



UNIVERSITY INTERSCHOLASTIC LEAGUE

Mathematics

Study Packet 2020

This Mathematics packet contains tests and keys from **only** 2020 Invitational A, B and District. Region and State are not available.

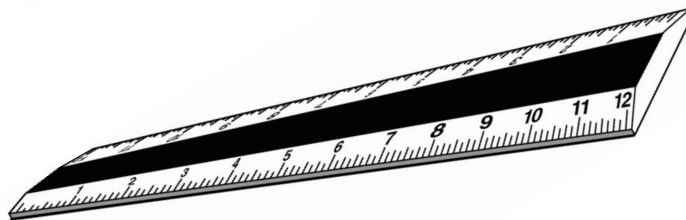
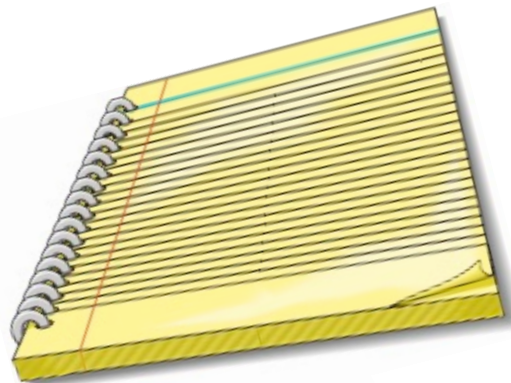
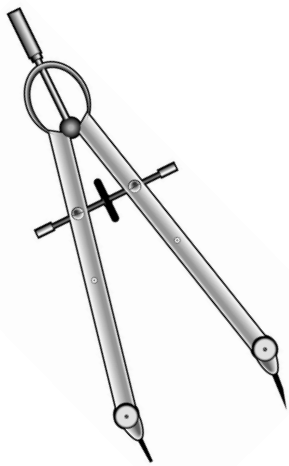
This item is intended for High School grade levels.



UNIVERSITY INTERSCHOLASTIC LEAGUE

Mathematics

Invitational A • 2020



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1. Evaluate: $1 \times 10 - 20 \div 2 - 20 + 2^0$

- (A) -25 (B) -24 (C) -20 (D) -19 (E) -18

2. Lotta Werk is paid \$12.00 an hour for an 8-hour work day, time and a half for overtime during the work week, and double time on Saturday. What is her week's gross amount if she worked 44 hours during the week and 4 hours on Saturday?

- (A) \$528.00 (B) \$616.00 (C) \$624.00 (D) \$648.00 (E) \$888.00

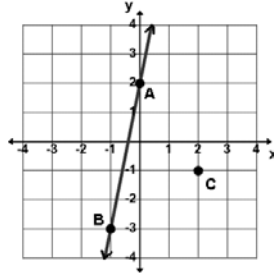
3. The average of four natural numbers is 72. If three of the numbers are increased by 12 and the fourth number is decreased by 8, then the average of the new numbers is _____.

- (A) 76 (B) 78 (C) 79 (D) 80 (E) 82

4. Which of the following mathematicians was from Texas and was mainly interested in set topology and combinatorics?

- (A) Mary Rudin (B) Aryabhata (C) Sophie Germain (D) Alicia Stott (E) Alan Turing

5. Find the equation of the line through point C and perpendicular to line shown below.



- (A) $x - 5y = 3$ (B) $5x - y = -3$ (C) $x + 5y = 3$ (D) $5x + y = -3$ (E) $x + 5y = -3$

6. $3B1A_{12} \times 11_{12} = \text{_____}_{12}$.

- (A) 441BA (B) 452BA (C) 43B3A (D) 430BA (E) 4B03A

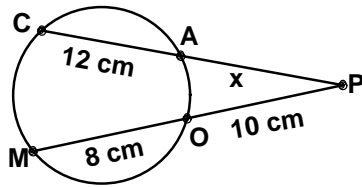
7. The *Buy Sikle* shop has a mountain bike for sale costing \$125.00, tax included. Willie Byette saved \$5.00 from his weekly allowance for 8 weeks. He received \$14.00 for his 14th birthday. If he saves \$7.00 from his future allowances, how many weeks would it take for him to have enough money to buy the bike?

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

8. Point P($-3, 1$) lies on the x-y plane. P is reflected across the line $y = -2$ to point Q. Then Q is rotated 90° clockwise about the point $(0, -5)$ to point R. Then R is translated horizontally 4 units to point S. Then S is translated vertically -1 unit to point T(x, y). Find $x + y$.

- (A) 1 (B) -1 (C) -2 (D) -7 (E) -8

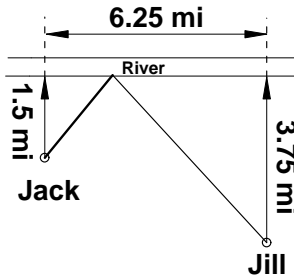
9. Find $PC - PM$ using the information from the drawing below. (nearest tenth)



- (A) 1.0 cm (B) 1.7 cm (C) 2.0 cm (D) 2.7 cm (E) 3.5 cm
10. Let $(8x^3 - 6x^2 - 3x + 1) \div (2x + 1) = ax^2 + bx + c$. Find $a - b + c$.
- (A) 0 (B) 5 (C) 8 (D) 10 (E) 11
11. The distance from the hypotenuse of a right triangle to its incenter is _____ the distance from the base of the triangle to the incenter.
- (A) one-third (B) one-half (C) two-thirds (D) equal to (E) twice
12. Let $a^4 \times b^3 \div a^5 \times b^{-3} \div (a^4)^2 \div b = a^m \times b^n$. Find $m \times n$.
- (A) -10 (B) 7 (C) 9 (D) 35 (E) 45
13. Let $b:c = 7$ and $a:b = 3$. Find $(a - b):(b - c)$.
- (A) $\frac{3}{7}$ (B) $\frac{2}{5}$ (C) 5 (D) $2\frac{1}{2}$ (E) $2\frac{1}{3}$
14. The number of students affected by "text-thumb" lockup increases exponentially with the number of texts. Suppose 5 students are affected before texting. After 30 texts, 25 students are affected. Based on this exponential growth, how many students will be affected after 70 texts?
- (A) 257 (B) 214 (C) 125 (D) 106 (E) 100
15. The graph of the function $y = \sin(x) - 2x$, where $\frac{\pi}{2} \leq x \leq \frac{3\pi}{4}$, lies in which of the quadrants?
- (A) II & IV (B) I & III (C) I & IV (D) II only (E) IV only
16. Ellie Vait needs to build a ramp for her grandmother's wheelchair. The ramp needs an angle of inclination of 12° and extends to the top of the 5' porch. How long will the ramp need to be? (nearest foot)
- (A) 30 ft (B) 24 ft (C) 20 ft (D) 18 ft (E) 15 ft
17. $(421_6 \times 5_6 - 151_6) \div 4_6$ has a remainder of _____.
- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4
18. The graph of the equation $-5x^2 + 3y^2 + 12x - 4 = 0$ is which of the following type of conic.
- (A) circle (B) ellipse (C) hyperbola (D) parabola (E) not a conic

19. Dee Athleet competes in a local triathlon. She walks a third of the distance at a rate of 3 km/hr. Then she runs a third of the distance at 5 km/hr. Then she covers the remaining distance on her bicycle at a rate of 9 km/hr. What was her average speed for the whole distance? (nearest tenth)
- (A) 5.7 km/hr (B) 5.1 km/hr (C) 5.0 km/hr (D) 4.7 km/hr (E) 4.5 km/hr

20. Jack went to the river to get a pail of water then took it to Jill. What is the minimum total distance Jack can travel to the river then to Jill to deliver the water? (nearest hundredth)



- (A) 8.04 mi (B) 8.16 mi (C) 8.41 mi (D) 8.50 mi (E) 8.75 mi
21. If $f(x) = 4x + 1$, $g(x) = 3x - 2$, $h(x) = 2x + 3$, and $f(h(g(2x - 5))) = ax + b$, then $a + b = ?$
- (A) 9 (B) -45 (C) -67 (D) -75 (E) 15
22. Willie Drawette has a box of map pencils; eight green, five red, six blue, seven brown, and four yellow. He randomly selects two pencils without replacement. What is the probability both were green or both were yellow? (nearest tenth)
- (A) 1.3% (B) 7.8% (C) 26.9% (D) 3.5% (E) 15.2%
23. How many arrangements of five letters are possible using three constants and two vowels from the word REGIONAL?
- (A) 566 (B) 1,568 (C) 2,880 (D) 2,400 (E) 360
24. Points P, Q, and R lie on segment AB in order as stated. AP is 30% of AB, AR is 75% of AB, and QR is 20% of AB. PQ is what percent of AB?
-
- (A) 20% (B) 25% (C) 30% (D) 45% (E) 50%
25. If $2x - y = 3$, $y = \frac{x+1}{3}$ and $ax + y = 4$, then a equals:
- (A) -2 (B) -.5 (C) 1 (D) 1.5 (E) 3
26. The harmonic mean of the roots $4x^4 - 20x^3 + 35x^2 - 25x + 6 = 0$ is _____.
- (A) -1.2 (B) -0.68 (C) 0.24 (D) 0.68 (E) 0.96

27. The graph of $f(x) = 5 - \log_5 |x|$ lies in quadrant(s) _____.

- (A) I, II, III, & IV (B) III & IV (C) II & III (D) I & IV (E) I & II

28. $\begin{vmatrix} \cos(A) & \sin(A) \\ \cos(B) & \sin(B) \end{vmatrix}$ equals:

- (A) $\cos(A + B)$ (B) $\cos(A - B)$ (C) $\sin(A + B)$ (D) $\sin(A - B)$ (E) none of these

29. Find the remainder when 15^{19} is divided by 17.

- (A) 1 (B) 3 (C) 6 (D) 8 (E) 9

30. Which of the points lie on the line that is tangent to the curve $x^2 + 2y^2 = 9$ at point (1, 2).

- (A) (-3, 3) (B) (-1, 2) (C) (-6, 4) (D) (10, 0) (E) (1, -2)

31. Find the units digit of $27^{(27)} - 27$.

- (A) 4 (B) 5 (C) 6 (D) 7 (E) cannot be determined

32. What is the first positive happy Lucas number greater than 1?

- (A) 3 (B) 4 (C) 5 (D) 7 (E) 11

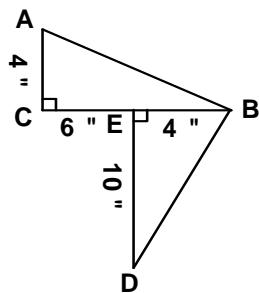
33. Which of the following is the 15th Fibonacci number?

- (A) 377 (B) 521 (C) 610 (D) 713 (E) 987

34. Twenty members of the *Cracked Nuts* club were surveyed. 12 liked pecans, 10 liked peanuts, 7 liked walnuts, 5 liked pecans and peanuts, 3 liked only walnuts, 7 liked only pecans, and 2 liked all three. How many liked peanuts and walnuts by not pecans?

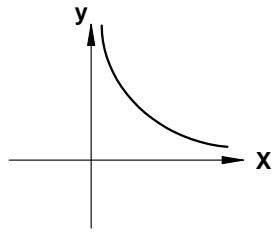
- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4

35. Find AD using the information from the drawing below.



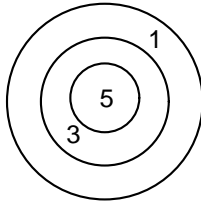
- (A) 15.2" (B) 15.5" (C) 19.8" (D) 20.0" (E) 21.5"

36. Which of the following functions could be represented by this graph, where $x > 0$ and $n \geq 1$?



- (A) $y = ax^n, n > 1$ (B) $y = \log_a(x)$ (C) $y = ax$ (D) $y = ab^x, b > 1$ (E) $y = \frac{a}{x^n}$
37. Units of dry measurements include pints, quarts, gallons, pecks, and bushels. Tater Pharmed had a full grain storage bin with a capacity of 10 bushels. He removed 3 bushels 2 pecks 1 quart of grain to feed his animals. How much grain was left in the bin?
- (A) 6 bushels 1 peck 1 gal 3 qts (B) 6 bushels 1 peck 3 gals (C) 6 bushels 3 pecks 3 qts
(D) 6 bushels 3 pecks 1 gal 3 qts (E) 6 bushels 1 peck 3 gal 3 qts
38. A job can be done by 8 men in 4 hours or 12 boys in 9 hours. How long would it take 3 men and 9 boys working together to do the job? (nearest minute)
- (A) 5 hrs 8 min (B) 5 hrs 39 min (C) 6 hrs 28 min (D) 8 hrs 15 min (E) 8 hrs 45 min
39. Lily Pond has a circular wading pool with a radius of 3 feet and a depth of 18 inches. How much water is in the pool when it is only half full? (nearest gallon)
- (A) 26 gals (B) 53 gals (C) 141 gals (D) 159 gals (E) 231 gals
40. Hickory, Dickory, and Doc looked up at the circular clock. The time shown was 9:04 PM. Find the measure of the smaller angle between the big hand and the little hand.
- (A) 158° (B) 112° (C) 108° (D) 92° (E) 48°
41. Mary Gorown took a 4 hour hike through the forest. She left her camp traveling $N30^\circ W$ for 2 miles. She turned and traveled $S70^\circ E$ for 2 miles. When it was time to head back to camp, what course would she need to take?
- (A) $W30^\circ S$ (B) $S50^\circ E$ (C) $S40^\circ W$ (D) $E60^\circ S$ (E) $W40^\circ S$
42. The weekly cost for each of three day care centers in Littleton County were \$109.00, \$91.00, and \$79.00. Find the *mean deviation* of this set of data? (nearest hundredth)
- (A) 9.33 (B) 10.67 (C) 10.00 (D) 9.30 (E) 9.64
43. Nicole Flipur tossed a nickel three times and recorded the results. She was looking for the probability of tossing at least one head. How many members of the event's sample space would be successful members?
- (A) 1 (B) 3 (C) 6 (D) 7 (E) 8

44. Robin Canduit shot his arrow at the three ring target. Each ring has a value as shown in the picture. The probability of hitting the center ring is 25%, the outer ring is 40%, the middle ring is 30%, and missing the target is 5%. Robin gets — 10 points if he misses the target. What is the mathematical expectation on any one arrow?

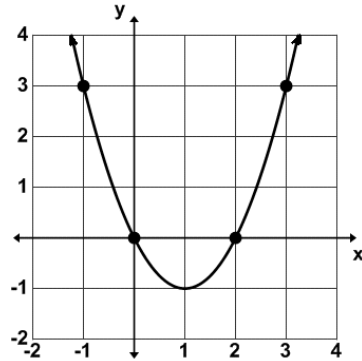


- (A) 2.05 (B) 2.25 (C) 2.75 (D) 3 (E) 3.5
45. Bill Maker has one \$10 bill, five \$5 bills, and ten \$1 bills in his cash box. He randomly draws out two bills without replacement. What are odds that both of them are \$1 bills? (nearest %)
- (A) 30% (B) 38% (C) 54% (D) 60% (E) 63%
46. Nona Digette has an interesting 9-digit Social Security number. The first and the last digits are 5's. The sum of any three consecutive digits is 12. What is the median digit?
- (A) 1 (B) 2 (C) 4 (D) 5 (E) 7
47. Find the least positive integer n such that $n > 1$ and the expression $\sqrt{1 + 2 + 3 + 4 + \dots + n}$ simplifies to an integer.
- (A) 8 (B) 9 (C) 10 (D) 12 (E) 16
48. Let $f(x) = \begin{cases} 2x + 5 & -3 \leq x \leq 0 \\ -3 & x = 0 \\ -5x & x > 0 \end{cases}$. Find the range of function f .
- (A) $[-3, \infty)$ (B) $[-3, 5]$ (C) $(-\infty, 5]$ (D) $(-\infty, -3]$ (E) all Reals
49. If $a_1 = -2$, $a_2 = -1$, $a_3 = 1$ and $a_n = (a_{n-3}) + (a_{n-1})^{(a_{n-2})}$, where $n \geq 4$, then a_6 equals:
- (A) 0.5 (B) 1 (C) 2 (D) -0.75 (E) -1
50. The ordered pair (x, y) satisfies the equation $2x + 3y = 2020$, where x and y are positive integers. How many such ordered pairs exist?
- (A) 253 (B) 302 (C) 337 (D) 404 (E) 406
51. Which of the following equations can be obtained from the graph of the parent function $y = \sin(x)$ by applying a vertical stretch of 4 units, a vertical shift of 2 units, and a horizontal shift of 3 units?
- (A) $y = 2 + 4\sin(x - 3)$ (B) $y = 3 + 2\sin(x + 4)$ (C) $y = 4 - 2\sin(x - 3)$
(D) $y = 3 + 4\sin(x + 2)$ (E) $y = 2 + 4\sin(x + 3)$

52. Let $S = 1 + \frac{1}{3} + \frac{1}{9} + \dots$. Find the least number of terms in this geometric progression such that $1\frac{1}{2} - S < \frac{3}{1000}$.

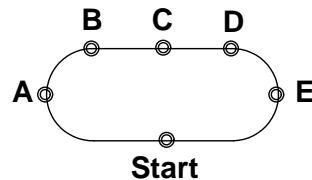
- (A) 9 (B) 8 (C) 7 (D) 6 (E) 5

53. The graph of $h'(x)$ is shown below. Find $h(4)$, when $h(0) = 1$.



- (A) $3\frac{1}{3}$ (B) 10 (C) $6\frac{1}{3}$ (D) 8 (E) $9\frac{1}{3}$

54. Hi Spede can cover any distance in one-third the time it takes Dee Loper to cover the same distance. They start at the same time with Hi going clockwise and Dee going counter clockwise. Where will they meet the first time?



- (A) A (B) B (C) C (D) D (E) E

55. The vertices of a quadrilateral are $(-4, 0)$, $(0, -3)$, $(4, 0)$, and $(0, 3)$. Find the area of the quadrilateral in square units. (nearest tenth)

- (A) 13.9 (B) 24.0 (C) 6.9 (D) 25.0 (E) 12.0

56. Point P lies on side BC of $\triangle ABC$ such that segment AP bisects $\angle BAC$ and forms an isosceles triangle, $\triangle APC$. Find PC if $m \angle BAC = 80^\circ$ and $AP = 8''$. (nearest tenth)

- (A) 5.5'' (B) 11.7'' (C) 12.3'' (D) 5.2'' (E) 1.5''

57. Max Kutter has piece of cardboard that is 2 feet long and 1 foot wide. He needs to cut a square out of each corner in order to create a cardboard box that has maximum volume. What is the area of the square that needs to cut out of each corner? (nearest tenth)

- (A) 2.5 sq. in (B) 4.5 sq. in (C) 6.4 sq. in (D) 7.1 sq. in (E) 7.9 sq. in

58. Given: Square ABCD with point P on AB such that $AP = 3.3x$ and $PB = 4.4x$. Find $m\angle CPD$. (nearest degree)

- (A) 24° (B) 30° (C) 53° (D) 60° (E) 67°

59. The table shows the distribution of the same 20 students who answered 5 questions each of 3 days. They received 1 point for each question answered correctly. No student received the same score on two different days. If a student is selected at random, what is the probability that the selected student received a score of 5 on Day 2 or Day 3, given that the student received a score of 5 on one of the three days? (nearest percent)

	5/5	4/5	3/5	2/5	1/5	0/5	Total
Day 1	2	3	4	6	2	3	20
Day 2	2	3	5	5	4	1	20
Day 3	3	3	4	5	3	2	20
Total	7	9	13	16	9	6	60

- (A) 8% (B) 57% (C) 63% (D) 70% (E) 71%

60. Given that the set of natural numbers continue in the triangular pattern shown below, find the first number in row 10.

				1						(row 1)
				2	3	4				(row 2)
			5	6	7	8	9			(row 3)
		10	11	12	13	14	15	16		(row 4)
	17	18	19	20	21	22	23	24	25	(row 5)
				...						(...)

- (A) 97 (B) 90 (C) 85 (D) 82 (E) 81

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**University Interscholastic League
MATHEMATICS CONTEST
HS • Invitation A • 2020
Answer Key**

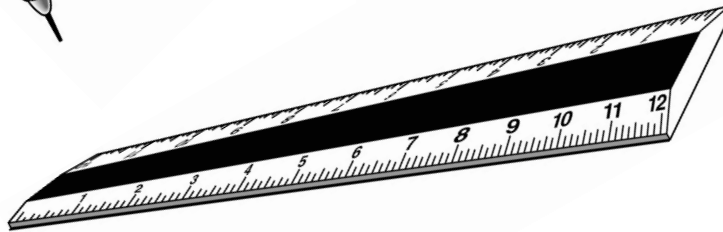
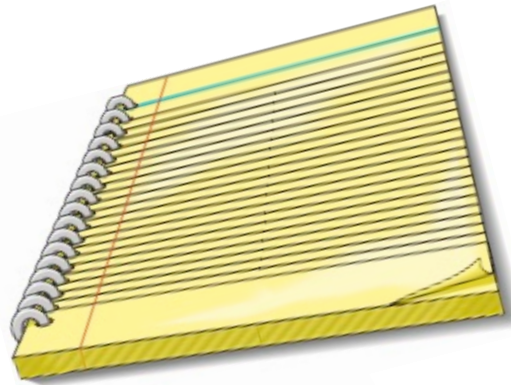
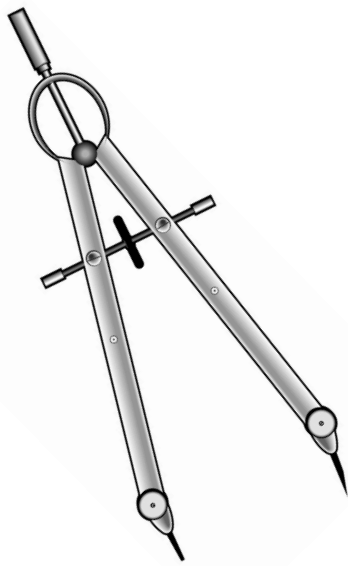
- | | | |
|-------|-------|-------|
| 1. D | 21. D | 41. C |
| 2. D | 22. B | 42. B |
| 3. C | 23. C | 43. D |
| 4. A | 24. B | 44. A |
| 5. E | 25. D | 45. D |
| 6. D | 26. E | 46. B |
| 7. E | 27. E | 47. A |
| 8. A | 28. E | 48. C |
| 9. D | 29. E | 49. A |
| 10. D | 30. A | 50. C |
| 11. D | 31.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



UNIVERSITY INTERSCHOLASTIC LEAGUE

Mathematics

Invitational B • 2020



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1. Find k : $2 \times k - (2^0 + 3!) - 1 + 4 \div 2^0 = 10$

- (A) 5.5 (B) 6.5 (C) 7 (D) 9 (E) 12

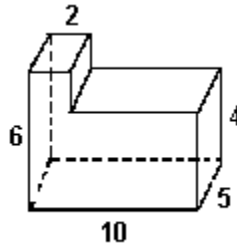
2. Bill Braker went to the *I-Stop-Shoppe* on "no tax weekend" to buy some attire for school. He bought two shirts at \$9.95 each, three pairs of pants at \$12.50 per pair, one belt at \$8.75, and two pairs of sandals at \$14.75 each. He gave the cashier four \$20 bills, one \$10 bill, and three \$5 bills. How much change should he receive back?

- (A) \$13.10 (B) \$4.35 (C) \$11.65 (D) \$1.90 (E) \$9.35

3. Three-fifths is to two-thirds as one-fourth is to what?

- (A) $\frac{1}{10}$ (B) $\frac{5}{18}$ (C) $\frac{9}{40}$ (D) $\frac{5}{8}$ (E) $\frac{8}{5}$

4. A larger rectangular prism has a smaller rectangular prism cut out from the top right part of the larger prism as shown in the figure. What percent of the volume of the original larger prism was removed?



- (A) $18\frac{2}{3}\%$ (B) 20% (C) $22\frac{1}{3}\%$ (D) 25% (E) $26\frac{2}{3}\%$

5. If $\frac{2x}{5} = 2\frac{2}{3}$, then $\frac{3x+10}{15}$ equals:

- (A) 0.88 (B) 1.666... (C) 2 (D) 2.1333... (E) 3

6. Let $(3x + 2)(ax + b) = 24x^2 - 11x - 18$. Find $a + b$.

- (A) -17 (B) -2 (C) -1 (D) 1 (E) 8

7. Given: \overline{AX} intersects \overline{BY} at point P, $AB = 7'$, $AP = 10'$, $BP = 12'$, $PX = 500'$, $PY = 600'$. Find XY.

- (A) $416\frac{2}{3}'$ (B) 300' (C) $291\frac{2}{3}'$ (D) 350' (E) 420'

8. How many negative roots exist for the polynomial $x^5 - 11x^4 + 45x^3 - 85x^2 + 74x - 24 = 0$ is ?

- (A) none (B) 1 (C) 2 or none (D) 3 or 1 (E) 5, 3, or 1

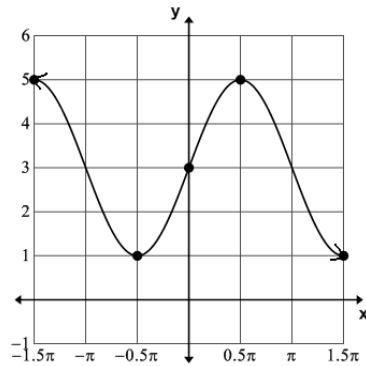
9. Let $(ab^3)^{-2} \div (a^5b^{-4})(a^4b) = a^mb^n$. Find $m + n$.

- (A) 4 (B) -2 (C) -3 (D) -4 (E) -14

10. If $a_1 = 3, a_2 = 6, a_3 = 12, a_4 = 24, a_5 = P, a_6 = 96, a_7 = Q, a_8 = R, \dots$, then $P + Q + R = ?$

- (A) 432 (B) 576 (C) 624 (D) 768 (E) 816

11. The equation $y = \underline{\hspace{2cm}}$ will produce this graph.



- (A) $2 - 3\cos(x - \pi)$ (B) $3 - 2\sin(\frac{1}{2}(2x + \pi))$ (C) $3 + 2\sin(x - \pi)$
 (D) $3 + 2\cos(x - \pi)$ (E) $3 - 2\sin(x + \pi)$

12. If $\tan^{-1}(a) = T$ and $\cos^{-1}(b) = C$, where $a, b > 0$, then $\tan(T) + \cos(C)$ equals:

- (A) $2a + b$ (B) $a - b$ (C) $a + b$ (D) $a - 2b$ (E) $a + 2b$

13. $1D_{316} + 24A_{16} - CE_{16} = \underline{\hspace{2cm}}_{16}$.

- (A) 3FE (B) 34F (C) 35D (D) 25E (E) 355

14. Roland Bones rolls a die then rolls a second die. Find the probability that the sum of the pips on the top faces is greater than 9 if the first die rolled shows a 5.

- (A) $5\frac{5}{9}\%$ (B) $11\frac{1}{9}\%$ (C) 20% (D) $33\frac{1}{3}\%$ (E) $55\frac{5}{9}\%$

15. The directrix of the parabola $(y - 3)^2 = -8(x + 2)$ is:

- (A) $x = -3$ (B) $x = -2$ (C) $x = 0$ (D) $x = 2$ (E) $x = 4$

16. When $3k - 1$ is divided by 8, the remainder is 2. What is the remainder when $2k + 5$ is divided by 8?

- (A) 1 (B) 2 (C) 3 (D) 5 (E) 7

17. The average rate of change of $f(x) = x^2 + bx$ from $x = 4$ to $x = 6$ is 14.5. Find the value of b .

- (A) 3.5 (B) 3.75 (C) 4 (D) 4.25 (E) 4.5

18. Find the remainder when 24^{14} is divided by 13.

- (A) 1 (B) 2 (C) 4 (D) 9 (E) 11

19. Tater Chip has a box containing five chips numbered 1, 2, 3, 4, 5. He wants to randomly draw two chips without replacement to determine the odds of drawing a 4. How many members are in the unsuccessful event's sample space?

- (A) 13 (B) 8 (C) 4 (D) 12 (E) 20

20. Which of the following numbers are considered to be "self" numbers?

- I. 21 II. 31 III. 43

- (A) I & III (B) II & III (C) II only (D) none of them (E) all of them

21. Which of the following mathematicians developed the ability to visualize in a fourth dimension and coined the term "polytopes"?

- (A) Ada Byron (B) Sonya Kovalevsky (C) Sophie Germain (D) Alicia Stott (E) Karen Smith

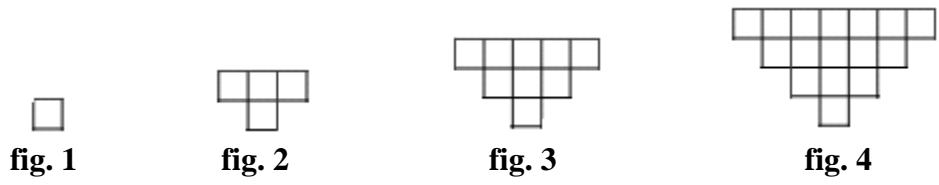
22. Sets A and N are subsets of the set of digits and letters used in base 16. Set A = {1, 3, 6, A, F}, set N = {1, 5, C}, and S = {A ∪ N}. Find the number of elements in the complement of S.

- (A) 1 (B) 7 (C) 9 (D) 10 (E) 15

23. If $5 \odot 2 = 13$, $3 \odot 3 = 6$, and $2 \odot 4 = 2$, find $2 \odot 8$.

- (A) -2 (B) -1 (C) $-\frac{1}{4}$ (D) 4 (E) 14

24. The figures below are made up of little squares. The side length of each little square is 1 cm. If the pattern of the shapes continues how many little squares will it take to form figure 7?



- (A) 13 (B) 36 (C) 49 (D) 57 (E) 64

25. Which of the following types of triangles are formed by plotting the points (-4, 3), (1, 2), and (-3, -1).

- (A)cute (O)btuse (R)ight (E)quilateral (S)calene (I)sosceles

- (A) A & E (B) O & S (C) A & S (D) R & I (E) R & S

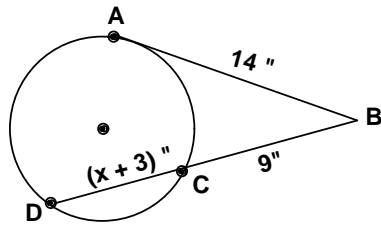
26. How many positive integer solutions does $2(x + y) = xy + 7$ have?

- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4

27. A tangent and a chord intersect in a point on the circle. The measure of the angle formed is _____ the measure of the intercepted arc.

- (A) one-third (B) one-half (C) two-thirds (D) equal to (E) twice

28. Find x using the information from the drawing below. (nearest tenth)



- (A) 9.8 (B) 8.7 (C) 6.0 (D) 5.5 (E) 2

29. In $\triangle PQR$, $PQ = 5$ cm, $QR = 7$ cm, and $m\angle PQR = 152^\circ$. Find $m\angle QPR$. (nearest minute)

- (A) $11^\circ 37'$ (B) $12^\circ 52'$ (C) $14^\circ 0'$ (D) $16^\circ 1'$ (E) $16^\circ 23'$

30. Which multiple of 11 is nearest to 10^3 ?

- (A) 979 (B) 990 (C) 999 (D) 1,001 (E) 1,011

31. The distances between the hash marks (|) are equal. Find the length of segment AD if $A = \frac{1}{3}$ and $E = 1\frac{1}{9}$.

- (A) $\frac{7}{12}$ (B) $1\frac{1}{4}$ (C) $\frac{7}{9}$ (D) $\frac{11}{36}$ (E) $\frac{7}{36}$

32. Fifteen students took a 10-question quiz. No student missed more than 5 questions. Find the standard deviation of the distribution shown in the chart. (nearest hundredth)

# wrong	1	2	3	4	5
# students	4	5	3	1	2

- (A) 1.23 (B) 1.31 (C) 1.72 (D) 2.47 (E) 2.50

33. The point (x, y) is an inflection point on the graph of the equation $y = \frac{8}{x^2 + 4}$. Find y .

- (A) 1.5 (B) 2 (C) $\frac{\sqrt{3}}{3}$ (D) $\frac{2\sqrt{3}}{3}$ (E) $\frac{\sqrt{2}}{3}$

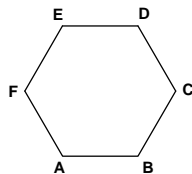
34. Tye Gur has a large box containing 50 golf balls, all of which are white or yellow. If the probability of drawing two yellow balls in a row without replacement is $\frac{256}{625}$, how many of the balls are yellow?

- (A) 35 (B) 32 (C) 30 (D) 28 (E) 20

35. The operation \odot is defined as $x \odot y = x^2 + 2xy + y^2$, where x, y are integers. Find the value of $(-1 \odot 3) \odot (5 \odot -7)$.

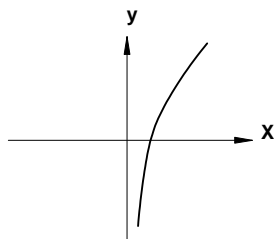
- (A) 16 (B) 25 (C) 36 (D) 64 (E) 121

36. The figure below is a regular hexagon. Find the area of $\triangle CDF$ if the area of the quadrilateral $ABCF$ is 20 cm^2 .



- (A) $6\frac{2}{3} \text{ cm}^2$ (B) $7\frac{1}{2} \text{ cm}^2$ (C) $12\frac{1}{2} \text{ cm}^2$ (D) $13\frac{1}{3} \text{ cm}^2$ (E) 15 cm^2
37. Which of the following equations have no real roots?
- (A) $x^2 + 4x - 3 = 0$ (B) $-2x^2 + 6x + 8 = 0$ (C) $x^2 - 14x + 12 = 0$
 (D) $3x^2 - 4x + 2 = 0$ (E) $4x^2 + 6x + 1 = 0$
38. Let $f_0 = 0, f_1 = 1, f_2 = 1, f_3 = 2, f_4 = 3, \dots, f_k = 6,765, \dots$ be the terms of the Fibonacci sequence. Find f_{k+1} .
- (A) 8,856 (B) 10,946 (C) 11,618 (D) 11,912 (E) 13,237
39. Cal Boye had a rope 30 feet long. He cut off 1 yard 1 foot 5 inches because it was frayed. Then he cut off 3 smaller ropes of lengths 4 yards, 2 yards 1 foot 8 inches, and 1 yard 2 feet 3 inches. How long was the remaining piece?
- (A) 3 inches (B) 8 inches (C) 11 inches (D) 1 foot 3 inches (E) 1 foot 8 inches
40. Will Wocker traveled 1,020 miles to his vacation resort. He traveled by train at 55 miles an hour and the same number of hours by plane at 285 miles an hour. How many hours did it take to reach his resort, disregarding any wait time?
- (A) 3 hrs (B) 4 hrs (C) 4.5 hrs (D) 5.5 hrs (E) 6 hrs
41. Willie Snarett is building a zoid trap in the shape of an isosceles trapezoid. His original plan has base lengths of 11 feet and 15 feet and a height of 7 feet. If he changes the plans adding 2 feet to the shorter base and decreasing the height 2 feet how much less area would he have?
- (A) 21 sq. ft (B) 19 sq. ft (C) 10.5 sq. ft (D) 4 sq. ft (E) 2 sq. ft
42. Mae Belait lives 275 miles from the airport. She didn't want to miss her plane, so she saved a half hour by averaging 5 miles per hour faster to the airport than her normal speed. What is her normal speed?
- (A) 57.5 mph (B) 55 mph (C) 52.5 mph (D) 52 mph (E) 50 mph
43. The angle of inclination from the top of Sid Upp's house to the top of Hi Upp's cell tower is 18° and the angle of depression to the base of the tower is 25° . How tall is Hi's tower if it is 150 meters from Sid's house? (nearest meter)
- (A) 103 m (B) 110 m (C) 119 m (D) 161 m (E) 279 m

44. A hot air balloon lifts off on a windless day, rising straight up from a football field. It is tracked by a range finder positioned 500 ft from the lift-off point. When the range finder's angle of elevation is $\frac{\pi}{8}$, the angle is increasing at the rate of 0.1 radians per minute. How fast is the balloon rising? (nearest ft/min)
- (A) 341 ft/min (B) 140 ft/min (C) 88 ft/min (D) 59 ft/min (E) 43 ft/min
45. The *Sir Kus* cruise ship sailed from Port Wring on a bearing of 200° for 300 km. The *Ha Lan* cruise ship sailed from Port Wring on a bearing of 100° for 200 km. How far was the *Sir Kus* from the *Ha Lan*? (nearest km)
- (A) 388 km (B) 250 km (C) 330 km (D) 245 km (E) 247 km
46. The Lake Ivie fishing report states the probability of catching a catfish is 40%, the probability of catching a bass is 25% , and the probability of catching both is 10%. What is the probability that a fisherman will catch a bass or a catfish? (nearest percent)
- (A) 55% (B) 6.5% (C) 45% (D) 75% (E) 20%
47. One-third of a pole is in the mud, one-half in the water, and three feet out of the water. How long is the pole?
- (A) 21 ft (B) 18 ft (C) 9 ft (D) 6 ft (E) not enough information
48. Point $P(3, 1)$ lies on the x - y plane. P is translated vertically -4 units to point Q . Then Q is reflected across the line $x = 1$ to point R . Then R is rotated 270° clockwise about the origin to point S . Then S is translated horizontally -5 units to point $T(x, y)$. Find $x + y$.
- (A) 4 (B) 1 (C) 0 (D) -1 (E) -3
49. Which of the following functions could be represented by this graph?



- (A) $y = ax^n, n > 1$ (B) $y = \log_a(x)$ (C) $y = ax$ (D) $y = ab^x, b > 1$ (E) $y = \frac{a}{x^n}$

50. If $r, s,$ and t are real numbers such that $r + s + t = 14$, $t^2 = r^2 + s^2$, and $rs = 14$, find the value of t .
- (A) 8 (B) 6 (C) 7 (D) 5 (E) 4

51. $\triangle ABC$ has vertices at $(-2, 2)$, $(1, -1)$, and $(5, 3)$. Find the measure of the smallest angle. (nearest degree)

- (A) 31° (B) 37° (C) 45° (D) 49° (E) 53°

52. Given that the set of natural numbers continue in the triangular pattern shown below, find the fourth term in row 8.

			2				(row 1)
			3	3			(row 2)
		4	5	4			(row 3)
	5	7	7	5			(row 4)
	6	9	12	9	6		(row 5)
	7	11	16	16	11	7	(row 6)
			...				(...)

- (A) 36 (B) 44 (C) 28 (D) 82 (E) 64

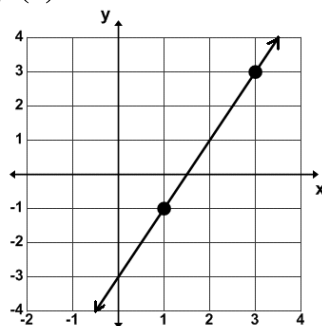
53. Which of the following equations have vertices $(-5, 1)$, $(3, 1)$ and foci $(-7, 1)$, $(5, 1)$?

- (A) $4x^2 + 10x - 5y^2 + 8y = 82$ (B) $5x^2 + 10x - 4y^2 + 8y = 79$ (C) $5x^2 + 8x - 4y^2 + 10y = 80$
 (D) $5x^2 - 10x - 4y^2 - 8y = 79$ (E) $4x^2 + 8x - 5y^2 + 10y = 80$

54. Rusty Pipes has a leaky pipe dripping water onto the floor forming a circular pool. The radius of the pool increases at a rate of 5 cm/min. How fast is the area of the pool increasing when the radius is 85 cm? (nearest cm^2/min)

- (A) $534 \text{ cm}^2/\text{min}$ (B) $31 \text{ cm}^2/\text{min}$ (C) $2,670 \text{ cm}^2/\text{min}$ (D) $267 \text{ cm}^2/\text{min}$ (E) $2,125 \text{ cm}^2/\text{min}$

55. The graph of $g'(x)$ is shown below. Find $g(7)$, when $g(-1) = 2$.



- (A) 30 (B) 26 (C) 11 (D) -2 (E) -14

56. Yu Neek is creating code words consisting of six letters from the word FRACTIONS. The first four letters of the code word must be consonants and the last two letters must be vowels. How many such six-letter code words are possible? (no repetitions)

- (A) 45 (B) 366 (C) 720 (D) 1,080 (E) 2,160

57. A recent poll showed that 26% of rural people supported a waste dump project, 68% opposed the project, and 6% had no opinion. What is the probability that of 30 randomly chosen people, 8 supported the project? (nearest percent)

- (A) 16% (B) 27% (C) 33% (D) 35% (E) 38%

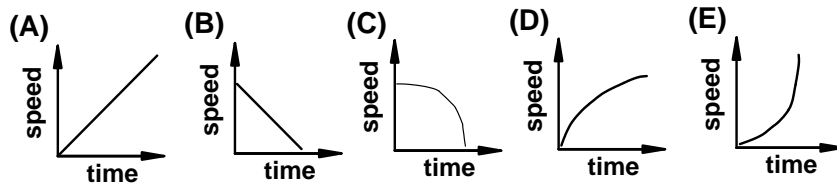
58. Let $\triangle PQR$ be an acute scalene triangle. Point K lies on the triangle opposite $\angle PRQ$ forming an equilateral triangle $\triangle KQR$. Find $m\angle PRK$ given $KR = 2''$ and $PK = 1.2$. (nearest degree)

- (A) 18° (B) 25 (C) 11° (D) 27° (E) 22°

59. Let $f(n) = 2f(n - 1) + 3f(n - 2)$, $f(1) = 1$, and $f(2) = 2$. Find $f(5)$.

- (A) 5 (B) 7 (C) 20 (D) 61 (E) 182

60. A ball is dropped from a balcony. Which graph shows how its speed changes with time up to the moment when it hits the ground, ignore drag due to air resistance?



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**University Interscholastic League
MATHEMATICS CONTEST
HS • Invitation B • 2020
Answer Key**

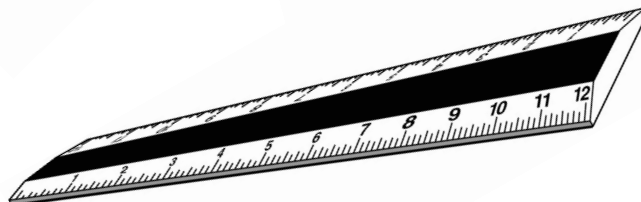
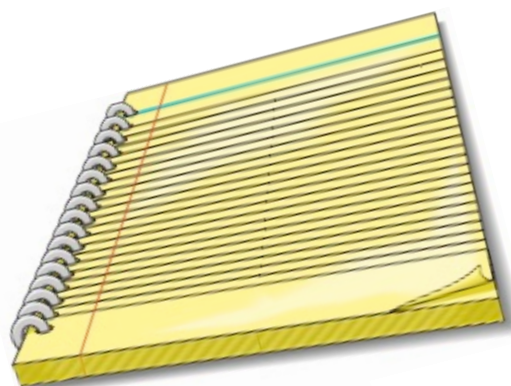
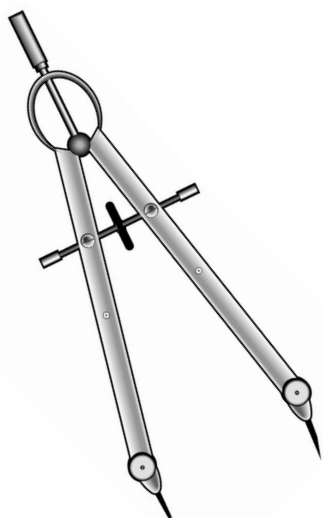
- | | | |
|-------|-------|-------|
| 1. C | 21. D | 41. A |
| 2. E | 22. D | 42. E |
| 3. B | 23. A | 43. C |
| 4. E | 24. C | 44. D |
| 5. C | 25. C | 45. A |
| 6. C | 26. C | 46. A |
| 7. D | 27. B | 47. B |
| 8. A | 28. A | 48. E |
| 9. D | 29. E | 49. B |
| 10. C | 30. D | 50. B |
| 11. E | 31.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



UNIVERSITY INTERSCHOLASTIC LEAGUE

Mathematics

District • 2020



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YOU ARE INSTRUCTED TO DO SO!

1. Evaluate: $(2 + 3) - 2 \times 8 \div 20 + 2^0$

- (A) 1.2 (B) 2.2 (C) 3.2 (D) 4.2 (E) 5.2

2. $\{\{o, n, e\} \cup \{u, n, o\} \cup \{e, i, n\}\} \cap [\{t, w, o\} \cup \{d, o, s\} \cup \{z, w, e, i\}]$ contains how many elements?

- (A) 10 (B) 8 (C) 5 (D) 3 (E) 1

3. Ester Bawnett bought a dozen plastic eggs, 3 chocolate bunnies, 6 yellow peeps, and 3 baskets. The plastic eggs cost 49¢ for a 3-pack. The bunnies were \$1.29 each. The peeps were 2 for 45¢. And the baskets were \$3.95 each. How much change would she get back if she paid her bill with a \$20 bill?

- (A) 48¢ (B) 97¢ (C) \$1.46 (D) \$3.55 (E) \$7.16

4. Let $(2x^2 - 3x - 5) \times (7x - 11) = ax^3 + bx^2 + cx + d$. Find $a + b + c + d$.

- (A) 24 (B) 5 (C) 2 (D) -10 (E) -47

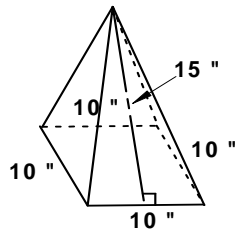
5. Let $24x^2 - 9x - a = (bx - 3)(cx + 5)$, where a , b , & c are integers. Find $a + b + c$.

- (A) -4 (B) -1 (C) 25 (D) 26 (E) 40

6. P, Q, and R are consecutive odd natural numbers, such that 3 times the sum of the smallest number and the largest number is 30 more than 4 times the middle number. Find the product of the smallest and the largest numbers.

- (A) 165 (B) 195 (C) 221 (D) 247 (E) 255

7. Find the volume of the square-based polyhedron shown. (nearest cubic inch)



- (A) 500 in^3 (B) 189 in^3 (C) 373 in^3 (D) 471 in^3 (E) 408 in^3

8. The odds of bowling a score above 250 is $\frac{3}{7}$. If 21 tournament contestants bowled 250 or less, then how many contestants bowled above 250?

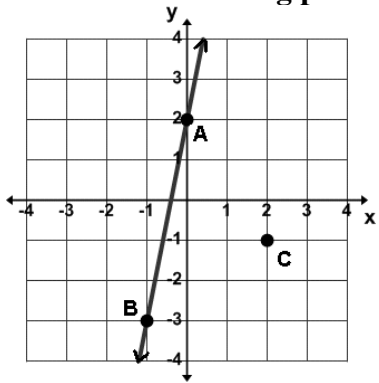
- (A) 19 (B) 16 (C) 7 (D) 36 (E) 9

9. Let $(a^0b^{-1}) \div (ab^2) \times (a^3b^{-4}) = a^m b^n$. Find m^n .

- (A) 4 (B) $\frac{1}{128}$ (C) -14 (D) $\frac{1}{32}$ (E) 49

10. Let $m\angle ABC = 2x - 3$ degrees, $m\angle CBD = 5x + 1$ degrees, and $\angle ABC$ be supplementary to $\angle CBD$. Find $m\angle CBE$ if $\angle ABC$ is complementary to $\angle CBE$.
- (A) 41° (B) 53° (C) 51° (D) 39° (E) 47°
11. Lily Garten has a rectangular pool for her famous lily pads. The pool is 50 feet wide and 70 feet long. Each pad needs a 3 ft by 3 ft area to grow in. What is the largest number of pads that she can have growing in her pool?
- (A) 359 (B) 400 (C) 291 (D) 240 (E) 388
12. If -1 , 1 , and 3 are the roots of $2x^3 - bx^2 - cx + d = 0$, then $b + c + d$ equals?
- (A) -3 (B) -2 (C) 7 (D) 10 (E) 14
13. Cal Hoarse has a son and a daughter, Rope and Riggin. Rope is three years older than Riggin. In one year Cal will be six times as old as Riggin is now. In ten years Cal will be fourteen years older than the combined ages of Rope and Riggin are at that time. What is Cal's present age?
- (A) 29 (B) 38 (C) 41 (D) 42 (E) 45
14. Let $\sin A = \frac{12}{37}$, where A is in QII. Find $\sec A$.
- (A) $-3\frac{1}{12}$ (B) $-2\frac{11}{12}$ (C) $-1\frac{2}{35}$ (D) $\frac{12}{37}$ (E) $\frac{35}{37}$
15. Find k if $(\sin(x) - \cos(x))^2 + (\sin(x) + \cos(x))^2 + k = 0$.
- (A) -4 (B) -2 (C) 1 (D) 2 (E) 3
16. Lotta Coins has two nickels and three dimes. She randomly arranges the coins in a single row. What is the probability that the coins at both ends are nickels?
- (A) 10% (B) 20% (C) 30% (D) 40% (E) 50%
17. Bea Drone flies 25 miles on a course heading 40° east of north. How far north has Bea flown at the end of the 25 miles? (nearest tenth)
- (A) 21.0 mi (B) 19.2 mi (C) 29.8 mi (D) 16.1 mi (E) 20.0 mi
18. Find the remainder when $f(x) = x^3 + 2x^2 + 3x + 4$ is divided by $x + 5$.
- (A) -86 (B) -64 (C) 18 (D) 738 (E) 194
19. Let $f(x) = \frac{5x^3 - 8}{x^2 + 3x - 1}$ and $s(x)$ be the slant asymptote of f . Find the value of $s(-2)$.
- (A) -25 (B) -23 (C) -5 (D) 16 (E) 27

28. Which of the following points lies on the line containing the points A and C.



- I. $(-1, -8)$ II. $(-1, 7)$ III. $(6, -7)$ IV. $(-2, 5)$

- (A) II & III (B) I, III, & IV (C) II & IV (D) III & IV (E) none of these

29. Which of the following equations can be obtained from the graph of the parent function $y = \cos(x)$ by applying a vertical stretch of 3 units, a vertical shift of -2 units, and a horizontal shift of 5 units?

- (A) $y = 3 - 2\cos(x - 3)$ (B) $y = 2 - 3\sin(x + 5)$ (C) $y = -2 + 3\cos(x - 5)$
 (D) $y = -2 + 3\cos(x + 5)$ (E) $y = -2 - 3\cos(x - 5)$

30. $(3D_{16}) \times (4_{16}) - AF_{16} = \underline{\hspace{2cm}}_{16}$.

- (A) 63 (B) 57 (C) 5D (D) B4 (E) 45

31. Let $f(x) = 2x + 5$, $g(x) = 5x - 2$, and $f(f(x + 1)) - g(g(x - 1)) = ax + b$. Find $a + b$.

- (A) 77 (B) 50 (C) 85 (D) 35 (E) 47

32. Tater Chip has a box containing four chips numbered 2, 3, 5, and 7. He wants to select two chips at random without replacement to try to determine the probability that the sum of the two chips is greater than 9. How many members will be in the successful event's sample space?

- (A) 2 (B) 4 (C) 6 (D) 8 (E) 12

33. Find the units digit of $28^{(27)} - 26$.

- (A) 0 (B) 2 (C) 6 (D) 8 (E) cannot be determined

34. Phil Ettup has a 2 gallon bucket that is 75% full of water. He adds two 20-ounce bottles of water to the bucket. Then he dips out three cups of water to water his plants. How many ounces of water are left in the bucket?

- (A) 188 oz (B) 204 oz (C) 208 oz (D) 226 oz (E) 272 oz

35. If a 30 question test is scored on a 0 to 45 scale, what is the least number of correct answers needed to score at least 75 on a 0 to 100 scale?

- (A) 22 (B) 23 (C) 25 (D) 33 (E) 34

36. How many positive integers between 200 and 600 are multiples of 4, but are not multiples of 5?

- (A) 19 (B) 20 (C) 30 (D) 79 (E) 80

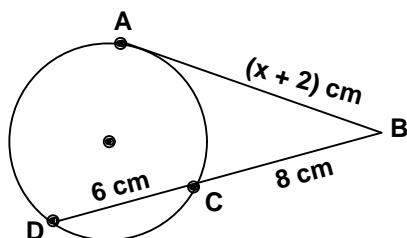
37. If $3x - 2y = 5$, $y = \frac{x-1}{4}$ and $kx + y = 6$, then k equals:

- (A) 3.222... (B) $3\frac{3}{11}$ (C) 3.444... (D) $2\frac{19}{22}$ (E) $2\frac{13}{22}$

38. Let P , Q , and R be the roots of $2x^3 - 3x^2 + 2x + 8 = 0$. Find $P + Q + R - PQR$.

- (A) 6.5 (B) 5.5 (C) 2.5 (D) -1.5 (E) -2.5

39. Find x using the information from the drawing below. (nearest tenth)



- (A) 8.6 cm (B) 9.0 cm (C) 10.6 cm (D) 12.0 cm (E) 12.6 cm

40. The orthocenter of an obtuse angled triangle lies _____ triangle.

- (A) inside the (B) on one of the vertices of the (C) on the circumcenter of the
(D) outside the (E) on the base of the

41. Find the positive integral value of k such that the roots of $4x^2 - 20x + k = 0$ are in a ratio of 1:9 and k is relatively prime to 4.

- (A) 2 (B) 5 (C) 7 (D) 9 (E) 45

42. Find the sum of all of the x -values of the positive integer ordered pairs (x, y) that satisfy the equation $x^2 + 5 = xy - 2x$.

- (A) 6 (B) 8 (C) 13 (D) 14 (E) 22

43. Point P lies on side BC of an acute triangle, $\triangle ABC$, such that segment AP bisects $\angle BAC$ and forms an isosceles triangle, $\triangle APC$. Find PC if $m\angle BAC = 50^\circ$ and $AP = 10''$. (nearest tenth)

- (A) 11.3'' (B) 7.1'' (C) 5.3'' (D) 4.7'' (E) 4.3''

44. Which of these mathematicians argued: "... in a race the quickest runner can never overtake the slowest, since the pursuer must first reach the point whence the pursued started, so that the slower must always hold a lead."

- (A) Aryabhata (B) Eratosthenes (C) Hypatia (D) Zeno of Elea (E) Theano

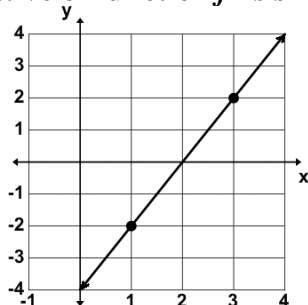
45. The positive square root of $15 - 20i = a + bi$. Find $a + b$. (nearest tenth)

- (A) 0.6 (B) 4.2 (C) 1.1 (D) 2.9 (E) 2.2

46. Bell Starr High School's math team had team scores of 562, 496, and 402 at the state meet the past three years. Find the standard deviation of their team scores. (nearest tenth)

- (A) 42.0 (B) 56.4 (C) 58.0 (D) 65.7 (E) 65.8

47. The graph of the derivative of function f is shown below. Find $f(5)$, when $f(3) = -2$.



- (A) 6 (B) 7.5 (C) 8 (D) 10.5 (E) 13

48. How many arrangements of six letters are possible using the letters from the words TEXAS PRIDE such that the second and fifth letters are vowels and the other letters are consonants?

- (A) 1,440 (B) 25 (C) 8,400 (D) 372 (E) 4,320

49. Willie Gethair drove to work at an average speed of 36 mph. On the way home, he hit traffic and only drove an average of 27 mph. His total time in the car was 1 hour and 45 minutes. How far does Willie live from work? (nearest mile)

- (A) 13 miles (B) 9 miles (C) 34 miles (D) 22 miles (E) 27 miles

50. Point $P(1, -5)$ lies on the x - y plane. P is 180° rotated clockwise about the point $A(1, -1)$ to point Q . Then Q is translated horizontally -4 units to point R . Then R is reflected across the line $y = -3$ to point S . What is the slope of the line through points A and S ?

- (A) 1 (B) 2 (C) 2.5 (D) 3.25 (E) 4

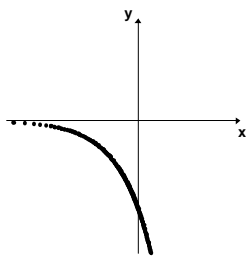
51. Let $f_0 = 0, f_1 = 1, f_2 = 1, f_3 = 2, f_4 = 3, \dots$ be the terms of the Fibonacci sequence. Find the least common multiple of f_8 and f_{12} .

- (A) 378 (B) 720 (C) 756 (D) 1,008 (E) 1,512

52. Saul T. Quacker is holding a duck race. The Eider ducks are numbered 1, 3, 6, 10, and 15. The Ruddy ducks are numbered 2, 1, 3, 5, and 8. What is the probability that the sum of the ducks' numbers of the first two ducks finishing the race is an odd number given that the first finisher is a Ruddy duck? (nearest whole percent)

- (A) 50% (B) 53% (C) 56% (D) 60% (E) 66%

53. Which of the following functions could be represented by this graph?



- (A) $y = ax^n, n > 1$ (B) $y = \log_a(x)$ (C) $y = ax$ (D) $y = ab^x, b > 1$ (E) $y = \frac{P(x)}{Q(x)}$

54. Let $S = 1 + \frac{1}{4} + \frac{1}{16} + \dots$. Find the least number of terms in this geometric progression such that $1\frac{1}{3} - S < \frac{4}{250}$.

- (A) 3 (B) 4 (C) 5 (D) 6 (E) 7

55. What is the smallest abundant Fibonacci number?

- (A) 8 (B) 21 (C) 34 (D) 55 (E) 144

56. The volume of air in a volleyball is decreasing at a steady rate of $\frac{2}{25}$ mL/min.. How fast will the radius be decreasing when the ball is 20 mm across? (nearest thousandth)

- (A) $\frac{8}{125}$ mm/min (B) $\frac{3}{50}$ mm/min (C) $\frac{11}{20}$ mm/min (D) $\frac{47}{1000}$ mm/min (E) $\frac{1}{25}$ mm/min

57. Which of the following functions are considered to be "neither an even nor an odd function"?

- I. $f(x) = x^5 - 4x$ II. $g(x) = 3x^2 + 8$ III. $h(x) = 2x^2 - x - 1$

- (A) II only (B) I & II (C) III only (D) II & III (E) none of these

58. Which of the following equations have vertices $(-3, 0)$, $(3, 0)$ and foci $(-5, 0)$, $(5, 0)$?

- (A) $25x^2 - 9y^2 = 225$ (B) $25x^2 - 16y^2 = 400$ (C) $16x^2 - 9y^2 = 144$
 (D) $4x^2 - 3y^2 = 12$ (E) $5x^2 - 3y^2 = 15$

59. $\triangle PQR$ is a right triangle with $m\angle PQR = 90^\circ$. Let point B lie on side QR, point A lie on side PQ, $RQ = 3''$, $BQ = \frac{1}{3}RQ$, $AQ = \frac{2}{3}PQ$, and $m\angle RPQ = 40^\circ$. Find $m\angle BAQ$. (nearest degree)

- (A) 13° (B) 23° (C) 27° (D) 33° (E) 40°

60. If the triangular pattern continues as shown below, then sum of the numbers in row 9 is:

2	(row 1)
4 6	(row 2)
8 10 12	(row 3)
14 16 18 20	(row 4)
...	

- (A) 720 (B) 729 (C) 738 (D) 810 (E) 819

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**University Interscholastic League
MATHEMATICS CONTEST
HS • District • 2020
Answer Key**

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