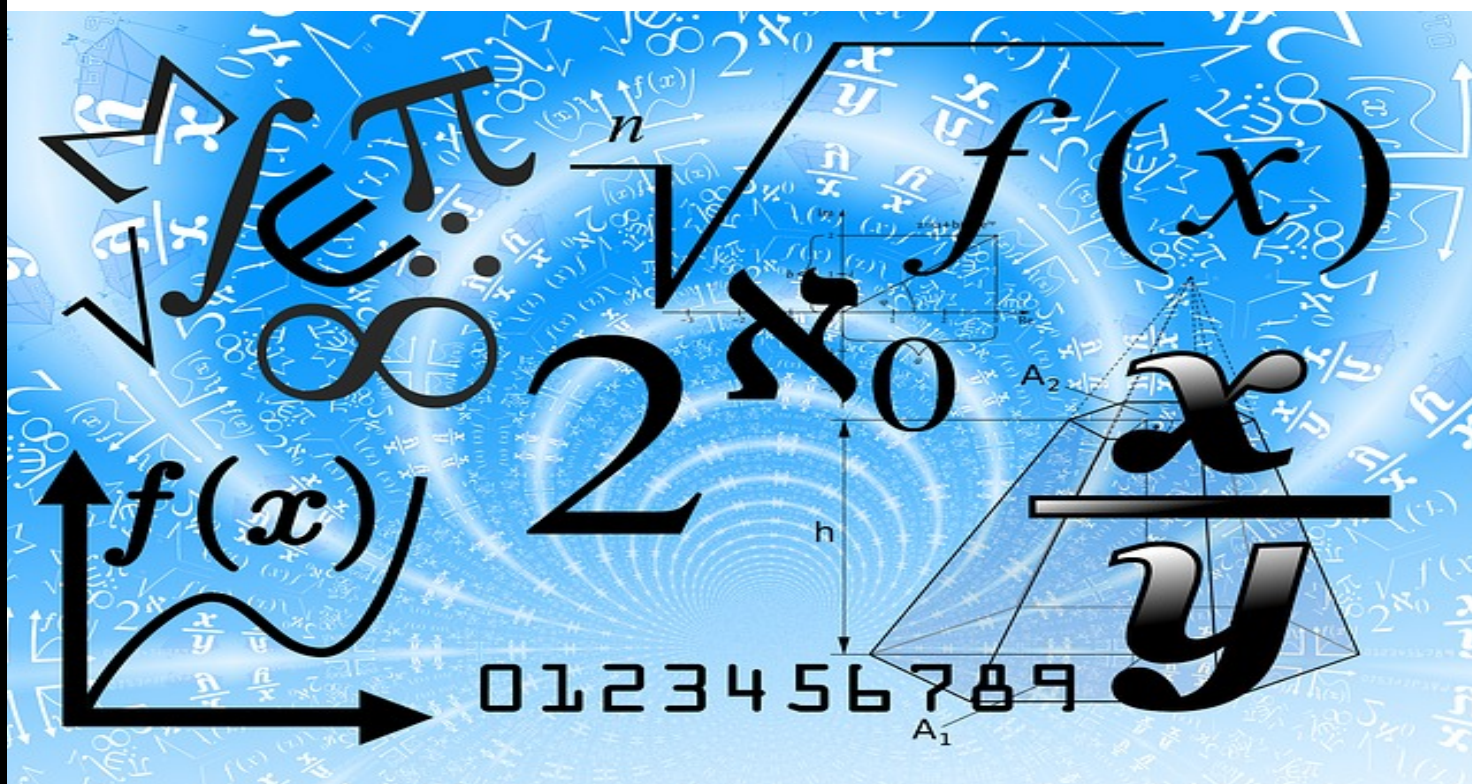


THE VIRTUAL MEET EXPERIENCE

2022-2023

HS VIRTUAL CHALLENGE MEET #2



MATHEMATICS

DO NOT OPEN TEST UNTIL TOLD TO DO SO

The Virtual Challenge Meets™

1. Solve for k if $7(4k + 5) = 11 - (k + 2)$.

- (A) $-\frac{62}{29}$ (B) $-\frac{22}{29}$ (C) $\frac{4}{29}$ (D) $-\frac{22}{31}$ (E) $-\frac{26}{29}$

2. Cora budgeted \$550 for a Spring Break trip with friends. She spent 50% of her money on hotels, 30% of her money on meals and an additional \$75 on tickets and entrance fees. How much did she have left to contribute to the shared gasoline cost?

- (A) \$27.50 (B) \$27.00 (C) \$106.00 (D) \$35.00 (E) \$54.75

3. A plane flying the 4745 miles from Dallas to London has a 40-mph tailwind. The flight's *point of no return* is the point at which the flight time required to return to Dallas is the same as the time required to continue to London. If the plane's speed in still air is 560 mph, how far is Dallas from the point of no return? (nearest mile)

- (A) 2203 mi (B) 2318 mi (C) 2542 mi (D) 2427 mi (E) 2411 mi

4. The line segment \overline{AB} has endpoints $(-7, 5)$ and $(11, -1)$. Which of the following points lies on the perpendicular bisector of \overline{AB} ?

- (A) $(5, 1)$ (B) $(7, 1)$ (C) $(-4, -4)$ (D) $(7, 17)$ (E) $(2, 32)$

5. Let $(5x - 3)(ax + b) = 10x^2 + 39x - 27$. Find $a + b$.

- (A) -18 (B) 11 (C) 15 (D) -11 (E) 7

6. Simplify completely: $\frac{\frac{9a^2 - 25b^2}{ab}}{\frac{3a - 5b}{b^2}}$.

- (A) $\frac{3ab + 5b}{a}$ (B) $\frac{3a - 5b}{a}$ (C) $\frac{3a + 5b}{ab}$ (D) $\frac{3a + 5b}{b}$ (E) $\frac{3ab + 5b^2}{a}$

For problems 7, 8 and 9, use the graph on the right.

7. If the vertex of the parabola is (a, b) , calculate $a + b$.

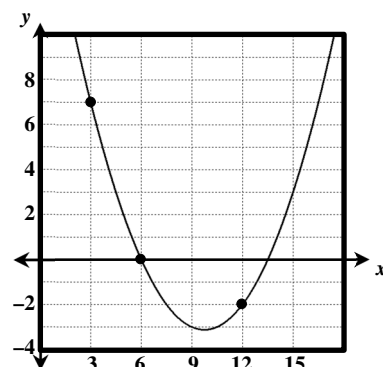
- (A) 9.75 (B) 6.625 (C) -3.125 (D) 6.75 (E) 9.875

8. The focus of the parabola is $(9.75, \underline{\hspace{1cm}})$.

- (A) -1 (B) -3.125 (C) -6.5 (D) -2 (E) -1.75

9. The graph shown is $y = h'(x)$. If $h(6) = 49$, then $h(0) = \underline{\hspace{1cm}}$.

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



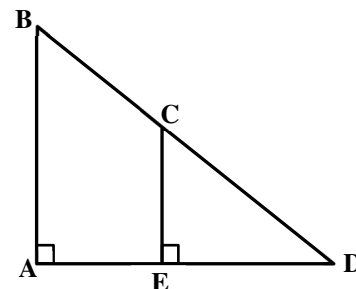
10. Two consecutive angles in a pentagon are supplementary. The other three angles are congruent. What is the measure of one of the three congruent angles?

(A) 60° (B) 90° (C) 150° (D) 120° (E) 135°

11. $A = \begin{bmatrix} a & 7 \\ -3 & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} -17 & -28 \\ 12 & -17 \end{bmatrix}$. Find the value of a .

(A) -2 (B) 4 (C) -5 (D) 2 (E) -4

12. On the triangles shown below, $CE = 8$ ft, $AB = 12$ ft and $ED = 10$ ft. Find the perimeter of triangle ABD. (nearest tenth foot)



(A) 40.8 ft (B) 29.8 ft (C) 46.2 ft
(D) 52.8 ft (E) 48.4 ft

13. A large conical water tank has a base diameter of 2 meters and a total height of 3.5 meters. How many gallons of water will the tank hold? (nearest gallon)

(A) 968 gal (B) 3,873 gal (C) 11,619 gal (D) 2,905 gal (E) 1936 gal

14. A triangle has a perimeter of 52 m and an area of 85 m^2 . A similar triangle has a perimeter of 88 m. The area of the second triangle is _____ m^2 . (nearest square meter)

(A) 144 (B) 178 (C) 223 (D) 243 (E) 265

15. Paul consistently makes 75% of his free throws during the regular season. If he attempted 6 free throws during Saturday's district playoff game, find the probability that he made at least 4 of them. (nearest tenth percent)

(A) 57.8% (B) 83.1% (C) 53.4% (D) 72.3% (E) 77.6%

16. Over the ten years that Mrs. Gibson has been teaching pre-calculus, the scores on her students' first semester final exam have followed a normal distribution with a mean of 72.6 and a standard deviation of 7.3. If a passing grade is defined as any grade of at least 70 with a maximum score of 100, what percentage of her students passed the final? (nearest tenth percent)

(A) 72.2% (B) 53.8% (C) 64.7% (D) 59.7% (E) 63.9%

17. Two of the roots of $x^4 + bx^3 + cx^2 + dx + e = 0$ are $\sqrt{2}$ and $5i$. $b + c + d + e =$

(A) 73 (B) -29 (C) -73 (D) -27 (E) 23

18. An 18-ft plank is used for a ramp up to the edge of a porch that stands 2.25 ft off the ground. Find the angle of elevation to the nearest second.

(A) $7^\circ 7' 30''$ (B) $7^\circ 10' 51''$ (C) $82^\circ 49' 9''$ (D) $7^\circ 18'$ (E) $7^\circ 12' 50''$

19. Consider triangle ABC with vertices A(-6,2), B(1,7) and C(3,-2). If the coordinates of the centroid of triangle ABC are (a,b), then $a+b=$ _____.

- (A) $\frac{7}{3}$ (B) $\frac{2}{3}$ (C) $\frac{5}{3}$ (D) 2 (E) $\frac{8}{3}$

20. The circumference of the Earth at sea level along the equator is 4.38267×10^7 yd. Carla is at rest in a city at sea level located at 32° north latitude. Her linear speed due to the rotation of the Earth is _____ft/s. (nearest whole number)

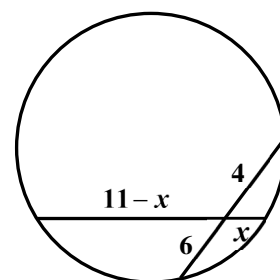
- (A) 430 (B) 317 (C) 1291 (D) 951 (E) 1060

21. $1A_{16} + 11_8 + 10_4 =$ _____₂

- (A) 101001 (B) 100001 (C) 100010 (D) 100111 (E) 100000

22. Find the largest possible value of x on the picture shown.

- (A) 3 (B) 4 (C) 6 (D) 7 (E) 8



23. How many distinct five-letter arrangements can be made from the letters in the word FLOYDADA if repetition is permitted?

- (A) 2040 (B) 120 (C) 840 (D) 720 (E) 1440

24. Find the area of the triangle with vertices (-6,2), (1,13) and (7,-5).

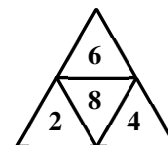
- (A) 27 (B) 54 (C) 64 (D) 96 (E) 108

25. The point (-4,7) is reflected over the x -axis, reflected over the line $y = x$, rotated 180° clockwise around the origin, then shifted down three units to the point (a,b) . $a + b = ?$

- (A) -11 (B) -9 (C) 8 (D) -14 (E) 6

26. Allan folded the net shown into a fair, tetrahedral die, then rolled it and added the three visible sides. What is the expected value of the sum?

- (A) 15 (B) 17 (C) 12 (D) 20 (E) 16



27. The period of $h(x) = \frac{1}{k} \cos(4\pi kx)$ is 7. Find the amplitude of $h(x)$.

- (A) 1 (B) 7 (C) $\frac{1}{7}$ (D) 14 (E) $\frac{1}{14}$

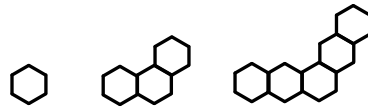
28. If $\sin x \cos x = -\frac{1}{4}$, then $\cos 2x$ could be

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

29. Coach Thompson and his 8 math team students are sitting around a circular practice table. If Meagan and Jessica insist on sitting together, how many seating arrangements are possible?

- (A) 1,440 (B) 10,080 (C) 5,040 (D) 720 (E) 2,880

30. The three shapes below are made up of regular hexagons with side lengths of 1 unit. If the pattern continues, the perimeter of the shape with 56 hexagons will be _____ units.



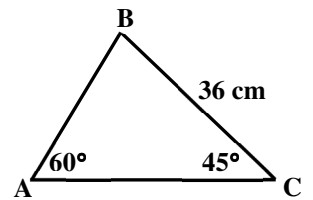
- (A) 226 (B) 220 (C) 242 (D) 230 (E) 224

31. If $f''(x) = 18x - 10$, $f(1) = -14$ and $f(-1) = -16$, find $f(2)$.

- (A) 11 (B) 15 (C) -10 (D) -9 (E) 2

32. The area of triangle ABC is _____ cm^2 . (nearest square centimeter)

- (A) 511 (B) 456 (C) 1022 (D) 913 (E) 529



33. Convert the rectangular equation to polar form: $2x - 5y + 8 = 0$.

- (A) $r = 8 \csc \theta$ (B) $r = \frac{8}{2 \sin \theta + 5 \cos \theta}$ (C) $r = 8 \sec \theta$
(D) $r = -\frac{8}{2 \cos \theta - 5 \sin \theta}$ (E) $r = \frac{8}{2 \cos \theta - 5 \sin \theta}$

34. Find the domain of the function $f(x) = \frac{\sqrt{5x+10}}{x^2+4x-96}$.

- (A) $(-\infty, \infty)$ (B) $x \geq -2, x \neq 8$ (C) $x > -2$ (D) $x \geq -2, x \neq 12$ (E) $x \neq -12, x \neq 8$

35. If $s(x)$ is the slant asymptote of $f(x) = \frac{x^2+4x-9}{x-2}$, then $s(4) = ?$

- (A) -10 (B) 2 (C) 10 (D) 6 (E) -2

36. A ball is dropped from a height of 90 feet. Each time it hits the floor, it bounces to 70% of its previous height. Find the total distance traveled by the ball.
- (A) 510 ft (B) 300 ft (C) 420 ft (D) 815 ft (E) 540 ft
37. The data set $9, a, b, c, 24, 35$ is shown least to greatest and has a mean of 20, mode of 24 and median of 20. Calculate the value of $a + c$.
- (A) 39 (B) 36 (C) 40 (D) 48 (E) 35
38. Which of the following equations in rectangular form can be written as $r - 8\sin\theta = 0$ in polar form?
- (A) $x^2 + y^2 = 16$ (B) $x^2 + y^2 = 4$ (C) $x^2 + y^2 - 8y = 0$
- (D) $x^2 - 8x + y^2 = 0$ (E) $x^2 + y^2 = 2\sqrt{3}$
39. Find the distance between the plane $5x - 11y + 2z = 18$ and the point $(1, -3, 5)$. (nearest tenth)
- (A) 1.9 (B) 2.1 (C) 2.2 (D) 2.4 (E) 2.5
40. Which of the following is one of the four fourth roots of the complex number $256i$? (answers are in standard form and have been rounded to the nearest hundredth)
- (A) $-3.70 + 1.53i$ (B) $1.53 + 3.70i$ (C) $1.27 + 2.85i$ (D) $-2.85 + 1.27i$ (E) $-3.70 - 1.53i$
41. Find the rectangular coordinates of the point given in polar coordinates $\left(6, \frac{8\pi}{7}\right)$. (nearest hundredth)
- A) $(5.00, 0.08)$ (B) $(-5.41, -2.60)$ (C) $(2.60, -5.41)$ (D) $(5.99, 0.38)$ (E) $(-5.99, -0.38)$
42. Consider the function $g(x)$, which is continuous and differentiable on $[3, 8]$, and with $g(3) = 6$ and $g(6) = 6$. If $g''(x)$ is continuous and negative on $[3, 8]$, then which of the following must be true?
- (A) $g'(4) = 0$ (B) $g'(7) > 0$ (C) $g'(4) < 0$ (D) $g'(7) < 0$ (E) $g'(7) > 0$
43. Find the volume of the solid generated by revolving the region bounded by $f(x) = \sqrt{x} + 3$, $x = 1$, $x = 6$ and the x -axis about the line $x = -2$. (nearest whole number)
- (A) 852 (B) 426 (C) 1339 (D) 451 (E) 901
44. If $(5 - 2i)(2 + 3i) \div (1 - i) = a + bi$, then $b =$ _____.
- (A) -27 (B) 27 (C) $\frac{27}{2}$ (D) $-\frac{5}{2}$ (E) $\frac{5}{2}$

45. If $f(x) = \sec x$ then $\lim_{h \rightarrow 0} \frac{f\left(\frac{\pi}{6} + h\right) - f\left(\frac{\pi}{6}\right)}{h}$ equals?

- (A) $\frac{2}{3}$ (B) $\frac{1}{2}$ (C) $\frac{3}{2}$ (D) $-\frac{1}{2}$ (E) does not exist

46. Find the interval of convergence of $\sum_{n=1}^{\infty} \frac{x^n}{2n-1}$.

- (A) $\left[-\frac{1}{2}, \frac{1}{2}\right)$ (B) $[-1, 1)$ (C) $(-1, 1)$ (D) $\left(-\frac{1}{2}, \frac{1}{2}\right)$ (E) $[1, 1]$

47. Find the number that is $\frac{3}{5}$ of the way from $-7\frac{2}{3}$ and $10\frac{1}{9}$.

- (A) $\frac{5}{9}$ (B) $\frac{7}{9}$ (C) 1 (D) 3 (E) $-\frac{7}{9}$

48. The vector $u = \langle -2, 3, -1 \rangle$ is orthogonal to the vector $v = \underline{\hspace{1cm}}$.

- (A) $\langle 4, -8, 4 \rangle$ (B) $\langle 8, 4, 16 \rangle$ (C) $\langle -4, -8, 4 \rangle$ (D) $\langle 4, 8, 16 \rangle$ (E) $\langle -4, -8, -4 \rangle$

49. Amber looks out her office window, at the building across the street. The two buildings are 200 feet apart. The angle of the depression to the bottom of the building is 33° , and the angle of elevation to the top of the building is 42° . How tall is the building across the street? (nearest foot)

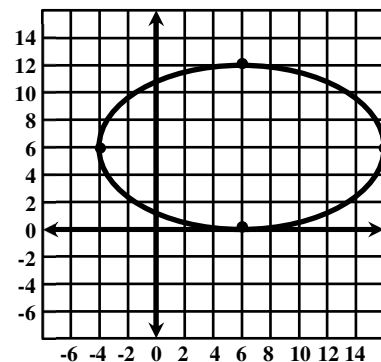
- (A) 298 ft (B) 301 ft (C) 305 ft (D) 307 ft (E) 310 ft

50. If $\int_2^x f(t) dt = \frac{20x}{\sqrt[3]{125x^3 - 5}} - 2$, then $\int_2^{\infty} f(t) dt = \underline{\hspace{1cm}}$.

- (A) 2 (B) 6 (C) -2 (D) 8 (E) 1

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

- (A) 0.80 (B) 0.36 (C) 0.60
(D) 0.64 (E) 1.33



52. Carol has bins containing red, blue, green and purple markers. How many different ways can Carol package 6 markers together?

- (A) 210 (B) 42 (C) 105 (D) 84 (E) 462

53. According to Wikipedia, this English mathematician “is credited with inventing the first mechanical computer, the Difference Engine.”

(A) Charles Babbage

(B) Jon von Neumann

(C) Tommy Flowers

(D) Alan Turing

(E) Christian Goldbach

54. For a given spring, the extension, x , varies directly with the magnitude of the force, F . If $x = 0.25$ meters when $F = 3$ Newtons, find x when $F = 10$ Newtons. (nearest hundredth)

(A) 0.80 m

(B) 0.62 m

(C) 0.67 m

(D) 0.75 m

(E) 0.83m

55. If $g(x) \leq f(x) \leq h(x)$ for all x, k in $[a, b]$, where $x \neq k$, and $\lim_{x \rightarrow k} g(x) = L$ and $\lim_{x \rightarrow k} h(x) = L$ then $\lim_{x \rightarrow k} f(x) = L$. This theorem is known as:

(A) Sandwich Theorem

(B) Rolle’s Theorem

(C) Fundamental Theorem of Calculus

(D) Intermediate Value Theorem

(E) Fundamental Theorem of Algebra

56. If $f(x) = x^3 - 3$ and $g(x) = 2x + 9$, then $g(f'(4)) = \underline{\hspace{2cm}}$.

(A) 105

(B) 131

(C) 24

(D) 99

(E) 122

57. An equilateral triangle has an area of 438 cm^2 . Find the area of a circle whose circumference equals the perimeter of the triangle. (nearest whole number)

(A) 150 cm^2

(B) 682 cm^2

(C) 708 cm^2

(D) 724 cm^2

(E) 744 cm^2

58. The square root of 1331_8 is:

(A) 25_8

(B) 27_8

(C) 33_8

(D) 30_8

(E) 31_8

59. Given that $(x + 1)$ and $(x - 2)$ are factors of $f(x) = x^3 + px^2 + qx - 12$, find the value of $p + q$.

(A) 3

(B) -4

(C) -3

(D) 4

(E) -1

60. Find the second-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 thousandth)

(A) 0.031

(B) 0.018

(C) 0.041

(D) 0.027

(E) 0.022

2022-2023
Virtual Challenge Meet #2
Mathematics – Student Answer Sheet

Contestant Name _____ Grade _____

Score 1: _____	Score 2: _____
Score 3: _____	Final Score: _____

1. _____
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2022-2023
VIRTUAL CHALLENGE MEET #2
MATHEMATICS - KEY

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

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 #2

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*, 1.23x10^{0*} 1.23x10¹,
1.23x10⁰¹, .0190, 0.0190, 1.90x10⁻²

Incorrect: 12.30, 123.0, 1.23(10)², 1.23·10², 1.230x10²,
1.23x10², 0.19, 1.9x10⁻², 19.0x10⁻³, 1.90E-02

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

- B. For stated problems

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

- Angle measure: rad means radians; deg means degrees.
- Inverse trigonometric functions: arcsin for inverse sine, etc.
- Special numbers: π for 3.14159 ...; e for 2.71828 ...
- Logarithms: Log means common (base 10); Ln means natural (base e); exp(u) means e^u .

23V-1. $(-2.6 - 0.662)/(3.48)$ ----- 1=_____

23V-2. $39.7/94.4 + 0.0505 - 0.421$ ----- 2=_____

23V-3. $(0.856 - 0.223 + 0.728) \times (-0.728) - \pi$ ----- 3=_____

23V-4. $\frac{5130 + 8910 - 7030}{(-63.8)(70.3)(67.6)}$ ----- 4=_____

23V-5. $\frac{(-0.00826 - 0.00244)(842)}{\{(347)/(-439)\}} - (11.8 - 6.19)$ ----- 5=_____

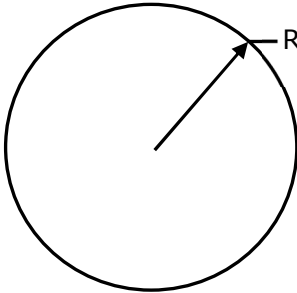
23V-6. Teresa purchased 4.2 pounds of cherries which cost \$3.77 per pound. How much did she pay?----- 6=\$_____

23V-7. Jen works 20 hours each week at Taco Casa. She started at a rate of \$7.50 per hour, but after six weeks, her pay increased to \$11.75 per hour. How much more per week will she make after the increase? ----- 7=\$_____

23V-8. If light travels 3.0×10^8 m/s, how far will light travel in 46 milliseconds? ----- 8=_____ km

23V-9.

CIRCLE



R = 11.7

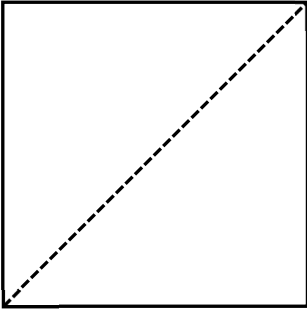
Circumference = ?

23V-9 = _____

23V-10.

SQUARE

AB = 17.3



B

Area = ?

23V-10 = _____

23V-11. $\frac{(-0.732 + 0.0793)(0.659 + 1.52)}{(-7.63)(0.423)(2210 - 2280)}$ ----- 11=_____

23V-12. $\frac{(0.742 + 0.295 - 1.2)(52.2)(63.9)}{(5.63 - 3.55)(35.6 - 87)}$ ----- 12=_____

23V-13. $\frac{(746)(790 - 572)\{-3.83 \times 10^5 - (796)(-263)\}}{(956 + 100)(626 - 856)}$ ----- 13=_____

23V-14. $\frac{\{(0.301 + 1.29)(8.75 + 4.18) + 63.2 - 23.7\}}{(-996 - 870)(3.75 + 4.72 - 1.75)}$ ----- 14=_____

23V-15. $\frac{(0.622 + 5.81)}{2.71 - 14} + \frac{-0.0245}{29.5 + 32.4} + \frac{(0.315)(399 - 306)}{(-604)(0.7)}$ ----- 15=_____

23V-16. John travels a total of 90 miles each day driving to work and driving home after work. If his Subaru gets 36 mi/gal and gas cost \$3.85/gal how much does he spend on gas each 5-day work week? ----- 16=\$_____

23V-17. At a recent birthday party for Curtis, every person was served 2 slices of pizza and a 20-oz cup of tea. If 175 people were present, how many gallons of tea were needed? ----- 17=_____ gal

23V-18. Scotty’s average heart rate has been 75 beats/min throughout his life. If today is his 20th birthday, how many times has his heart beat in his life? ----- 18=_____ beats

<div data-bbox="77 1287 191 1318" data-label="Text"><p>23V-19.</p></div> <div data-bbox="203 1318 730 1711" data-label="Diagram"> <p style="text-align: center;">RIGHT TRIANGLE</p> <p style="text-align: center;">Area = ?</p> </div> <div data-bbox="77 1959 479 1990" data-label="Text"><p>23V-19 = _____</p></div>	<div data-bbox="841 1287 954 1318" data-label="Text"><p>23V-20.</p></div> <div data-bbox="885 1318 1510 1711" data-label="Diagram"> <p style="text-align: center;">RIGHT TRIANGLE</p> </div> <div data-bbox="841 1959 1242 1990" data-label="Text"><p>23V-20 = _____</p></div>
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23V-21. $\left[\frac{\sqrt{2.21 - 2.05}}{8.43} + \frac{(0.0598)}{2.66}\right]^2$ ----- 21=_____

23V-22. $\sqrt{\frac{(0.152)(\pi)}{797 + 790}} + 0.0123$ ----- 22=_____

23V-23. $[-53 + \sqrt{2180}]^2 \times [748 + 4740]^2 \times \sqrt{0.421/0.364}$ ----- 23=_____

23V-24. $\frac{\sqrt{0.606 + 0.583 + (0.0346)/(0.0469)}}{-0.435 + 0.0498}$ ----- 24=_____

23V-25. $\left[\frac{1.3 + \pi + \sqrt{0.83/0.828}}{-0.204 + 0.08}\right]^2$ ----- 25=_____

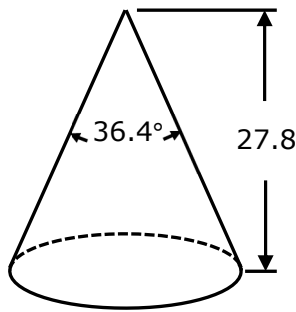
23V-26. A population of bunnies doubles every 9 months if unchecked. If the initial population was 12 bunnies, what is the expected population after 10 years? ----- 26=_____

23V-27. Mary got a new coach. She has been averaging 56.5 mi/week. Her new coach wanted her to average 70.0 mi/week. What is the percent increase in her weekly mileage?----- 27=_____%(SD)

23V-28. A sphere has a volume of 140 cm³. If the radius is increased by 14.7%, what is the new surface area? ----- 28=_____cm²

23V-29.

CONE

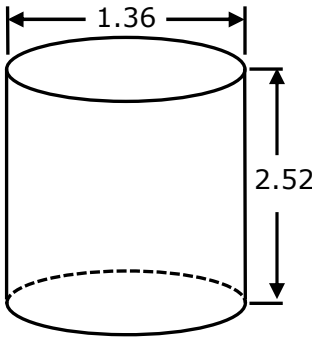


Volume = ?

23V-29 = _____

23V-30.

CYLINDER



Total Surface Area = ?

23V-30 = _____

23V-31. $\frac{1}{0.00238} + \frac{1}{\sqrt{1.04 \times 10^{-4}}} + \frac{(\pi + 6 - 0.987)^2}{\sqrt{1.85 - 1.26}}$ ----- 31=_____

23V-32. $\left[\frac{-9.19 \times 10^{-5}}{8.85 \times 10^{-5} + 8.41 \times 10^{-5}} + 0.752 \right] \times \left\{ 5400 + (-83.1)^2 - \sqrt{1.26 \times 10^8} \right\}$ 32=_____

23V-33. $\frac{[(55.2 - 42.2)(0.626/0.628)]^{1/2}}{(0.25)^2 + (0.12 + 0.29)^2 + 0.145}$ ----- 33=_____

23V-34. $\frac{\sqrt{(2.95 \times 10^{-4}) / \{ (7.39 \times 10^{-4}) / \sqrt{7.33 \times 10^{-5}} \}}}{0.0145 + (0.315)(5.12)} + \{ 0.00109 + 0.00689 \}^{1/2}$ 34=_____

23V-35. $\frac{(4490 + 14400)^2 - (37900 - 801)^2}{\sqrt{(577)(0.213)(810 + 800 - 1030)^2}}$ ----- 35=_____

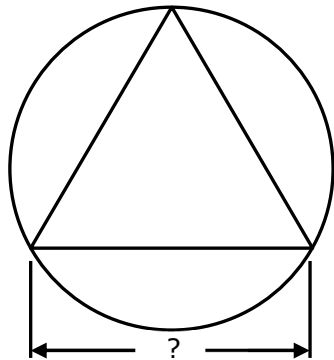
23V-36. Two boats leave each other. One travels southwest at 12 knots, and the other travels north at 15 knots. How long will it take them to be 150 miles apart? (1 knot = 1.15 mph) ----- 36=_____ hr

23V-37. How long after 7:33 do the minute and hour hands align? ----- 37=_____ min

23V-38. The parabola $y_1 = ax^2 - 6x + 4$ intersects the line $y_2 = 0.75x - 6$ at the point $(x, -5.184478)$. Find the value of a . ----- 38=_____

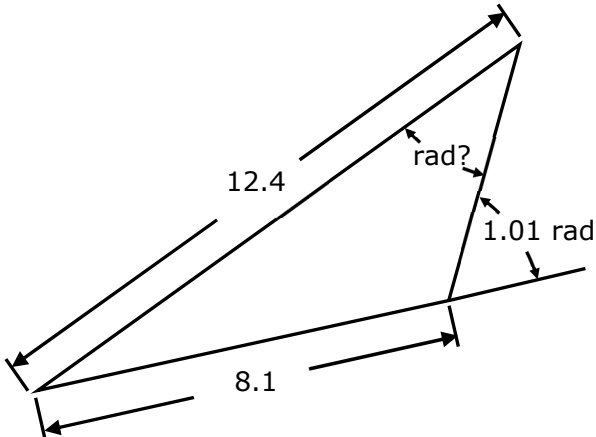
23V-39. EQUILATERAL TRIANGLE AND CIRCLE

Area of Circle = 238



23V-39 = _____

23V-40. SCALENE TRIANGLE



23V-40 = _____

23V-41. $10^{-\{(0.302 - 0.88)/(0.228 + 0.189)\}}$ ----- 41=_____

23V-42. $-6.29 e^{0.88} + (\pi) e^{-0.558}$ ----- 42=_____

23V-43. $\frac{\text{Ln}(66500 + 74800 - 23100)}{(4.68 \times 10^5)}$ ----- 43=_____

23V-44. $(-9.12 \times 10^5 + 1.69 \times 10^6)^{-(0.767 + 0.958)}$ ----- 44=_____

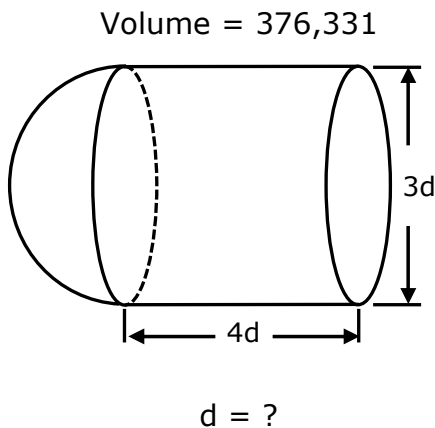
23V-45.(deg) $\frac{\cos\{(19.8^\circ)/(7.28)\}}{\sin\{49.2^\circ - 72.2^\circ\}}$ ----- 45=_____

23V-46. A statue of Joey Aboussie in front of Old High is 15 ft tall and weighs 2680 pounds. If Anthony builds a scale model that is 12 inches tall and made of the same material as the statue, how much will the model weigh?----- 46=_____lb

23V-47. Dak was on an unmarked football field estimating the distance from him to his receivers. Here is some data (estimated distance, actual distance) in inches: (1480, 1440), (1600, 1620), (1760, 1800), (1940, 1980) and (2100, 2160). If Dak estimates that CeeDee is 2600 inches away, what is the actual distance as predicted by the linear regression of the data? ----- 47=_____in

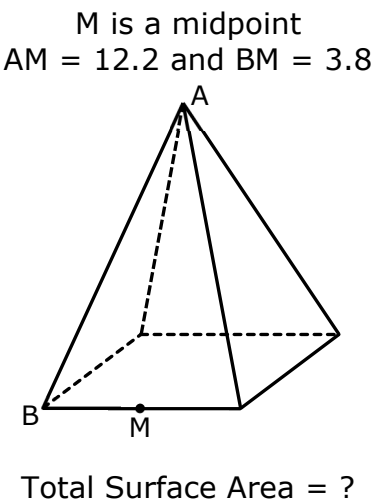
23V-48.(rad) Solve for w , $w < 0$, if $\cos(3w) = 4w^2 + \frac{6}{w}$. ----- 48=_____

23V-49. CYLINDER AND HEMISPHERE



23V-49 = _____

23V-50. SQUARE PYRAMID



23V-50 = _____

23V-51. $10^{+(0.598)} + 10^{-(0.778)} + \left[10^{(0.551/0.562)} - 10^{(0.362)}\right]^{1/2} \text{ -- } 51 = \underline{\hspace{2cm}}$

23V-52. $\frac{1 + e^{\{0.734 + (0.212)(1.48)\}}}{(8.99 \times 10^7)(2.88 - e^{(-0.424)})} \text{ ----- } 52 = \underline{\hspace{2cm}}$

23V-53. $(8.83) \ln \left[\frac{5.88 + (7.82)(0.15)}{1.75 + 1.99} \right] \text{ ----- } 53 = \underline{\hspace{2cm}}$

23V-54. $\frac{1}{(0.62)^{(-0.586)}} + (0.611 + 0.549)^{(0.944 - 0.141)} \text{ ----- } 54 = \underline{\hspace{2cm}}$

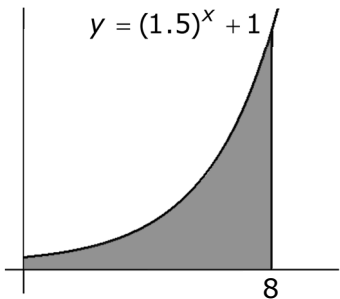
23V-55.(rad) $\arctan \left[\frac{(4900)(0.135)}{(8.49)(61.3)} \right] + (0.867)(2.32) \text{ ----- } 55 = \underline{\hspace{2cm}}$

23V-56. If $f(x) = 2(x - 3)^2 - 8(x + 5) + 12$, at what value of x is the slope of the line tangent to the graph of the curve equal 2.2? ----- 56=_____

23V-57. The area of a circle is increasing at a constant rate of 3.31 in²/s. Find the rate at which the radius is increasing when the radius is 5.8 in. ----- 57=_____ in/s

23V-58. $A = \begin{bmatrix} -4 \\ 8 \\ -2 \end{bmatrix}$ and $B = \begin{bmatrix} 8 \\ -16 \\ 4x \end{bmatrix}$. If $3A + 6B = \begin{bmatrix} 36 \\ -72 \\ 39.12 \end{bmatrix}$, then x = ? ----- 58=_____

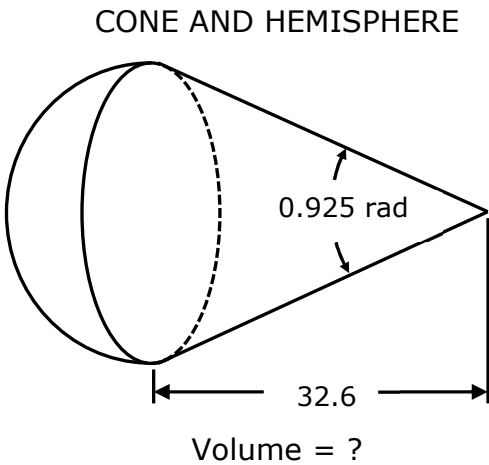
23V-59.



Shaded Area = ?

23V-59 = _____

23V-60.



Volume = ?

23V-60 = _____

23V-61. Today, Jane placed \$19,000 into an account that earns 5.75% annual interest compounded quarterly. She also placed \$17,500 into an account that earns 6.50% annual interest compounded monthly. How many years will it be until both accounts have the same value? ----- 61=_____yr

23V-62. Evaluate 5555^{7777} . ----- 62=_____

23V-63. A projectile is launched from the ground at a speed of 120 ft/s at an angle of 42° above the horizontal. What was the maximum height obtained by the projectile? ----- 63=_____ft

23V-64.

SQUARE AND SEMICIRCLE

Shaded Area = ?

23V-64 = _____

23V-65.

SCALENE TRIANGLES

23V-65 = _____

23V-66. $(1/2)\text{Ln}\left[\frac{(1.78) \times (8) \times (6.76)^3}{(6.76)(0.885)^2}\right]^2$ ----- 66=_____

23V-67.(rad) $\cos(1.35 - 0.252) \cos(1.35 + 0.252)$ ----- 67=_____

23V-68.(deg) $\sin(-77.6^\circ)\cos(125^\circ) + \cos(-77.6^\circ)\sin(125^\circ)$ ----- 68=_____

23V-69. $1 + 0.16 + (0.16)^2 + \frac{(0.16)^4}{8} - \frac{(0.16)^5}{15}$ ----- 69=_____

23V-70.(rad) $\frac{\arctan\left\{e^{-(0.726)(0.549)}\sqrt{(-0.174)/(-0.721)}\right\}}{(0.748)\sqrt{(0.684)(0.246)(0.396)}}$ ----- 70=_____

2022-2023

HS Virtual Challenge Meet #2 – Key

23V-1	= -0.937 = -9.37×10^{-1}	23V-11	= -0.00630 = -6.30×10^{-3}	23V-21	= 0.00489 = 4.89×10^{-3}
23V-2	= 0.0501 = 5.01×10^{-2}	23V-12	= 5.09 = 5.09×10^0	23V-22	= 0.0296 = 2.96×10^{-2}
23V-3	= -4.13 = -4.13×10^0	23V-13	= 116000 = 1.16×10^5	23V-23	= 1.29×10^9
23V-4	= -0.0231 = -2.31×10^{-2}	23V-14	= -0.00479 = -4.79×10^{-3}	23V-24	= -3.60 = -3.60×10^0
23V-5	= 5.79 = 5.79×10^0	23V-15	= -0.639 = -6.39×10^{-1}	23V-25	= 1930 = 1.93×10^3
23V-6	= \$15.83	23V-16	= \$48.13	23V-26	= 124,000 = 1.24×10^5
23V-7	= \$85.00	23V-17	= 27.3 = 2.73×10^1	23V-27	= 24 (2SD) = 2.4×10^1
23V-8	= 13800 = 1.38×10^4	23V-18	= 7.89×10^8	23V-28	= 172 = 1.72×10^2
23V-9	= 73.5 = 7.35×10^1	23V-19	= 254 = 2.54×10^2	23V-29	= 2430 = 2.43×10^3
23V-10	= 150 = 1.50×10^2	23V-20	= 0.418 = 4.18×10^{-1}	23V-30	= 13.7 = 1.37×10^1

2022-2023

HS Virtual Challenge Meet #2 – Key

23V-31 = 605 = 6.05×10^2	23V-41 = 24.3 = 2.43×10^1	23V-51 = 6.82 = 6.82×10^0	23V-61 = 10.6 = 1.06×10^1
23V-32 = 237 = 2.37×10^2	23V-42 = -13.4 = -1.34×10^1	23V-52 = 1.92×10^{-8}	23V-62 = 2.56×10^{29122}
23V-33 = 9.58 = 9.58×10^0	23V-43 = 2.50×10^{-5}	23V-53 = 5.60 = 5.60×10^0	23V-63 = 100 = 1.00×10^2
23V-34 = 0.125 = 1.25×10^{-1}	23V-44 = 6.89×10^{-11}	23V-54 = 1.88 = 1.88×10^0	23V-64 = 8920 = 8.92×10^3
23V-35 = -159000 = -1.59×10^5	23V-45 = -2.56 = -2.56×10^0	23V-55 = 2.92 = 2.92×10^0	23V-65 = 61.2 = 6.12×10^1
23V-36 = 5.22 = 5.22×10^0	23V-46 = 0.794 = 7.94×10^{-1}	23V-56 = 5.55 = 5.55×10^0	23V-66 = 6.72 = 6.72×10^0
23V-37 = 5.18 = 5.18×10^0	23V-47 = 2730 = 2.73×10^3	23V-57 = 0.0908 = 9.08×10^{-2}	23V-67 = 0.487 = 4.87×10^{-1}
23V-38 = -2.25 = -2.25×10^0	23V-48 = -1.07 = -1.07×10^0	23V-58 = 1.88 = 1.88×10^0	23V-68 = 0.736 = 7.36×10^{-1}
23V-39 = 15.1 = 1.51×10^1	23V-49 = 22.0 = 2.20×10^1	23V-59 = 68.7 = 6.87×10^1	23V-69 = 1.19 = 1.19×10^0
23V-40 = 0.586 = 5.86×10^{-1}	23V-50 = 243 = 2.43×10^2	23V-60 = 18000 = 1.80×10^4	23V-70 = 1.65 = 1.65×10^0

The Virtual Challenge Meets

HS Number Sense Test • VCM #2 • 2022-2023

Contestant's Name _____

School _____

Contestant's Grade 9 10 11 12

Final _____

2nd _____

1st _____

Score Initials

**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. 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) $723 - 327 =$ _____

(2) $2023 + 797 =$ _____

(3) $1.5 \div 2\frac{1}{4} =$ _____ (fraction)

(4) $\frac{11}{5} \times \frac{35}{33} =$ _____ (improper fraction)

(5) $\frac{5}{7} \times 13 =$ _____ (mixed number)

(6) $12^2 + 11^0 - 8^1 =$ _____

(7) $19^2 =$ _____

(8) $14 \times 5 - 4 \times 6 + 3 \times 4 =$ _____

(9) $22 \times 34 + 14 \times 34 =$ _____

*(10) $135 \times (148 + 121) =$ _____

(11) $41 \times 23 =$ _____

(12) The LCM of 15, 25, and 30 is _____

(13) $92 \times 88 =$ _____

(14) $16\frac{2}{3}\%$ of 96 is _____

(15) The largest prime divisor of 33^2 is _____

(16) If 9 dozen eggs cost \$36.00,
then 5 dozen eggs cost \$ _____

(17) $15 \times 225 =$ _____

(18) $23^2 - 17^2 =$ _____

(19) $35 \times 46 =$ _____

*(20) $593 \times 302 - 422 \times 301 =$ _____

(21) $293 \div 6$ has a remainder of _____

(22) 208 is divisible by _____ positive prime integers

(23) If $11^x = 7$, then $11^{3x} =$ _____

(24) $87 \times 27 =$ _____

(25) 3 pecks = _____ quarts

(26) Find x if $17 - 3x = 2$. _____

(27) $93 \times 96 =$ _____

(28) $8\frac{2}{11} \times 8\frac{9}{11} =$ _____ (mixed number)

(29) $46 \times 46 =$ _____

*(30) $\sqrt{317842} =$ _____

(31) $147_8 =$ _____ base 10

(32) $44137 \div 101 =$ _____

(33) The number of
positive integral divisors of 42 is _____

(34) $(8^3 - 1) \div (8 - 1) =$ _____

(35) The sum of 8 consecutive integers is 364.
The sum of the greatest and least integers is _____

(36) $(\sqrt[3]{343} + \sqrt{196})^2 =$ _____

- (37) $(2x - 3)^4 = ax^4 + bx^3 + cx^2 + dx + e$,
then $a - b + c - d + e =$ _____
- (38) $[39 + 21 \times 22 - 11^2] \div 5$ has a remainder of _____
- (39) $\frac{3}{7} =$ _____ % (mixed number)
- *(40) $831724 \div 307 =$ _____
- (41) $98 \times 109 =$ _____
- (42) Find the ordinate of the y-intercept of
 $y - 13 = 2(x - 4)^2$. _____
- (43) $44^2 + 45^2 =$ _____
- (44) The sum of the coefficients of the x^3y^2 term and x^2y^3 term in the expansion of $(2x + y)^5$ is _____
- (45) $(7C_3)^2 =$ _____
- (46) If y varies directly with x and y = 18 when x = 15,
then y = _____ when x = 10
- (47) $(24_7 + 22_7) \times 5_7 =$ _____ 7
- (48) The product of the roots of $3x^3 - 7x^2 - 19x = 12$ is _____
- (49) $0.181818... + 0.454545... =$ _____ (fraction)
- *(50) $428571 \times 56 =$ _____
- (51) If $2x + 3y < 11$ and $y > 1$, then $x <$ _____
- (52) $3\frac{4}{m} \times n\frac{4}{5} = 10$, where m and n are
natural numbers. Find m + n. _____
- (53) $(6 - 4i)(2 + 3i) = a + bi$. Find a + b. _____
- (54) A box of pens contains 7 black ones, 4 red, 6 blue,
and 3 green. The probability of randomly
selecting a pen that is not blue is _____ %
- (55) $25 \times \frac{29}{31} =$ _____ (mixed number)
- (56) $18^{1.5} = a\sqrt{b}$. Find a. _____
- (57) The vertex of $x^2 = 8(y - 4)$ is at (0, _____)
- (58) If $\sum_{k=1}^n (-1)^k (k)^2 = 210$, then n = _____

- (59) $\frac{5}{12} - \frac{5}{24} + \frac{5}{48} - \frac{5}{96} + + \dots =$ _____
- *(60) 38 radians = _____ degrees
- (61) $15 \times 5! + 10 \times 6! =$ _____
- (62) $(4x^3 + 2x^2 - 9x + 13) \div (x - 3)$
has a remainder of _____
- (63) The harmonic mean of 0.25, 0.5 and 1 is _____
- (64) $\sqrt{12} + \sqrt{75} = \sqrt{x}$. x = _____
- (65) Find the first four digits of the
base 6 decimal of $\frac{17}{35_{10}}$ is 0. _____
- (66) $222 \times \frac{4}{27} =$ _____ (mixed number)
- (67) Let $f(x) = x^2 - 8x + 16$ and $g(x) = x + 7$.
 $f(g(9)) =$ _____
- (68) $(1 + i)^6 = a + bi$. Find a. _____
- (69) $\sin \left(\text{Arccos} \frac{\sqrt{33}}{7} \right) =$ _____
- *(70) 325 gallons = _____ ounces
- (71) The determinant of $\begin{bmatrix} 8 & -10 \\ 3 & x+3 \end{bmatrix} = 50$. x = _____
- (72) $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x^2 + 4x - 12} =$ _____
- (73) Find x, $0 \leq x \leq 12$, if $3x - 1 \equiv 3 \pmod{13}$. _____
- (74) If $f'(x) = 7$ and $f(5) = 11$. Find $f(9) =$ _____
- (75) The y-intercept of the line tangent to
 $y = x^2 - 5x + 4$ at $x = 2$ is _____
- (76) $\int_0^6 (3x - 5) dx =$ _____
- (77) $(5.25)^{-2} =$ _____ (fraction)
- (78) The maximum value of
 $f(x) = \frac{2x+9}{x+2}$ over the interval $[0, 3]$ is _____
- (79) If $x - y = 4$ and $xy = 6$, then $x^3 - y^3 =$ _____
- *(80) 0.1777... of $(275000 \div 0.111 \dots)$ = _____

2022-2023 Virtual Challenge Meet #2 • HS Number Sense - Key

(1) 396	(19) 1610	(36) 441	(59) $\frac{5}{18}$
(2) 2820	*(20) 49461 – 54667	(37) 625	*(60) 2069 – 2286
(3) $\frac{2}{3}$	(21) 5	(38) 0	(61) 9000
(4) $\frac{7}{3}$	(22) 2	(39) $42\frac{6}{7}$	(62) 112
(5) $9\frac{2}{7}$	(23) 343	*(40) 2574 – 2844	
(6) 137	(24) 2349	(41) 10682	(63) $\frac{3}{7}$
(7) 361	(25) 24	(42) 45	(64) 147
(8) 58	(26) 5	(43) 3961	(65) 2525
(9) 1224	(27) 8928		
*(10) 34500 – 38130	(28) $72\frac{18}{121}$	(44) 120	(66) $32\frac{8}{9}$
(11) 943	(29) 2116	(45) 1225	(67) 144
(12) 150	*(30) 536 – 591	(46) 12	
(13) 8096	(31) 103	(47) 332	(68) 0
(14) 16	(32) 437		(69) $\frac{4}{7}$
(15) 11	(33) 8	(48) 4	*(70) 39520 – 43680
(16) 20.00	(34) 73	(49) $\frac{7}{11}$	(71) $-\frac{1}{2}$ or $-.5$
(17) 3375		*(50) 22799978 – 25199974	(72) $\frac{1}{2}$ or $.5$
(18) 240	(35) 91	(51) 4	(73) 10
		(52) 9	(74) 39
		(53) 34	
			(75) 0
			(76) 24
		(54) 70	
		(55) $23\frac{12}{31}$	(77) $\frac{16}{441}$
		(56) 54	(78) $\frac{9}{2}$, $4\frac{1}{2}$, or 4.5
		(57) 4	(79) 136
		(58) 20	*(80) 418000 – 462000