THE VIRTUAL MEET EXPERIENCE

2022 - 2023

HS VIRTUAL CHALLENGE MEET #1

MATHEMATICS

DO NOT OPEN TEST UNTIL TOLD TO DO SO

The Virtual Challenge Meets™

1. Solve for k if $\left|\frac{4k-2}{4}\right| = \left|\frac{3-5k}{6}\right|$ and $k > 0$.

(A) $\frac{5}{9}$ (B) $\frac{7}{11}$ (C) $\frac{2}{11}$ (D) $\frac{6}{11}$ (E) $\frac{4}{9}$

2. Andres travels the same route to work Monday through Friday every week. Last week, the average speeds on his trips were 65.8 mph, 57.2 mph, 66.7 mph, 71.0 mph and 62.8 mph. What was his average speed for the whole week? (nearest tenth)

(A) 64.7 mph (B) 64.4 mph (C) 64.5 mph (D) 65.1 mph (E) 65.3 mph

3. $\overline{AB}$ has endpoints A(3,5) and B(–7,3). Which of the following is an equation of the perpendicular bisector of $\overline{AB}$?

(A) $y = -5x - 6$ (B) $y = \frac{1}{5}x + \frac{22}{5}$ (C) $y = -5x - 16$ (D) $y = -5x + 20$ (E) $y = \frac{1}{5}x - \frac{28}{5}$

4. Elisa paid $12,000 down on a new Jeep Gladiator, which had a total cost of $49,505. The dealership is offering to finance the remainder of the cost, interest free, over 60 months. What will be the amount of each monthly payment?

(A) $604.28 (B) $618.75 (C) $622.90 (D) $625.08 (E) $630.17

5. Let $(3x+2)(ax+b) = 33x^2 + 19x - 2$. Find $a+b$.

(A) –13 (B) –11 (C) 15 (D) –15 (E) 10

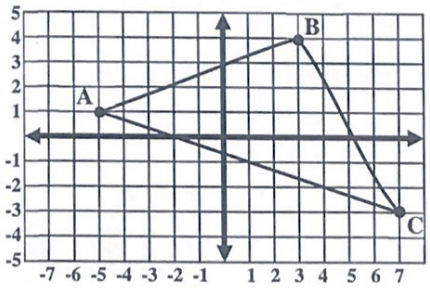
6. The volume of a rectangular solid is 1152 in^3. The length is triple the width and the height is two less than the width. Find the total surface area.

(A) 768 in^2 (B) 748 in^2 (C) 640 in^2 (D) 852 in^2 (E) 426 in^2

7. Which ordered pair is a solution to the system $y < -x - 4$ and $y \geq 3x + 1$?

(A) (2,3) (B) (–2,0) (C) (–4,0) (D) (–2,4) (E) (–5,–2)

For problems 8, 9 and 10, use the graph to the right.



8. Find the perimeter of triangle ABC. (nearest whole number)

(A) 25 (B) 26 (C) 27 (D) 28 (E) 29

9. Find the measure of angle $\angle ACB$. (nearest degree)

(A) 42° (B) 43° (C) 44° (D) 45° (E) 46°

10. Find the area of triangle ABC. (nearest whole number)

(A) 32 (B) 33 (C) 34 (D) 35 (E) 36

11. Consider a regular hexagon with vertices ABCDEF respectively. If AC = $12\sqrt{3}$, then the area of the hexagon is _____. (nearest whole number)

(A) 215 (B) 648 (C) 277 (D) 374 (E) 389

12. Bob rowed 18 km upstream in 2 hours. After resting, he rowed 18 km downstream in 1.5 hours. If he rowed at the same constant rate for the entire 36 km, what was the speed of the current?

(A) 1.0 kph (B) 1.2 kph (C) 1.25 kph (D) 1.5 kph (E) 1.75 kph

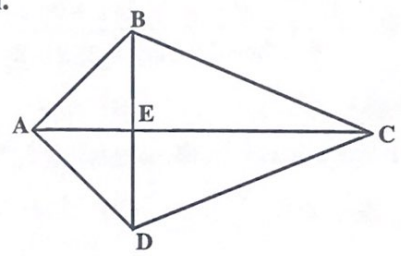
13. Points A, B, C and D lie on a circle with the center O. Chords $\overline{CD}$ and $\overline{AB}$ intersect at point P. If AP = $6x-3$, BP = $8x+2$, DP = $8x+4$ and CD = $10x+8$ then CD =_____. (nearest whole number)

(A) 29 (B) 31 (C) 30 (D) 32 (E) 28

14. The roots of $2x^3+bx^2+cx+d=0$ are $-3, -1$ and 2. $b+c+d=?$

(A) −18 (B) −9 (C) 9 (D) −26 (E) −22

15. Kite ABCD has an area of 80 in^2. If BE = 5 in, then AC = _____in.



(A) 8 (B) 16 (C) 10 (D) 12 (E) 18

16. Jennifer has twelve pictures of her grandpa. She plans to choose 5 of them to put in a frame with 5 openings in a row to hang them on her wall. How many different arrangements are possible in the frame?

(A) 3,960 (B) 95,040 (C) 792 (D) 106,920 (E) 42,768

17. A student has five straight straws with lengths of 6 in, 8 in, 9 in, 13 in and 15 in. How many acute triangles could the student make using only three straws at a time?

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

18. The polynomial x^3+ax^2-3x+b is divisible by $(x-2)$ and has a remainder of 6 when divided by $(x+1)$. Calculate the value of a.

(A) −12 (B) 18 (C) 6 (D) −10 (E) −2

19. If the area of the circle $x^2+y^2-12x+6y+k=0$ is 254.469, what is the value of k? (nearest tenth)

(A) −81 (B) −126 (C) −56 (D) −36 (E) 45

20. Which of the following is/are asymptotes of $f(x)=\dfrac{x^2-9}{x^2-2x-15}$.

I. $x=-3$ II. $x=3$ III. $x=5$ IV. $y=1$

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

21. Aaron deposits \$15,000 into an account that earns 5.75% annual interest compounded quarterly. Anthony deposits \$18,000 into an account that earns 3.25% annual interest compounded daily. How many years are required for the balance in Aaron's account to equal the balance in Anthony's account? (nearest tenth)

(A) 6.8 (B) 7.0 (C) 7.2 (D) 7.4 (E) 7.6

22. Consider a triangle with the vertices $(-6,5)$, $(-1,-1)$ and $(4,3)$. If the coordinates of the centroid of the triangle are (a,b), then $a+b=$_____.

(A) $1\frac{1}{3}$ (B) 1 (C) $1\frac{2}{3}$ (D) $2\frac{1}{3}$ (E) 2

23. If $\dfrac{A}{x-8}+\dfrac{B}{3x-1}=\dfrac{17x+2}{3x^2-25x+8}$ then $A+B=$_____.

(A) 7 (B) 5.5 (C) 6 (D) 5 3 320

24. If the pattern in the sequence 2, 8, 16, 26, 38, ... continues, find the 15th term.

(A) 252 (B) 284 (C) 302 (D) 236 (E) 268

25. Consider the geometric sequence 15, a, b, c, $115\frac{20}{27}$, d, ... If $a>0$, then $a+b+c=$_____.

(A) $136\frac{1}{9}$ (B) $136\frac{2}{3}$ (C) $136\frac{5}{9}$ (D) $136\frac{1}{3}$ (E) $136\frac{8}{9}$

26. Which of the following is a cube root of -512?

(A) $-4-4\sqrt{3}i$ (B) $-4\sqrt{3}-4i$ (C) $-4\sqrt{3}+4i$ (D) $4+4\sqrt{3}i$ (E) $4\sqrt{3}+4i$

27. The graph of $y=\frac{2}{3}\tan(2x)$ has a vertical asymptote at $x=$_____.

(A) $\frac{7\pi}{6}$ (B) π (C) $\frac{5\pi}{4}$ (D) $\frac{5\pi}{2}$ (E) $\frac{3\pi}{2}$

28. Given that $\cot\alpha=-\frac{8}{15}$, $\sin\beta=-\frac{7}{25}$ and that neither α nor β in standard position terminates in QIV, find the exact value of $\cos(\alpha-\beta)$.

(A) $\frac{207}{425}$ (B) $\frac{87}{425}$ (C) $-\frac{416}{425}$ (D) $-\frac{304}{425}$ (E) $-\frac{416}{87}$

29. Lynn started hiking from her cabin and traveled 5 miles on a bearing of 18°, then changed direction and hiked another 7.2 miles on a bearing of 118°. How far would Lynn have to hike to go straight back to the cabin? (nearest tenth)

(A) 10.0 mi (B) 11.6 mi (C) 9.6 mi (D) 8.0 mi (E) 4.6 mi

30. If $f''(x) = 18x - 10$, $f'(1) = 7$ and $f(-1) = -25$, find $f(2)$.

(A) 11 (B) 15 (C) 20 (D) –9 (E) 2

31. Clyde stood on a platform at the water's edge watching the USS Missouri sail directly away. The high point on the Missouri is 38 ft above the waterline. Clyde's eye level was 15 ft above the water line. How far was the high point of the Missouri from Clyde when the high point disappeared from his sight? The radius of the earth is 3960 mi. (nearest tenth)

(A) 11.8 mi (B) 13.2 mi (C) 12.3 mi (D) 12.0 mi (E) 14.8 mi

32. The vertex of the parabola $2x^2 - 24x - y = -18$ is (a,b). $a + b =$ _____.

(A) –54 (B) –48 (C) –60 (D) 60 (E) –44

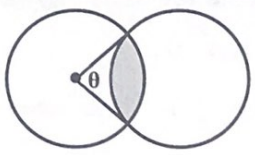
33. Assume that the license plates in a small country must consist of 3 letters followed by 4 digits with no repeating letters or digits. How many distinct license plates can be formed with this arrangement?

(A) 175,760,000 (B) 47,174,400 (C) 546,000 (D) 78,624,000 (E) 23,860,200

34. Find the rectangular coordinates of the point with polar coordinates $\left(8, \frac{7\pi}{3}\right)$. (nearest tenth)

(A) (6.9, 1.7) (B) (1.0, 4.0) (C) (4.0, 6.9) (D) (6.9, 4.0) (E) (6.9, 1.0)

35. The illustration shows two congruent circles each with a radius of 23 cm and $\theta = 1.3$ radians. The area of the shaded region is _____ cm^2. (nearest whole number)



(A) 178 (B) 688 (C) 344 (D) 89 (E) 676

36. Paul's mischievous roommate removed all of the labels from the cans in Paul's pantry. He knows that he has 4 cans of corn, 2 cans of peas and 2 cans of beans. If Paul decides to open cans until he opens a corn then stop, find E(x), the number of cans Paul should expect to open to before he stops.

(A) $\frac{7}{6}$ (B) 2 (C) $\frac{9}{5}$ (D) $\frac{4}{3}$ (E) $\frac{3}{2}$

37. Find the distance between the plane $2x - 7y + 3z = 11$ and the point (1, 3, 5). (nearest tenth)

(A) 1.9 (B) 0.8 (C) 1.7 (D) 1.1 (E) 1.5

38. Claire tracked her bakery sales for 6 days. Her total sales for each day were \$3,280, \$2,892, \$3,001, \$2,487, \$3,562 and \$3,325. Find the sum of the mean, median and range of this data. (nearest dollar)

(A) \$6,232 (B) \$7,168 (C) \$7,446 (D) \$7,307 (E) \$6,371

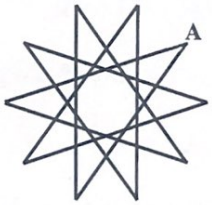
39. Find the slope of the line tangent to the graph of $f(x) = x - \frac{7}{x}$ at the point (7,6).

(A) $\frac{6}{7}$ (B) $\frac{8}{7}$ (C) $\frac{1}{2}$ (D) $\frac{7}{3}$ (E) 1

40. Find the fourth degree Maclaurin polynomial for $f(x) = \cos(x)$, then calculate the magnitude of the exact error when evaluating $f(0.9)$ using this polynomial. (nearest hundred thousandth)

(A) 0.00073 (B) 0.00089 (C) 0.00127 (D) 0.00065 (E) 0.00103

41. The angles at each point on the star shown are congruent. What is m∠A ?



(A) 18° (B) 30° (C) 32° (D) 36° (E) 45°

42. If $(3-2i)(2+7i) \div (1+i) = a+bi$, then $b =$_____.

(A) −37 (B) $\frac{37}{2}$ (C) 37 (D) $-\frac{3}{2}$ (E) $\frac{3}{2}$

43. Consider two vertical posts that are 80 ft apart. Post A is 18 ft tall and post B is 26 ft tall. They are to be stayed by two wires attached to a single stake. A wire runs from ground level to the top of each post. Find the least amount of wire needed. (nearest inch)

(A) 91' 4" (B) 90' 8" (C) 92' 2" (D) 90' 7" (E) 92'

44. Find the units digit of $47^{26} - 91$.

(A) 0 (B) 2 (C) 4 (D) 6 (E) 8

45. Let $\sum a_n$ be a series with nonzero terms. The Ratio Test for determining the convergence or divergence will show that the series diverges when $\lim_{n\to\infty} \left| \frac{a_{n+1}}{a_n} \right| =$ _____.

(A) 0 (B) 0.25 (C) 0.5 (D) 1 (E) 1.25

46. Consider the function $f(x) = \frac{6x}{x^2 - 1}$. Find the y-intercept of the line tangent to $f(x)$ when $x = 2$.

(A) $\frac{8}{3}$ (B) $\frac{32}{3}$ (C) $\frac{22}{3}$ (D) $\frac{16}{5}$ (E) $\frac{32}{5}$

47. The intersection of the three perpendicular bisectors of the sides of a triangle is called the_____.

(A) Circumcenter (B) Centroid (C) Center (D) Orthocenter (E) Incenter

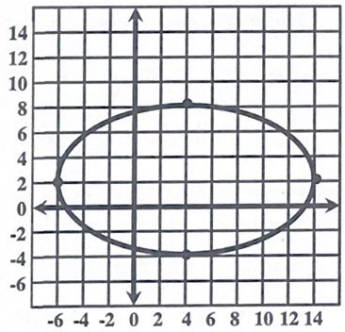
48. What is the angle between the vectors $\langle 4,-2\rangle$ and $\langle -3,-7\rangle$? (nearest degree)

(A) 116° (B) 47° (C) 133° (D) 83° (E) 87°

49. The parabola $y=-x^2+8x-12$ and the line $y=2x-12$ intersect at the points A and B. The midpoint of $\overline{AB}$ is the point (a,b). $a+b=$ _____.

(A) 3 (B) −9 (C) −3 (D) −6 (E) 0

50. What is the eccentricity of the ellipse shown? (nearest hundredth)



(A) 0.64 (B) 0.36 (C) 0.60

(D) 0.80 (E) 1.33

51. Find the area bounded by the graphs of the parabola $y=-x^2+8x-12$ and the line $y=2x-12$.

(A) 36 (B) 72 (C) 48 (D) 42 (E) 32

52. A student is randomly chosen from a large class. Use the information in the table to find the probability that the student selected did not pass given that he/she did not attend tutoring.

Event	Probability
Attended tutoring	0.45
Attended tutoring and passed	0.40
Did not attend tutoring and did not pass	0.15

(A) $0.\overline{3}$ (B) 0.2 (C) $0.2\overline{7}$ (D) $0.\overline{27}$ (E) 0.375

53. Karen rolled a fair die 7 times. Find the probability that she got at least one 6. (nearest thousandth)

(A) 0.721 (B) 0.999 (C) 0.738 (D) 0.981 (E) 0.732

54. $9B38A_{12}+6A74B_{12}=$ _____$_{12}$

(A) 14AB19 (B) 149B19 (C) 149A19 (D) BBB19 (E) 3083B

55. A mill produces bakery bags of flour that have a mean weight of 50 pounds with a standard deviation of 4 oz. The production process is such that the weight of each bag produced is independent of the others. The weights are approximately normally distributed. If three bags are randomly selected, what is the probability that all three will weigh more than 50.2 pounds? (nearest ten-thousandth)

(A) 0.0084 (B) 0.0089 (C) 0.0091 (D) 0.0095 (E) 0.0097

56. An equilateral triangle has a perimeter of 438 cm. Find the circumference of a circle that has the same area as the triangle. (nearest whole number)

(A) 170 (B) 108 (C) 427 (D) 341 (E) 328

57. The square root of 1161_8 is:

(A) 25_8 (B) 27_8 (C) 33_8 (D) 30_8 (E) 31_8

58. This mathematician introduced the notation $\frac{dy}{dx}$ for derivatives, which he referred to as a ratio of infinitesimals?

(A) Leibniz (B) Napier (C) Venn (D) Boole (E) Stott

59. The probability that Liz will get a multiple choice question right by randomly guessing is 0.25. If she guesses on every question on a 20-question quiz, find the probability that she will make above a 30%. (nearest thousandth)

(A) 0.214 (B) 0.244 (C) 0.783 (D) 0.217 (E) 0.783

60. Find $f(-5)-f(0.5)+f(1)$ if $f(x)=\begin{cases} 3x+2, & x\le -1 \\ 2x, & -1<x<1 \\ 3-4x, & x\ge 1 \end{cases}$

(A) –14 (B) –12 (C) 7 (D) 14 (E) –15

Name _____ Grade Level_____

Tie Breaker: Points scored on Stated and Geometry Problems			
	+ _____	+ _____	+ _____

5x(Last Problem Attempted)	+ _____	+ _____	+ _____
7x(Number Incorrect)	− _____	− _____	− _____
2x(Number Incorrect SDs)	− _____	− _____	− _____
TOTAL SCORE	_____	_____	_____

Calculator Applications

2022–2023

HS Virtual Challenge Meet #1

DO NOT OPEN THE TEST UNTIL INSTRUCTED TO BEGIN

I. Calculator Applications rules and scoring—See UIL Constitution

II. How to write the answers

A. For all problems except stated problems as noted below—write three significant digits.

1. Examples (* means correct but not recommended)

Correct: 12.3, 123, 123.*, 1.23x10*, $1.23\text{x}10^{0}$* $1.23\text{x}10^{1}$, $1.23\text{x}10^{01}$, .0190, 0.0190, $1.90\text{x}10^{-2}$

Incorrect: 12.30, 123.0, $1.23(10)^{2}$, $1.23\cdot10^{2}$, $1.230\text{x}10^{2}$, $1.23*10^{2}$, 0.19, $1.9\text{x}10^{-2}$, $19.0\text{x}10^{-3}$, 1.90E-02

2. Plus or minus one digit error in the third significant digit is permitted.

B. For stated problems

1. Except for integer, dollar sign, and significant digit problems, as detailed below, answers to stated problems should be written with three significant digits.

2. Integer problems are indicated by (integer) in the answer blank. Integer problems answers must be exact, no plus or minus one digit, no decimal point or scientific notation.

3. Dollar sign ($) problems should be answered to the exact cent, but plus or minus one cent error is permitted. The decimal point and cents are required for exact-dollar answers.

4. Significant digit problems are indicated by underlined numbers and by (SD) in the answer blank. See the UIL Constitution and Contest Manual for details.

III. Some symbols used on the test

A. Angle measure: rad means radians; deg means degrees.

B. Inverse trigonometric functions: arcsin for inverse sine, etc.

C. Special numbers: π for 3.14159 ...; e for 2.71828 ...

D. Logarithms: Log means common (base 10); Ln means natural (base e); exp(u) means e^{u}.

23U-1. $-0.65 + 0.487 - 1.77$ ---------- 1=_____

23U-2. $(-44.7 - 18.9)/(-48.3) + 0.262$ ---------- 2=_____

23U-3. $(-6.53 - \pi - 6.08 + 3.54) \times (1.05)$ ---------- 3=_____

23U-4. $\dfrac{(1630 - 1440)}{\{(-0.0451)/(0.082)\}} + (80.2 - 23.6)$ ---------- 4=_____

23U-5. $\dfrac{(79.9 + 75.4 - 252)(80.6)}{(-53.6)(67.4)(23.7)}$ ---------- 5=_____

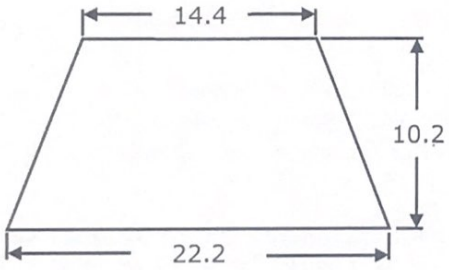
23U-6. What is $2814 \div 7.2$?---------- 6=_____

23U-7. What is the reciprocal of the product of 117 and 97.9? ---------- 7=_____

23U-8. How many inches are in 2 miles?---------- 8=_____ in

23U-9.

ISOSCELES TRAPEZOID



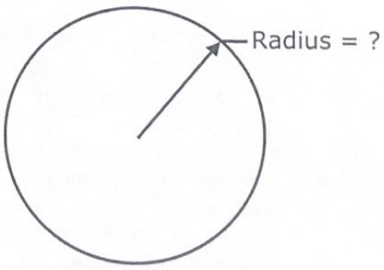
Area = ?

23U-9 =_____

23U-10.

CIRCLE

Circumference = 218



23U-10 =_____

23U-11. $\dfrac{(-4.79 + 4.29)(9.22 - 3.71 + 8.54)}{(\pi)(7.91) - 3.52}$ ---------- 11=_____

23U-12. $\dfrac{(0.0603)(-7.72) - (-1.87 + 1.39)(2.55)}{(-3.59 + 12.8 + 2.84)(9.26)}$ ---------- 12=_____

23U-13. $\dfrac{(531)(330 - 222)\{-5.96 \times 10^5 - (646)(-320)\}}{(-717 + 500)(-728 - 1370)}$ ---------- 13=_____

23U-14. $\dfrac{(1990 + 682 - 219)(0.00408 + 0.0107 - 0.00222)}{(-3.47 - 0.68)(4.15)(-4.72 - 0.54)}$ ---------- 14=_____

23U-15. $\dfrac{(52800 + 19300 - 29000)(0.391 - 0.194 - 0.897)}{(-267)(164)(-541)(5.77 + 4.32 + 5.24)}$ ---------- 15=_____

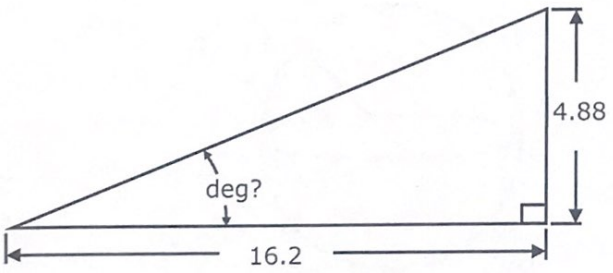
23U-16. A city is located at 40° south latitude. What is the width of a time zone here, assuming that it represents 1/24 of the circumference of Earth at this latitude?---------- 16=_____ mi

23U-17. What number when added to the numerator and denominator of $\frac{2}{5}$ yields –25?---------- 17=_____

23U-18. Assuming 365 days per year with 6 workdays per week, how many work days on average are in a year?---------- 18=_____ days

23U-19.

RIGHT TRIANGLE

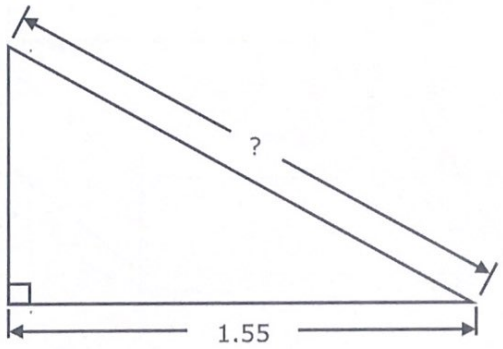


23U-19 =_____

23U-20.

RIGHT TRIANGLE

Area = 0.992



23U-20 =_____

23U-21. $\sqrt{\frac{(9.52)(1.22)}{560 + 282}} + 0.0168$ ---------- 21=_____

23U-22. $\left[\frac{(0.892)(0.334)}{\pi} + 0.05\right]^2 + \sqrt{4.61 \times 10^{-9}}$ ---------- 22=_____

23U-23. $(6.17)(0.0672)\sqrt{(-0.398)^2/0.462} + 1/\sqrt{6.19 + 15.1}$ ---------- 23=_____

23U-24. $(395)(0.0242) + \sqrt{(202)/(5.93)} + [(0.303)(8.16)]^2$ ---------- 24=_____

23U-25. $\frac{\sqrt{0.0528 + 0.00811 + (0.00135)/(0.0392)}}{0.0106 + 0.00451}$ ---------- 25=_____

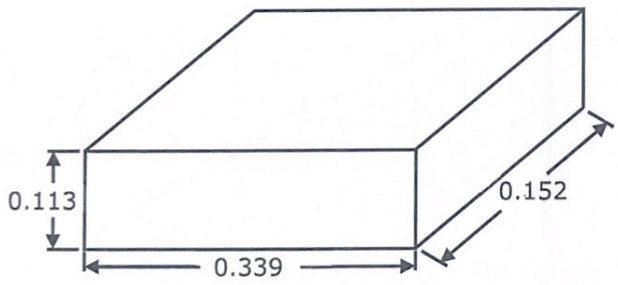
23U-26. The width of the two-lane highway from Argyle to Denton is 24 ft. If there is a 9.5 in layer of asphalt on this 6-mile stretch of highway, what is the volume of required asphalt? ---------- 26=_____ ft^3

23U-27. Erica entered the Driggs, Idaho 8-mile trail race in August. She ran the first 4 miles at a steady pace before the altitude got to her. She walked the last 4 miles at a speed equal to one-half of her running speed. If her total time was exactly 2 hours, what was her running speed during the first four miles? ---------- 27=_____ mph

23U-28. James can mow Russell's yard in 2 hr 45 min 7 sec. Carolyn can mow Russell's yard in 2 hr 20 min 15 sec. If they work together, how long would it take them to mow Russell's yard? ---------- 28=_____ min(SD)

23U-29.

RECTANGULAR SOLID

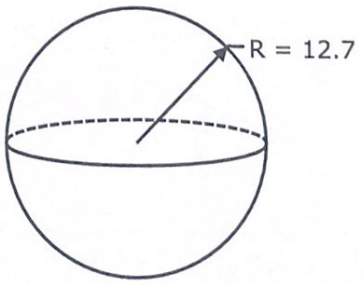


Volume = ?

23U-29 =_____

23U-30.

SPHERE



Surface Area = ?

23U-30 =_____

23U-31. $\left[\dfrac{-5.76\text{x}10^{-5}}{8.12\text{x}10^{-5} + 6.24\text{x}10^{-5}} + 1.8\right] \text{x} \left\{1990 + (-60.7)^2 - \sqrt{2.48\text{x}10^{7}}\right\}$ 31=_____

23U-32. $\sqrt{\dfrac{4.98}{\sqrt{95.5 + 27.7}}} \text{ x } \left[\dfrac{1}{(8.54 - \pi)^2} + \dfrac{1}{(8.09 + 7.26)^2}\right]$ ---------- 32=_____

23U-33. $\dfrac{[(77.5 - 54)(0.6/0.776)]^{1/2}}{(0.717)^2 + (0.424 + 0.601)^2 + 0.488}$ ---------- 33=_____

23U-34. $\dfrac{\sqrt{(6.28)/\{(3.69)/\sqrt{5.49}\}}}{0.813 + (0.238)(1.73)} + \{2.27 + 6.67\}^{1/2}$ ---------- 34=_____

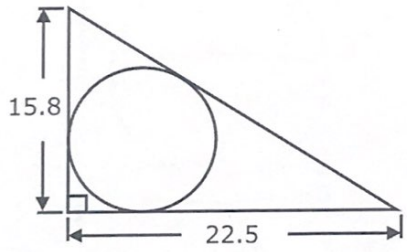
23U-35. $\dfrac{\left[\dfrac{(-9.55 + 8.8)}{(809 + 1460)}\right]^2 + \sqrt{\dfrac{5.09\text{x}10^{-15} + 1.56\text{x}10^{-14}}{\sqrt{0.553}}}}{\{(1.19)/(-0.888)\}^2}$ ---------- 35=_____

23U-36. Find a number such that the sum of the natural and base ten logarithms equal 177? ---------- 36=_____

23U-37. The line $2x + 3y = 7$ intersects the parabola $y = 0.75(x - 4)^2 - 2$ at points A and B. AB = ? ---------- 37=_____

23U-38. Isaac is in an airplane flying at 36,000 ft elevation. Find the distance from Isaac to the horizon. ---------- 38=_____ mi

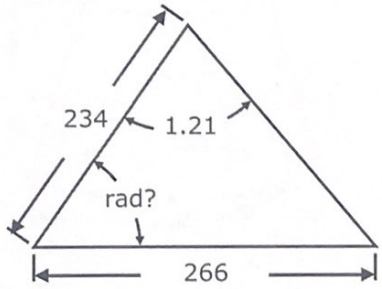
23U-39. RIGHT TRIANGLE AND CIRCLE



Area of Circle = ?

23U-39 =_____

23U-40. SCALENE TRIANGLE



23U-40 =_____

23U-41. $\dfrac{10^{-(4.14 - 7.24)}}{-0.0145 + 0.0109}$ ---------- 41=_____

23U-42. $3.54\text{x}10^{-4}\, e^{0.388} + (1.38\text{x}10^{-4})\, e^{-0.349}$ ---------- 42=_____

23U-43. $\dfrac{\text{Ln}(0.0985 + 0.185 - 0.0118)}{(-0.00133)}$ ---------- 43=_____

23U-44. $(2.27)^3 + (21 - 14.1)^{0.735}$ ---------- 44=_____

23U-45.(deg) $\dfrac{\cos\{(30.4°)/(7.32)\}}{\sin\{100° - 456°\}}$ ---------- 45=_____

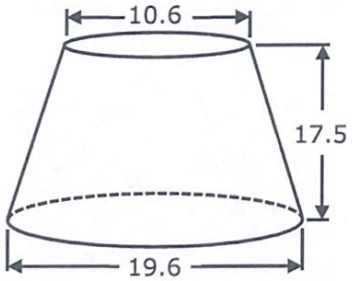
23U-46. The city square of Crosbyton has a perimeter of 0.25 mi. The courthouse in the center of the square is 48 ft high. If a 2 ft by 2 ft scaled model of the city square was constructed, how tall on the model would the courthouse be? ---------- 46=_____ in

23U-47. The population of Blackfoot in 10-year increments starting in 1970 is 13300, 13680, 14080, 14450, 14840 and 15250. Based on this data, predict the year the population will exceed 18000.---------- 47=_____ integer

23U-48.(rad) Solve for the negative value of k if $(12 - k)^{-3} \sin(k) = 9 - k^2$. -- 48=_____

23U-49.

FRUSTUM



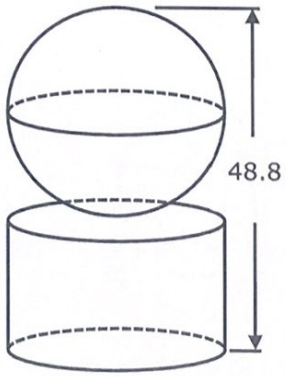
Total Surface Area = ?

23U-49 =_____

23U-50.

SPHERE AND CYLINDER

Volume of Sphere = Volume of Cylinder



Lateral Area of Cylinder = ?

23U-50 =_____

23U-51. $\dfrac{(-0.037)\,10^{-(8.26\,-\,3.29)}}{0.0865 + 0.0189}$ ---------- 51=_____

23U-52. $\dfrac{1 + e^{+\{0.84\,+\,(0.639)(\pi)\}}}{(1.96\times10^{-4})(9.5 - e^{(-0.207)})}$ ---------- 52=_____

23U-53. $\dfrac{\mathrm{Ln}\{(9160)(8250)(6690)\}}{5.71\times10^{5} + (67200)\,\mathrm{Ln}(83500)}$ ---------- 53=_____

23U-54. $\dfrac{(-4490 + 7310)^{-0.834}}{(2810)^{-(0.484\,+\,0.991)}}$ ---------- 54=_____

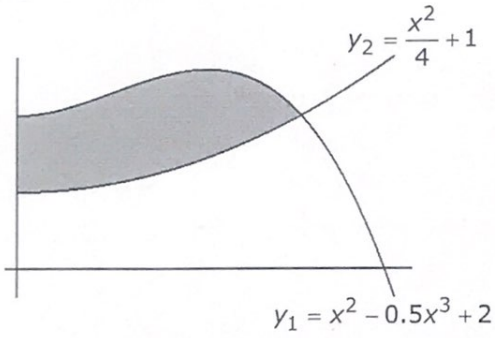
23U-55.(rad) $\dfrac{\arctan\{1.39 + (2.45)(0.407)\}}{\arcsin\{(4.71 + 0.839)/6.45\}}$ ---------- 55=_____

23U-56.(rad) What is the maximum value of $f(x) = 45\cos(x-2) - 0.3x^4$?---- 56=_____

23U-57. A 12-ft-long cord is cut into two pieces. One piece is used to form a square and the other piece is used to form a circle. Find the perimeter of the square if the sum of the areas is minimized. ---------- 57=_____ ft

23U-58. If $\det\left(\begin{bmatrix}2&4&6\\8&1&w\\5&7&9\end{bmatrix}\cdot\begin{bmatrix}1&3&5\\7&9&w\\4&6&8\end{bmatrix}\right) = -1608.75$ and $w > 0$ then w =?------- 58=_____

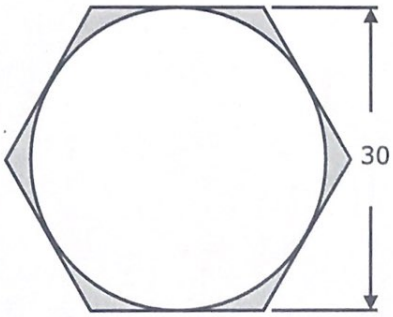
23U-59.



Shaded Area = ?

23U-59 =_____

23U-60. REGULAR HEXAGON AND CIRCLE



Shaded Area = ?

23U-60 =_____

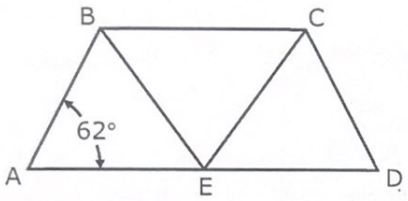
23U-61. Tan leaves Snyder and heads toward Dalhart, which is 294 miles away. After traveling for one hour at 62 mph, he speeds up to 75 mph. How long does the trip take? ---------- 61=_____ hr

23U-62. Evaluate 2022^{-2023}. ---------- 62=_____

23U-63. Ty accelerates from rest at 8.25 ft/s^2 over a distance of 45 ft. How long does it take him to run 220 yd at the final velocity? ---------- 63=_____ s

23U-64. ISOSCELES TRAPEZOID

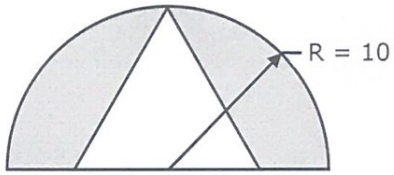
AE = ED = BE = 12



Area = ?

23U-64 =_____

23U-65. SEMICIRCLE AND EQUILATERAL TRIANGLE



Shaded Area = ?

23U-65 =_____

23U-66. $\text{Log}\left[(4.31)^{-\pi}\right] + (4.14)\text{Log}\left[(4.31)^{(8.37)}\right]$ ---------- 66=_____

23U-67. (rad) cos(1.92 - 0.563) - cos(1.92 + 0.563) ---------- 67=_____

23U-68. (deg) $\sqrt{1 + \left[\frac{\cos(61.9°)}{\sin(61.9°)}\right]^2} \times \frac{\cos(-68.5°)}{\sin(-68.5°)}$ ---------- 68=_____

23U-69. $1 + (0.1) + \frac{(0.1)^2}{2} + \frac{(0.1)^3}{6} + \frac{(0.1)^4}{24}$ ---------- 69=_____

23U-70. $\frac{-68.8}{\sqrt{62}}\,\text{Ln}\left[\frac{\sqrt{(64.9)^2 + (3070)} + \sqrt{3290}}{\sqrt{1.75} + (57.2)(0.00989)}\right]$ ---------- 70=_____

The Virtual Challenge Meets

HS Number Sense Test • VCM #1 • 2022-2023

Final ____ ____
2nd ____ ____
1st ____ ____
Score Initials

Contestant's Name _____

School _____

Contestant's Grade 9 10 11 12

Read directions carefully before beginning test

DO NOT UNFOLD THIS SHEET UNTIL TOLD TO BEGIN

Directions: Do not turn this page until the proctor gives the signal to begin. This is a ten-minute test test. There are 80 problems. Solve accurately and quickly as many as you can in the order in which they appear. ALL PROBLEMS ARE TO BE SOLVED MENTALLY. Make no calculations with paper and pencil. Write only the answer in the space provided at the end of each problem. Problems marked with an (*) require approximate integral answers; any answer to a problem with an asterisk that is within five percent of the exact answer will be scored correct; all other problems require exact answers.

The person conducting this contest should explain these directions to the contestants.

STOP – WAIT FOR SIGNAL!

(1) $2023 - 1975 =$ _____

(2) $2023 + 2022 + 2021 + 2020 + 2019 =$ _____

(3) $74 \times 0.7 =$ _____ (decimal)

(4) $\frac{7}{5} \times \frac{25}{21} =$ _____ (improper fraction)

(5) $1.333\ldots =$ _____ (improper fraction)

(6) $18 \times 125 =$ _____

(7) $16^2 =$ _____

(8) $8\frac{1}{2} - 3\frac{5}{6} =$ _____ (mixed number)

(9) $43\frac{1}{2}\% =$ _____ (fraction)

*(10) $142 + 1837 - 1398 =$ _____

(11) $59 \times 61 =$ _____

(12) Which is greater 0.64 or $\frac{5}{8}$? _____

(13) $27144 \div 9$ has a remainder of _____

(14) $11^3 =$ _____

(15) The greatest common divisor of 18 and 45 is _____

(16) The LCM of 18 and 45 is _____

(17) $12 \times 144 =$ _____

(18) $44 \times 250 =$ _____

(19) $\frac{13}{10} + \frac{10}{13} =$ _____ (mixed number)

*(20) $593 \times 302 =$ _____

(21) If 10 pods cost \$27.00, then 15 pods cost \$_____

(22) The volume of a cube with an edge of 9 is _____

(23) If $11^x = 7$, then $11^{2+x} =$ _____

(24) $47 \times 43 =$ _____

(25) 4 gallons = _____ pints

(26) The mean of 3, 7, 4, 1, 2, 7, 5, and 11 is _____

(27) $63 \times 43 =$ _____

(28) $\frac{23}{33} = 0.ababab\ldots$ and $a + b =$ _____

(29) $44^2 + 36^2 =$ _____

*(30) 2023 gallons = _____ cubic inches

(31) $13^2 + 39^2 =$ _____

(32) If $3.25 \times k = 1$, then $k =$ _____

(33) The number of positive integral divisors of 24 is _____

(34) $2A8_{15} =$ _____$_{10}$

(35) $53^{41} \div 41$ has a remainder of _____

(36) $\left(\sqrt[3]{125} + \sqrt{169}\right)^2 =$ _____

(37) $(x^2 + 3x + 5)^2 = ax^4 + bx^3 + cx^2 + dx + e$, then $a + b + c + d + e =$ _____

(38) $[37 + 21 \times 23 - 15] \div 9$ has a remainder of _____

(39) $\frac{1}{14} =$ _____ % (mixed number)

*(40) $\sqrt{71235} =$ _____

(41) How many total days are will there be from January 1, 2024 through December 31, 2027, inclusive? _____

(42) The sum of the abscissae of the x-intercepts of $y = 2x^2 - 18x - 5$ is _____

(43) $44^2 + 44 = 90k$ and $k =$ _____

(44) The coefficient of the x^4y^2 term in the expansion of $(x + 3y)^6$ is _____

(45) $({}_6C_2)^2 =$ _____

(46) If y varies inversely with x and $y = 15$ when $x = 8$, then $y =$ _____ when $x = 6$

(47) $(24_8 + 21_8) \times 5_8 =$ _____ $_8$

(48) The measure of an inscribed angle is 80°. The length of its intercepted arc is what fraction of the circle's circumference? _____

(49) $33^2 - 37^2 =$ _____

*(50) $(3.111\ldots)(134893) =$ _____

(51) If $2x + 3y < 11$ and $y > 2$, then $x <$ _____

(52) $3\frac{5}{m} \times n\frac{2}{13} = 8$, where m and n are natural numbers. Find $m + n$. _____

(53) $(5 - 4i)(2 + 4i) = a + bi$. Find b. _____

(54) A box of pens contains 7 black ones, 4 red, 6 blue, and 3 green. The probability of randomly selecting a red pen is _____ %

(55) The 6th hexagonal number is _____

(56) $(375_8 \times 14_8) \div 7_8$ has a remainder of _____ $_8$

(57) The vertex of $x^2 = 3(y - 4)$ is at (0, _____)

(58) $\sum_{k=1}^{15}(-1)^k(k)^2 =$ _____

(59) $\frac{5}{12} + \frac{5}{24} + \frac{5}{48} + \frac{5}{96} + \ldots =$ _____

*(60) $\sqrt[3]{193142} =$ _____

(61) $0.5 + 0.9 + 1.4 + \ldots + 25.4 + 41.1 + 66.5 =$ _____

(62) $(4x^3 + 2x^2 - 9x + 13) \div (x - 2)$ has a remainder of _____

(63) The Greatest Integer Function is written as $f(x) = [x]$. Find $[\,2e + \pi^2\,]$. _____

(64) $45 \times 46 =$ _____

(65) $\frac{1}{4_{10}} =$ _____ (base 6 decimal)

(66) $111 \times \frac{11}{27} =$ _____ (mixed number)

(67) Let $f(x) = x^2 + 10x + 25$ and $g(x) = 2x + 3$. $g(f(5)) =$ _____

(68) Let (r, θ) be the polar coordinates for the rectangular coordinates (8, 6). $r =$ _____

(69) $e^{5\ln 3} =$ _____

*(70) 185 mph = _____ feet per second

(71) The determinant of $\begin{bmatrix} 6 & -7 \\ 3 & x+5 \end{bmatrix} = 75$. $x =$ _____

(72) $\lim_{x \to -4} \frac{x^2-16}{x^2+2x-8} =$ _____

(73) Find x, $0 \le x \le 12$, if $5x - 1 \cong 3 \pmod{13}$. _____

(74) If $f'(x) = 2$ and $f(5) = 11$. Find k if $f(k) = 31$. _____

(75) The x-intercept of the line tangent to $y = 2x^2 - 5x - 4$ at $x = 1$ is _____

(76) $\int_0^6 (2x - 11)\,dx =$ _____

(77) $(1.5)^{-2} =$ _____ (fraction)

(78) The minimum value of $f(x) = \frac{x-5}{x+2}$ over the interval [0, 3] is _____

(79) $\frac{9}{14} - \frac{17}{29} =$ _____

*(80) 55.55% of $(300000 \div 0.4545\ldots) =$ _____

2022-2023
VIRTUAL CHALLENGE MEET #1
HS MATHEMATICS - KEY

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

2022-2023 Virtual Challenge Meet #1 • HS Number Sense - Key

(1) 48

(2) 10105

(3) 51.8

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

(5) $\frac{4}{3}$

(6) 2250

(7) 256

(8) $4\frac{2}{3}$

(9) $\frac{87}{200}$

*(10) 552 – 610

(11) 3599

(12) .64 or $\frac{16}{25}$

(13) 0

(14) 1331

(15) 9

(16) 90

(17) 1728

(18) 11000

(19) $2\frac{9}{130}$

*(20) 170132 – 188040

(21) 40.50

(22) 729

(23) 847

(24) 2021

(25) 32

(26) 5

(27) 2709

(28) 15

(29) 3232

*(30) 443948 – 490678

(31) 1690

(32) $\frac{4}{13}$

(33) 8

(34) 608

(35) 12

(36) 324

(37) 81

(38) 1

(39) $7\frac{1}{7}$

*(40) 254 – 280

(41) 1461

(42) 9

(43) 22

(44) 135

(45) 225

(46) 20

(47) 271

(48) $\frac{2}{9}$

(49) – 280

*(50) 398684 – 440650

(51) $\frac{5}{2}$, $2\frac{1}{2}$, or 2.5

(52) 9

(53) 12

(54) 20

(55) 66

(56) 5

(57) 4

(58) – 120

(59) $\frac{5}{6}$

*(60) 55 – 60

(61) 173.2, $173\frac{1}{5}$, or $\frac{866}{5}$

(62) 35

(63) 15

(64) 2070

(65) .13

(66) $45\frac{2}{9}$

(67) 203

(68) 10

(69) 243

*(70) 258 – 284

(71) 4

(72) $\frac{4}{3}$ or $1\frac{1}{3}$

(73) 6

(74) 15

(75) – 6

(76) – 30

(77) $\frac{4}{9}$

(78) $-\frac{5}{2}$, $-2\frac{1}{2}$, or – 2. 5

(79) $\frac{23}{406}$

*(80) 348299 – 384961

2022-2023
HS Virtual Challenge Meet #1 – Key

23U-1	$= -1.93$ $= -1.93\times10^{0}$	23U-11	$= -0.329$ $= -3.29\times10^{-1}$	23U-21	$= 0.134$ $= 1.34\times10^{-1}$
23U-2	$= 1.58$ $= 1.58\times10^{0}$	23U-12	$= 0.00680$ $= 6.80\times10^{-3}$	23U-22	$= 0.0210$ $= 2.10\times10^{-2}$
23U-3	$= -12.8$ $= -1.28\times10^{1}$	23U-13	$= -49000$ $= -4.90\times10^{4}$	23U-23	$= 0.460$ $= 4.60\times10^{-1}$
23U-4	$= -289$ $= -2.89\times10^{2}$	23U-14	$= 0.340$ $= 3.40\times10^{-1}$	23U-24	$= 21.5$ $= 2.15\times10^{1}$
23U-5	$= 0.0910$ $= 9.10\times10^{-2}$	23U-15	$= -8.31\times10^{-5}$	23U-25	$= 20.4$ $= 2.04\times10^{1}$
23U-6	$=391$ $=3.91\times10^{2}$	23U-16	$=794$ $=7.94\times10^{2}$	23U-26	$=602{,}000$ $=6.02\times10^{5}$
23U-7	$=0.0000873$ $=8.73\times10^{-5}$	23U-17	$= -4.88$ $=-4.88\times10^{0}$	23U-27	$=6.00$ $=6.00\times10^{0}$
23U-8	$=127{,}000$ $=1.27\times10^{5}$	23U-18	$=313$ $=3.13\times10^{2}$	23U-28	$=75.84$ (4SD) $=7.584\times10^{1}$
23U-9	$=187$ $=1.87\times10^{2}$	23U-19	$=16.8$ $=1.68\times10^{1}$	23U-29	$=0.00582$ $=5.82\times10^{-3}$
23U-10	$=34.7$ $=3.47\times10^{1}$	23U-20	$=2.01$ $=2.01\times10^{0}$	23U-30	$=2030$ $=2.03\times10^{3}$

2022-2023
HS Virtual Challenge Meet #1 - Key

23U-31 = 972
$= 9.72 \times 10^{2}$

23U-32 = 0.0258
$= 2.58 \times 10^{-2}$

23U-33 = 2.08
$= 2.08 \times 10^{0}$

23U-34 = 4.62
$= 4.62 \times 10^{0}$

23U-35 $= 1.54 \times 10^{-7}$

23U-36 $= 3.93 \times 10^{53}$

23U-37 = 3.74
$= 3.74 \times 10^{0}$

23U-38 = 232
$= 2.32 \times 10^{2}$

23U-39 = 91.7
$= 9.17 \times 10^{1}$

23U-40 = 0.965
$= 9.65 \times 10^{-1}$

23U-41 = −350000
$= -3.50 \times 10^{5}$

23U-42 = 0.000619
$= 6.19 \times 10^{-4}$

23U-43 = 980
$= 9.80 \times 10^{2}$

23U-44 = 15.8
$= 1.58 \times 10^{1}$

23U-45 = 14.3
$= 1.43 \times 10^{1}$

23U-46 = 3.49
$= 3.49 \times 10^{0}$

23U-47 = 2091 integer

23U-48 = -3.00
$= -3.00 \times 10^{0}$

23U-49 = 1250
$= 1.25 \times 10^{3}$

23U-50 = 1800
$= 1.80 \times 10^{3}$

23U-51 $= -3.76 \times 10^{-6}$

23U-52 = 10700
$= 1.07 \times 10^{4}$

23U-53 $= 2.02 \times 10^{-5}$

23U-54 = 162
$= 1.62 \times 10^{2}$

23U-55 = 1.13
$= 1.13 \times 10^{0}$

23U-56 = 41.0
$= 4.10 \times 10^{1}$

23U-57 = 6.72
$= 6.72 \times 10^{0}$

23U-58 = 7.75
$= 7.75 \times 10^{0}$

23U-59 = 2.00
$= 2.00 \times 10^{0}$

23U-60 = 72.6
$= 7.26 \times 10^{1}$

23U-61 = 4.09
$= 4.09 \times 10^{0}$

23U-62 $= 2.54 \times 10^{-6688}$

23U-63 = 24.2
$= 2.42 \times 10^{1}$

23U-64 = 186
$= 1.86 \times 10^{2}$

23U-65 = 99.3
$= 9.93 \times 10^{1}$

23U-66 = 20.0
$= 2.00 \times 10^{1}$

23U-67 = 1.00
$= 1.00 \times 10^{0}$

23U-68 = −0.447
$= -4.47 \times 10^{-1}$

23U-69 = 1.11
$= 1.11 \times 10^{0}$

23U-70 = −37.8
$= -3.78 \times 10^{1}$