

# Mathematics State • 2025



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2025 State

- 1. Each of the top three students on the SEM math team answered 56 problems on a UIL mathematics test. If Justin missed two problems, Cayden missed three problems and Rohan missed four problems, what was their team score?
  - (A) 934 (B) 936 (C) 938 (D) 940 (E) 942

2. Katherine left her home in Fort Bend and headed north on her bike. She cycled at a speed of 20 mph for 78 minutes. Then, she turned east and cycled at a speed of 24 mph for 90 minutes. Next, she turned south and cycled at a speed of 25 mph for 96 minutes. How far was she from home at this point? (nearest tenth)

(A) 38.6 mi (B) 38.9 mi (C) 39.2 mi (D) 39.5 mi (E) 39.8 mi

3. In Mrs. Craven's BC Calculus class, the final grade each six weeks is calculated by taking 20% of a student's homework average, 50% of a student's quiz average, 30% of a student's test average, and adding those values. If Natalie's homework average was 96, her test average was 96, and her final grade was 92, what was her quiz average?

(A) 80 (B) 82 (C) 84 (D) 86 (E) 88

4. Highland Park hosted a triangular meet with Argyle and Grapevine. Afterwards, all three teams went to Five Guys on Preston Road. Spencer paid \$56.30 for 3 burgers, 2 fries and 3 shakes. Sri paid \$63.15 for 3 burgers, 3 fries and 3 shakes. How much did Piyush pay for 4 burgers, 2 fries and 4 shakes?

(A) \$66.75 (B) \$68.00 (C) \$69.25 (D) \$70.50 (E) \$71.75

5. All of the houses on 36<sup>th</sup> Street in Pharr are the same size. Jonathan can paint a house by himself in 14 hours. Kevin can paint a house by himself in 16 hours. Daniel can paint a house by himself in 18 hours. If they work together, how long would it take them to paint 12 houses on 36<sup>th</sup> Street? (nearest tenth)

(A) 62.1 hr (B) 62.4 hr (C) 62.7 hr (D) 63.0 hr (E) 63.3 hr

6. Consider the sequence 5, 12, 19, 26, 33, 40, ... Find the sum of the 8<sup>th</sup> term and the 13<sup>th</sup> term.

- (A) 139 (B) 141 (C) 143 (D) 145 (E) 147
- 7. At the Paris Olympic Games, Cole Hocker of the U.S.A. set a new Olympic record when he won the gold medal in the 1500 meter run with a time of 3:27.65. Find his average speed. (nearest tenth)
  - (A) 16.2 mph (B) 16.5 mph (C) 16.8 mph (D) 17.1 mph (E) 17.4 mph
- 8. Mrs. Jones uses a linear formula of the form F = mA + b, where F = final grade, m = slope, A = actual average, and b = constant, to calculate grades in her calculus class. In this year's class, she wants an actual average of 50 to convert to a final grade of 70, and an actual average of 100 to convert to a final grade of a student with an actual average of 70.
  - (A) 78 (B) 80 (C) 82 (D) 84 (E) 86

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- 9. Stephen left his home in Dallas and traveled to Newberg, Oregon for a college visit. On day 1, he traveled 612 miles at an average speed of 62 mph. On day 2, he traveled 606 miles at an average speed of 68 mph. On day 3, he traveled at an average speed of 72 mph. On day 4, he traveled 324 miles at an average speed of 58 mph. If the total driving time for the trip was 31 hr 12 min, how far did he travel on day 3? (nearest mile)
  - (A) 486 mi (B) 489 mi (C) 492 mi (D) 495 mi (E) 498 mi
- 10. Monday through Friday, I leave my house at 7:15 AM and drive to my office in downtown Dallas. Traffic can vary on my morning drive to work. On Tuesday, I drove to work at an average speed of 48 mph and arrived 7.5 minutes late. On Friday, I drove to work at an average speed of 72 mph and arrived 10 minutes early. How long is my morning drive to work? (nearest mile)
  - (A) 36 mi (B) 39 mi (C) 42 mi (D) 45 mi (E) 48 mi
- 11. It is exactly 7:50 PM. Find the measure of the acute angle formed by the hour hand and the minute hand of Grandma's kitchen clock. (nearest whole number)
  - (A)  $63^{\circ}$  (B)  $65^{\circ}$  (C)  $67^{\circ}$  (D)  $69^{\circ}$  (E)  $71^{\circ}$
- 12. Consider a right rectangular prism with a length of 20, a width of 12 and a volume of 7680. Find the total surface area of the prism. (nearest whole number)
  - (A) 2512 (B) 2516 (C) 2520 (D) 2524 (E) 2528
- 13. Consider a hemisphere with a total surface area of 2723.76. Find the volume of the hemisphere. (nearest whole number)
  - (A) 10,282 (B) 10,286 (C) 10,290 (D) 10,294 (E) 10,298
- 14-15.  $\triangle ABC$  is an equilateral triangle. Point O is center of the circle with OC = 6. Region I is bounded by minor arc AB and  $\overline{AB}$ .
- 14. The length of minor arc BC = \_\_\_\_\_. (nearest tenth)
  - (A) 12.3 (B) 12.6 (C) 12.9 (D) 13.2 (E) 13.5
- 15. The area of region I = \_\_\_\_\_. (nearest tenth)
  - (A) 21.2(B) 21.5(C) 21.8(D) 22.1(E) 22.4



- 16. Consider regular pentagon ABCDE. The area of the circumscribed circle is 582. The area of the pentagon = \_\_\_\_\_. (nearest whole number)
  - (A) 424 (B) 428 (C) 432 (D) 436 (E) 440

- 17. Consider  $\triangle ABC$  with AC = 12. If Point D lies on  $\overrightarrow{AC}$  with  $\overrightarrow{BD} \perp \overrightarrow{AC}$ , AD = 5.4 and BD = 9, then the perimeter of  $\triangle ABC = \_$ . (nearest tenth)
  - (A) 33.7 (B) 33.9 (C) 34.1 (D) 34.3 (E) 34.5

18-19. Consider  $\triangle DEF$  with DE = EF = 12. Point G lies on line  $\overrightarrow{DF}$ , but outside of  $\triangle DEF$  with DG = 18 and FG = 6. Point M is the midpoint of line segment  $\overrightarrow{DE}$ .

- 18. The perimeter of  $\triangle DEG =$  \_\_\_\_\_. (nearest tenth)

   (A) 44.7
   (B) 45.0
   (C) 45.3
   (D) 45.6
   (E) 45.9
- **19.** The area of  $\triangle$ **MEG** = \_\_\_\_\_. (nearest tenth)
  - (A) 46.8 (B) 47.1 (C) 47.4 (D) 47.7 (E) 48.0

20. Given: f(x) = 4x - 7, g(x) = 2x + 3 and  $h(x) = (f \circ g)(x)$ .  $h^{-1}(9) =$ \_\_\_\_\_.

- (A) -1 (B)  $-\frac{1}{2}$  (C) 0 (D)  $\frac{1}{2}$  (E) 1
- 21. The windshield wiper on the rear window of a minivan rotates 150°. The total length of the wiper mechanism is 27 inches and the length of the wiper blade is 21 inches. The area covered by the wiper blade is \_\_\_\_\_\_ square feet. (nearest tenth)
  - (A) 6.0 (B) 6.3 (C) 6.6 (D) 6.9 (E) 7.2

22. Consider the graph of  $f(x) = \frac{x^2 - 25}{x^3 + x^2 - 30x}$ . The graph of y = f(x) has \_\_\_\_\_\_ asymptotes.

- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4
- 23. Consider a geometric sequence in which all of the terms are positive numbers. The 2<sup>nd</sup> term is 54 and the 4<sup>th</sup> term is 30.375. Find the sum of the first 11 terms of the sequence. (nearest thousandth)
  - (A) 275.533 (B) 275.634 (C) 275.735 (D) 275.836 (E) 275.937

24. Given: rectangle ABCD, AD = 30, PV = 22.5. PV is parallel to BC. Point M is the midpoint of DC. The circles are tangent to the sides of the rectangle and to each other. Point T lies on PV and is a point of tangency. Draw auxiliary line segment MB. Find m∠MBC. (nearest tenth)

- (A) 29.4° (B) 29.7° (C) 30.0°
- (D) 30.3° (E) 30.6°



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- 25. Michael placed \$245,000 into an account that earned X% annual interest compounded monthly. If it took 37 months to earn \$50,000 in interest, what is the value of X? (nearest hundredth)
  - (A) 5.82 (B) 5.93 (C) 6.04 (D) 6.15 (E) 6.26

26. Given:  $\angle u$  in quadrant II,  $\tan(u) = -\frac{12}{35}$ ,  $\angle v$  in quadrant IV,  $\tan(v) = -\frac{b}{a}$ , a and b are positive integers with 0 < a < b. If  $\csc(u - v) = -\frac{481}{360}$ , then  $m \angle v =$  \_\_\_\_\_. (nearest tenth)

- (A) 291.5° (B) 292.6° (C) 293.7° (D) 294.8° (E) 295.9°
- 27. Consider the polynomial  $ax^5 + bx^4 + cx^3 + dx^2 + ex + f$ . If (2+i) and (2+3i) are two roots of the polynomial, and if a = 1 and f = -12, then b =\_\_\_\_.
  - (A)  $-\frac{556}{65}$  (B)  $-\frac{546}{65}$  (C)  $-\frac{538}{65}$  (D)  $-\frac{532}{65}$  (E)  $-\frac{528}{65}$
- 28. Boat A leaves port at 12:00 PM traveling on a bearing of 70°. Boat B leaves port at 1:00 PM traveling 6 mph faster than boat A on a bearing of 200°. At 6:00 PM, the distance between the boats was 286.4 miles. Find the speed of boat B. (nearest whole number)
  - (A) 26 mph (B) 28 mph (C) 30 mph (D) 32 mph (E) 34 mph
- 29. The salary of a senior analyst increases by 12% every year. If the total amount she earned over her first 15 years was \$3,206,055, what was her salary her first year with the firm? (nearest dollar)
  - (A) \$84,000 (B) \$85,000 (C) \$86,000 (D) \$87,000 (E) \$88,000
- 30. Consider an ellipse centered at (-8, 3) with a vertex at (-8, -4). If the point (-10, 3) lies on the ellipse, what is the eccentricity of the ellipse? (nearest hundredth)
  - (A) 0.80 (B) 0.84 (C) 0.88 (D) 0.92 (E) 0.96
- 31. Consider a parabola with a vertex at point K(-6, -4) and with a focus at point F(-6, -2). The points A(-12, a) and B(12, b) lie on the parabola. AB = \_\_\_\_\_\_. (nearest tenth)
  - (A) 42.7 (B) 43.0 (C) 43.3 (D) 43.6 (E) 43.9
- 32. Consider a hyperbola with vertices at points E(-3, 6) and F(7, 6). The point Q(15, 15.6) lies on the hyperbola. If the focal points are the points T(t, 6) and R(r, 6), then TR = \_\_\_\_\_. (nearest tenth)
  - (A) 12.8 (B) 13.0 (C) 13.2 (D) 13.4 (E) 13.6

33. Consider the sequence 3, 7, 12, 18, 25, 33, 42, .... The sum of the first 20 terms is \_\_\_\_\_.

(A) 1952 (B) 1956 (C) 1960 (D) 1964 (E) 1968

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- 34. The circles are tangent to each other and to EF. The area of the circles are 36π and 16π respectively. Find the area of square ABCD. (nearest hundredth)
  - (A) 3.54
  - (B) 3.66
  - (C) 3.78
  - (D) 3.90
  - (E) 4.02



- 35. A 6-ft-tall man is walking at 6 ft/s toward a streetlight that is 36-ft-tall. His 4-ft-tall son follows at the same speed, staying 12 ft behind him. At t = 0, the man is 200 ft from the streetlight. At t = \_\_\_\_\_ seconds, the tips of the shadows of the man and his son are exactly the same distance from the streetlight. (nearest tenth)
  - (A) 3.0 (B) 3.3 (C) 3.6 (D) 3.9 (E) 4.2
- 36. The comet Encke was the second periodic comet ever discovered. It has an elliptical orbit with an eccentricity of 0.8484. The length of the major axis is 4.429 AU and the period of its orbit is 1,200 days. If 1 AU = 149.6×10<sup>9</sup> m, then the perihelion distance of Encke's orbit is \_\_\_\_\_ km. (nearest km) The next perihelion is predicted to occur on February 10, 2027.

(A) 50,001,221 (B) 50,112,332 (C) 50,223,443 (D) 50,334,554 (E) 50,445,665

37-38. The center of the circle is the point P(0, c) with c > 6. The radius of the circle is 2. f(x) = |3x|. The graph of y = f(x) is tangent to the circle at two points.

**37.** c = \_\_\_\_\_. (nearest hundredth)

(A)	6.23	<b>(B)</b>	6.26
<b>(C)</b>	6.29	<b>(D)</b>	6.32

- (E) 6.35
- **38.** Find the area of the region that lies between the two curves. (nearest tenth)
  - (A) 6.8 (B) 7.0



(E) 7.6

39. Consider the sequence  $\frac{3}{1}, \frac{4}{1}, \frac{7}{2}, \frac{12}{6}, \frac{19}{24}, \frac{28}{120}, \dots$  The sum of the next two terms is \_\_\_\_\_.

(C) 7.2

(A)  $\frac{43}{840}$  (B)  $\frac{37}{720}$  (C)  $\frac{65}{1008}$  (D)  $\frac{29}{560}$  (E)  $\frac{131}{2520}$ 

#### **UIL Mathematics**

(D) 7.4

- (A)  $\frac{17}{8}$  (B)  $\frac{9}{4}$  (C)  $\frac{5}{2}$ (D)  $\frac{11}{4}$  (E) 3
- 41. The line tangent to the parabola at point Q intersects the x-axis at the point (a, 0). a = \_\_\_\_\_.
  - (A) 18 (B) 20 (C) 22
  - (D) 24 (E) 26
- 42. Find the area of the region bounded by the parabola and line segment  $\overline{PQ}$ . (nearest whole number)
  - (A) 33 (B) 34 (C) 35 (D) 36 (E) 37
- 43. Find the arclength of arc PV. (nearest tenth)
  - (A) 16.0 (B) 16.2 (C) 16.4 (D) 16.6 (E) 16.8

44. Joy Kennedy decided to construct a large box, shaped like a right rectangular prism, to store her UIL medals and trophies. The base length of the box needs to be twice the base width. The box must have a volume of 6 ft<sup>3</sup>. The minimal surface area of the six-sided box = \_\_\_\_\_ ft<sup>2</sup>. (nearest tenth)

- (A) 20.6 (B) 20.9 (C) 21.2 (D) 21.5 (E) 21.8
- 45. Over a 60-day period, water due to melting snow in the mountains entered the American Falls Reservoir at a rate given by R(t) = .0205ln(t+1), 0 ≤ t ≤ 60. Engineers began releasing water from the dam at the southern end of the reservoir's dam into the Snake River at a rate given by D(t) = 0.00305t 0.0000255t<sup>2</sup>, 0 ≤ t ≤ 60. R(t) and D(t) are both measured in millions of acre-feet per day. At t = 0, the reservoir stored 0.894 million acre-feet of water. The maximum amount of water stored in the reservoir during this 60-day period was \_\_\_\_\_\_ million acre-feet. (nearest hundredth)
  - (A) 1.26 (B) 1.28 (C) 1.30 (D) 1.32 (E) 1.34

46. Consider the parametric equations  $x(t) = \ln(4t+2)$  and  $y(t) = 3t^2 + 4$  for  $0 \le t \le 12$ .

Find the value of 
$$\frac{d^2y}{dx^2}$$
 when  $t = \frac{1}{4}$ . (nearest tenth)  
(A) 4.1 (B) 4.3 (C) 4.5 (D) 4.7 (E) 4.9



- 47. f(x) is a continuous even function such that  $\int_{-8}^{8} f(x)dx = 36$  and  $\int_{8}^{14} f(x)dx = 12$ .  $\int_{14}^{0} f(x)dx =$ \_\_\_\_\_.
  - (A) -32 (B) -30 (C) -28 (D) -26 (E) -24

48. A particle is moving in the xy-plane. For  $t \ge 0$ ,  $\frac{dx}{dt} = 6t + 5$  and  $\frac{dy}{dt} = \cos(t^2) - 9$ . If x(0) = 2 and y(0) = -4, then the position of the particle at t = 7 is (a, b). a + b =\_\_\_\_.

(A) 114 (B) 116 (C) 118 (D) 120 (E) 122

49-50. Ranger Jim studied a population of grizzlies in the Gallatin National Forest near Bozeman over a period from 2000 to 2024. After analyzing all the data he collected, he decided that a logistic model was appropriate. Ranger Jim felt that the area could support a maximum of 400 bears. The initial population in 2000 was 16 bears. The population reached 40 bears in 2005.

- 49. Find Ranger Jim's logistic model for the grizzly population and predict the population in 2031.
  - (A) 371 (B) 373 (C) 375 (D) 377 (E) 379
- 50. According to Ranger Jim's logistic model, the maximum rate of growth of the grizzly population during his study was \_\_\_\_\_\_ bears per year. (nearest tenth)
  - (A) 19.0 (B) 19.3 (C) 19.6 (D) 19.9 (E) 20.2

51. Let f be a function with derivatives of all orders for x > 0 such that f(2) = 1, f'(2) = 5, f''(2) = 9, and f'''(2) = 10. Find  $P_3(x)$ , the third-degree Taylor polynomial for f about x = 2.  $P_3(2.2) =$ \_\_\_\_\_. (nearest hundredth)

- (A) 2.10 (B) 2.13 (C) 2.16 (D) 2.19 (E) 2.22
- 52. The graph of  $f(x) = ax^3 + bx^2 + cx + d$  has a relative maximum at (1, -5) and a point of inflection at (-1, -21). f(-6) =\_\_\_\_\_\_. (nearest whole number)
  - (A) 41 (B) 42 (C) 43 (D) 44 (E) 45
- 53. In a test of  $H_0: p = 0.28$  against  $H_a: p \neq 0.28$ , a random sample of size 400 yields a test statistic of z =2.03. The P-value of this test is approximately equal to \_\_\_\_\_. (nearest thousandth)
  - (A) 0.002 (B) 0.022 (C) 0.042 (D) 0.062 (E) 0.082
- 54. Assume the mean distance for men's long jumpers is 25 ft 8 in with a standard deviation of 9 in and the mean distance for women's long jumpers is 21 ft 2 in with a standard deviation of 8 in. If Trent jumped 27 ft 10 in, how far would Tara have to jump to have an equivalent performance? (nearest in)
  - (A) 23 ft 1 in (B) 23 ft 3 in (C) 23 ft 5 in (D) 23 ft 7 in (E) 23 ft 9 in

55. Russell has played Lebron in one-on-one games hundreds of times. Russell wins 72% of the time. Lebron flew into Dallas to play 8 games with Russell. If the results of each game are independent of previous games, find the probability that Lebron will win at least 4 games. (nearest hundredth)

(A) 0.14 (B) 0.16 (C) 0.18 (D) 0.20 (E) 0.22

56. Sixty-two percent of the seniors at Newcastle plan to attend MIT, and 74% of those plan to major in math. All of the other seniors plan to attend Harvard, and 36% of those plan to major in math. Given that a randomly selected senior plans to major in math, what is the probability that the senior plans to attend Harvard? (nearest hundredth)

(A) 0.17	<b>(B) 0.19</b>	(C) 0.21	(D) 0.23	(E) 0.25
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Flavor	Chocolate	Vanilla	Strawberry	Rocky Road
# of cones sold	63	54	39	44

57. At Madelin's Ice Cream Shoppe in Plains, she expects to sell an equal number of ice cream cones of each of the four flavors they offer every Saturday. The results from one randomly selected Saturday are in the table above. Are these results convincing evidence that Madelin's Ice Cream Shoppe does not sell an equal number of each flavor on Saturdays? Madelin performed an appropriate test at the  $\alpha = 0.05$  level. After analyzing the test results, Madelin stated "Based on a p-value of \_\_\_\_\_, there is insufficient evidence to conclude that the sales are not evenly distributed among the 4 flavors." (nearest thousandth)

(A) <b>0.044</b>	(B) 0.055	(C) 0.06	6 (D) 0.	.077 (E)	0.088
Final Score - S	0	1	2	3	4
P(S)	0.1	0.2	0.3	0.25	0.15

58. Ashley's favorite game is a game of chance with five possible final scores. The possible scores and the probability of each score is given in the table above. Ashleigh has enough time to play the game twice on the trip back to Newcastle. The second play is independent of the first play. Find the probability that the sum of final scores of two plays is 4. (nearest hundredth)

(A) 0.18 (B) 0.20 (C) 0.22 (D) 0.24 (E) 0.26

59. Dr. Williams spends his summers in Northern Idaho studying the Idaho Snow Bunny. As part of his research, he needs to construct a 96% confidence interval for the average weight of adult snow bunnies. Based on his previous research, he estimates that the standard deviation is 0.22 kg. Dr. Williams plans to select a random sample of adult snow bunnies and record their weights. Of the following, which is the smallest sample size that will result in a margin of error of 0.02 kg or less for the confidence interval?

(A) 391 (B) 421 (C) 451 (D) 481 (E) 511

60. The mean IQ of the students in the room is 125 with a standard deviation of 10. If a student has an IQ of 140, what percentile does that place the student at?

(A)  $89^{th}$  (B)  $91^{st}$  (C)  $93^{rd}$  (D)  $95^{th}$  (E)  $97^{th}$ 

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### University Interscholastic League MATHEMATICS CONTEST HS • State Meet • 2025 Answer Key

1.	В	21. B	41. C
2.	Α	22. D	42. D
3.	E	23. D	<b>43.</b> E
4.	D	24. A	44. A
5.	E	25. C	45. D
6.	С	26. B	46. C
7.	Α	27. D	47. B
8.	С	28. D	<b>48.</b> C
9.	С	29. C	<b>49.</b> E
10.	С	30. E	50. C
11.	В	31. C	51. D
12.	Ε	32. A	52. D
13.	С	33. C	53. C
14.	В	34. C	54. A
15.	D	35. B	55. B
16.	Ε	36. C	56. D
17.	Α	37. D	57. D
18.	Ε	38. B	58. C
19.	Α	39. C	59. E
20.	D	40. B	60. C