

Math Day 2026
at Murray State University
Lower Level Examination

- Do not open this exam until you are told to do so.
- Clearly fill in your NAME and STUDENT NUMBER on the bubble sheet. Your student number is located on the card your teacher gave you.
- You have 50 minutes to complete this exam.
- You may not use a calculator, phone, notes, book, or other aid. Any attempt to do so will result in disqualification.
- The exam will be scored as follows:
 - +1 point for a correct answer
 - $-\frac{1}{4}$ point for an incorrect answer
 - 0 points for a blank answer
- Clearly select one answer on the bubble sheet for each question. If more than one answer is selected, the answer will be marked as incorrect.

GOOD LUCK!

1. The ratio

$$\frac{10^{2025} + 10^{2027}}{10^{2026} + 10^{2026}}$$

is closest to which of the following numbers?

- (a) $\frac{1}{10}$
- (b) $\frac{1}{5}$
- (c) 1
- (d) 5
- (e) 10

2. How many positive integers m exist such that there is at least 1 positive integer n satisfying

$$mn \leq m + n?$$

- (a) 1
- (b) 4
- (c) 6
- (d) 9
- (e) None of the Above

3. Each of the small circles in the figure below has radius equal to one. The innermost circle is tangent to the six circles surrounding it, and each of those circles is tangent to the large circle and to its small-circle neighbors. What is the area of the shaded region?



- (a) π
- (b) $\frac{3\pi}{2}$
- (c) 2π
- (d) 3π
- (e) None of the Above

4. A cookie jar contains 5 oatmeal cookies, 4 chocolate chip cookies, 3 peanut butter cookies, and 2 sugar cookies. If two cookies are chosen from the jar at random, what is the probability that none will be chocolate chip cookies?

(a) $\frac{45}{91}$

(b) $\frac{45}{98}$

(c) $\frac{50}{91}$

(d) $\frac{5}{7}$

(e) None of the Above

5. Suppose in a room, there is an even total of T people, 99% of which are left-handed. In terms of T , how many left-handed people would need to leave the room such that the new percentage of left-handed people in the room is 98%?

(a) $T - 99$

(b) $T - 90$

(c) $T - 50$

(d) $\frac{T}{2}$

(e) None of the Above

6. What is the number of intersection points of $f(x) = |9 - x^2|$ and $g(x) = 2x + 6$ on the common domain $(-\infty, \infty)$?

(a) 0

(b) 1

(c) 2

(d) 3

(e) None of the Above

7. Suppose a 45° arc of circle C_1 is equal in length to a 30° arc of circle C_2 . If A_1 represents the area inside C_1 and A_2 represents the area inside C_2 , evaluate $\frac{A_1}{A_2}$.
- (a) $\frac{4}{9}$
 - (b) $\frac{2}{3}$
 - (c) $\frac{5}{6}$
 - (d) $\frac{3}{2}$
 - (e) None of the Above
8. Suppose Sam went into a store and bought 3 sodas and 4 lemonades for \$4.50. Lucy went into the same store and bought 4 sodas and 3 lemonades for \$4.46. How much does one soda cost?
- (a) \$0.60
 - (b) \$0.62
 - (c) \$0.64
 - (d) \$0.66
 - (e) None of the Above
9. Suppose Dan starts driving due east on a road at a speed of $50 \frac{\text{miles}}{\text{hour}}$. Twelve minutes later, Jan starts driving along the same road due east at a speed of $70 \frac{\text{miles}}{\text{hour}}$. If Jan started 10 miles west of where Dan started, and they stay on the same road, how long will it take her to catch up to Dan?
- (a) 48 minutes
 - (b) 58 minutes
 - (c) 62 minutes
 - (d) 72 minutes
 - (e) None of the Above

10. Find the sum of all the roots for $f(x) = x + 33 - 14\sqrt{x}$.
- (a) 14
 - (b) 34
 - (c) 130
 - (d) 1090
 - (e) None of the Above
11. Suppose you decide to take a leisurely 2-mile drive in which you drive $10\frac{\text{miles}}{\text{hour}}$ for the first half of the trip. How fast would you need to drive on the second half of the trip in order to achieve an average speed of $15\frac{\text{miles}}{\text{hour}}$ for the entire trip?
- (a) $20\frac{\text{miles}}{\text{hour}}$
 - (b) $22.5\frac{\text{miles}}{\text{hour}}$
 - (c) $25\frac{\text{miles}}{\text{hour}}$
 - (d) $30\frac{\text{miles}}{\text{hour}}$
 - (e) None of the Above
12. Suppose two distinct numbers x and y are randomly chosen from the set $\{1, 2, 3, 4, 5\}$ and one number z is randomly chosen from the set $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. What is the probability that $z > x + y$?
- (a) $\frac{2}{5}$
 - (b) $\frac{9}{20}$
 - (c) $\frac{1}{2}$
 - (d) $\frac{11}{20}$
 - (e) None of the Above

13. Suppose $a + 1 = b + 2 = c + 3 = d + 4 = a + b + c + d + 5$. Evaluate $a + b + c + d$.

(a) $\frac{2}{3}$

(b) $\frac{5}{3}$

(c) $-\frac{7}{3}$

(d) $-\frac{10}{3}$

(e) None of the Above

14. Suppose Brock's doghouse has a regular hexagonal base that measures 1 yard on each side. He is tied to a vertex with a two-yard piece of rope. What is the area, in square yards, of the region outside the doghouse that Brock can reach?

(a) 2π

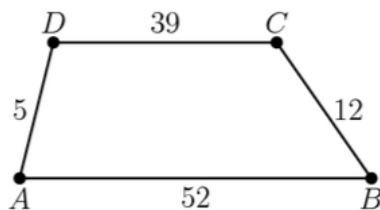
(b) 3π

(c) $\frac{8\pi}{3}$

(d) $\frac{11\pi}{3}$

(e) None of the Above

15. In trapezoid $ABCD$ below with bases AB and DC , lengths of sides are given and are NOT to scale. Given that the area of trapezoid $ABCD$ is 210, find the height h .



(a) $h = \frac{30}{13}$

(b) $h = \frac{45}{13}$

(c) $h = \frac{60}{13}$

(d) $h = \frac{120}{13}$

(e) None of the Above

16. Evaluate the expression

$$\frac{1}{5} + \frac{4}{3} + \frac{9}{2}.$$

- (a) $\frac{7}{5}$
- (b) $\frac{7}{15}$
- (c) $\frac{171}{30}$
- (d) 6
- (e) None of the Above

17. Suppose the second and fourth term of a geometric sequence are 2 and 6, respectively. Which of the following is a possible first term?

- (a) $\sqrt{3}$
- (b) $-\frac{\sqrt{3}}{3}$
- (c) $-\frac{2\sqrt{3}}{3}$
- (d) $\frac{4\sqrt{3}}{3}$
- (e) None of the Above

18. Solve the following equation for x :

$$25^{-2} = \frac{5^{48/x}}{5^{26/x} \cdot 25^{17/x}}.$$

- (a) $x = 2$
- (b) $x = 3$
- (c) $x = 5$
- (d) $x = 6$
- (e) None of the Above

19. Suppose older license plates were made using one letter ranging from A-Z followed by four digits ranging from 0-9. Newer license plates consist of three letters ranging from A-Z followed by three digits ranging from 0-9. Each letter and digit could be used more than once in both plates. How many times more possible newer license plates are there than possible older license plates?

(a) $\frac{26^2}{10}$

(b) $\frac{26^2}{10^2}$

(c) $\frac{26^3}{10}$

(d) $\frac{26^3}{10^3}$

(e) None of the Above

20. A line with slope 3 intersects another line with slope 5 at the point (10,15). What is the distance between the x -intercepts of these two lines?

(a) 5

(b) 7

(c) 12

(d) 20

(e) None of the Above

21. Given that $3^8 \cdot 5^2 = a^b$ where both a and b are positive integers, find the smallest possible value for $a + b$.

(a) 34

(b) 351

(c) 407

(d) 164026

(e) None of the Above

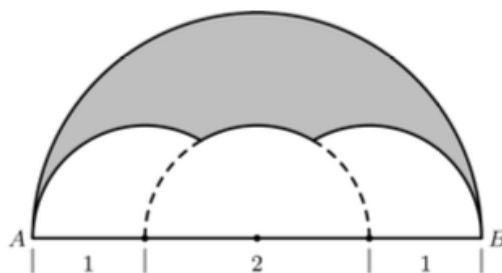
22. Suppose the following statement is true:

“If it is summer, then it is both hot and humid”.

Which of the following statements is equivalent?

- (a) “If it is not summer, then it is neither hot nor humid”.
- (b) “If it is either hot or humid, then it is summer”.
- (c) “If it is either not hot or not humid, then it is not summer”.
- (d) “If it is neither hot nor humid, then it is not summer”
- (e) None of the Above.

23. Three semicircles of radius 1 are constructed on diameter $\overline{AB}$ of a semicircle of radius 2. The centers of the small semicircles divide $\overline{AB}$ into four line segments of equal length, as shown below. What is the area of the shaded region?



- (a) $\pi - \sqrt{3}$
- (b) $\frac{\pi + \sqrt{2}}{2}$
- (c) $\frac{\pi + \sqrt{3}}{2}$
- (d) $\frac{7\pi - 3\sqrt{3}}{6}$
- (e) None of the Above

24. A recursive relation a_n is defined as $a_{n+1} = \frac{a_n^2}{2}$ when $n \geq 1$. If $a_1 = 1$, find m such that $a_n = \frac{1}{2^m}$.

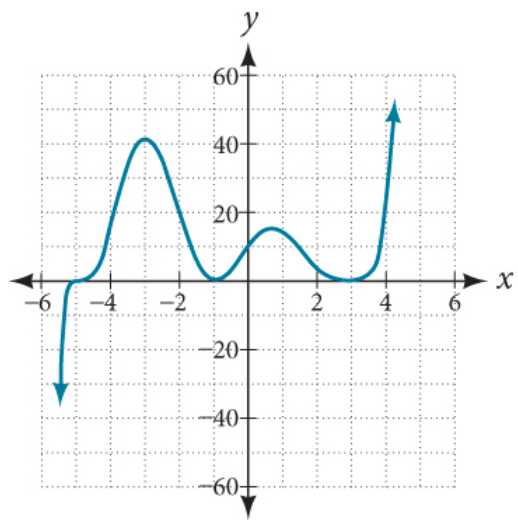
- (a) $m = 2^n$
- (b) $m = 2^n - 1$
- (c) $m = 2^{n-1}$
- (d) $m = 2^{n-1} - 1$
- (e) None of the Above

25. A bag contains two red beads and two green beads. You reach into the bag and pull out a bead, replacing it with a red bead regardless of the color you pulled out. What is the probability that all beads in the bag are red after three such replacements?

- (a) $\frac{1}{8}$
- (b) $\frac{3}{8}$
- (c) $\frac{7}{16}$
- (d) $\frac{9}{32}$
- (e) None of the Above

26. The graph of a polynomial $f(x)$ is shown below. A possible formula for $f(x)$ is

- (a) $f(x) = (x + 5)(x + 1)(x - 3)$
- (b) $f(x) = (x + 5)(x + 1)^2(x - 3)^2$
- (c) $f(x) = (x + 5)^2(x + 1)(x - 3)$
- (d) $f(x) = (x + 5)^2(x + 1)^2(x - 3)^2$
- (e) None of the Above



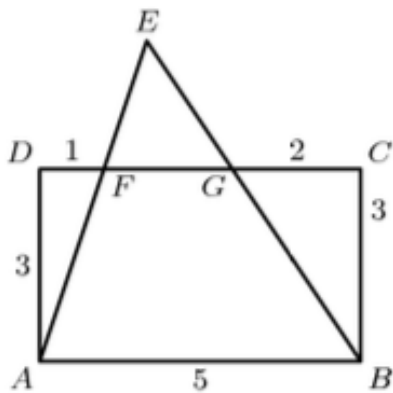
27. Suppose a car is on sale for \$9,566 which includes a 10% discount off of the original price. What was the original price rounded to the nearest dollar?

- (a) \$8,609
- (b) \$10,523
- (c) \$10,629
- (d) \$10,731
- (e) None of the Above

28. The product of all four roots of the function $f(x) = x^4 - 9$ is equal to

- (a) 3
- (b) -3
- (c) 9
- (d) -9
- (e) None of the Above

29. In rectangle $ABCD$, $AB = 5$ and $BC = 3$. Points F and G are on CD so that $DF = 1$ and $GC = 2$. Find the area of $\triangle AEB$.



- (a) $\frac{21}{2}$
- (b) $\frac{25}{2}$
- (c) 10
- (d) 12
- (e) None of the Above

30. What is the minimum value of the function $f(x) = 4x^2 - 9x + 20$?

(a) $\frac{9}{8}$

(b) $\frac{81}{16}$

(c) $\frac{239}{16}$

(d) $\frac{1199}{64}$

(e) None of the Above