

17. Let $f(x)=2x^2-19x+42$. For how many values of x are both x and $f(x)$ prime? (Note: 0, 1, and negative integers are *not* regarded as prime)

(A) none (B) one (C) two

(D) three (E) infinitely many

18. The polynomials x^2-2x+a and x^2-3x+b share a common root. What does that say about a and b?

(A) $a=b=0$ (B) $2a=3b$ (C) $b=2a$

(D) $(a-b)^2=2b-3a$ (E) none of these

19. A group of good friends go out to dinner at a restaurant and agree that they will split the cost evenly. However, by the time the bill totaling $\$87.50$ has arrived, two of them have left without paying. (Apparently, they were not really such good "friends" after all.) The remaining dinner guests are a little angry, but realize they only have to pay an extra $\$5$ each to cover the cost. How many people were in the original group?

(A) 7 (B) 8 (C) 9 (D) 10 (E) 11

20. What is the probability of getting a sum of sixteen in tossing three standard dice?

(A) $1/6$ (B) $1/27$ (C) $1/36$

(D) $1/12$ (E) None of the above

21. A staircase has twelve steps. You can take one or two steps at a time. In how many different ways can you go up the staircase?

(A) 116 (B) 228 (C) 233

(D) 427 (E) none of these

22. Mr. Jones (who commutes to work in the city by train) unexpectedly caught an earlier train than usual yesterday. Normally, his wife drives to the station, meets Mr. Jones, and they drive home together. Not having heard from her husband, Mrs. Jones left home for the station at her usual time yesterday. When he arrived at the station, Mr. Jones set out on foot toward home, met his wife on the way, and they arrived home 12 minutes earlier than they would have if he had waited at the station for his wife's arrival. Due to heavy traffic at rush hour, the car is only able to maintain an average speed that is 5 times the rate at which Mr. Jones is able to walk.
Mr. and Mrs. Jones arrived home at exactly six o'clock. At what time would he have reached home if he had had time to call his wife before boarding the train so that she could have met him at the station as his train arrived? The correct answer is closest to

(A) 5:18 (B) 5:24 (C) 5:30 (D) 5:36 (E) 5:42

23. The numerator of a fraction is $a6bc$ and the denominator of this fraction is $de3fg$, where $a, b, c, d, e, f, g,$ are unique digits. The numerator and the denominator consist of all of the digits 1,2,3,4,5,6,7,8, and 9. If the value of the fraction is one-half, what must be the value of digit e ?

(A) 5 (B) 7 (C) 8

(D) 9 (E) none of these

24. What is the smallest positive integer m for which there is an integer n such that $2010m + 2012n = 2$?

(A) 503 (B) 1005 (C) 2010

(D) 2011 (E) none of these

25. A professor distributes 20 sample mathematics problems and says there will be ten problems on the test from these twenty. What is the minimum number of these sample problems a student must know how to do in order to guarantee that they will pass the test with at least a grade of 60%?

(A) twenty questions (B) eighteen questions (C) sixteen questions

(D) fourteen questions (E) none of the above

2025 Answers / Level 2 Test

1. B
2. C
3. A
4. B
5. E
6. D
7. B
8. D
9. D
10. C
11. E
12. D
13. C
14. C
15. C
16. D
17. C
18. D
19. A
20. C
21. C
22. D
23. A
24. B
25. C