
2021 UH MATHEMATICS CONTEST

NUMBER SENSE EXAM

Directions: Read the instructions carefully before you begin this exam. You will have 30 minutes to complete this exam. Solve accurately as many problems as you can in the order in which they appear and enter your answers using the panel on your screen. ALL PROBLEMS ARE TO BE SOLVED MENTALLY. Make NO calculations on paper. Enter the answer correctly for each question. You cannot erase anything once the numbers are entered. Five points will be awarded for correct answers and four points will be deducted for each problem not solved correctly and for each problem skipped. No deduction is taken for problems after the last problem attempted. All answers should be either (simplified) fractions, or decimals, or just integers. Mixed numbers are not allowed. Answers should be written in the most efficient form possible.

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| (1) $719 + 917 =$ _____ | (22) The sum of the prime numbers less than or equal to 13 is _____ |
| (2) $11 \times 13579 =$ _____ | (23) $132 \times 2.727272\dots =$ _____ |
| (3) $\$30.14 - \$8.47 = \$$ _____ | (24) The sum of three consecutive integers is 108. The largest of the three integers is _____ |
| (4) $0.35 \div \frac{9}{14} =$ _____ (fraction) | (25) $\text{MMXXI} \div \text{XLVII} =$ _____ |
| (5) $327 \div 9 - 61 \div 3 =$ _____ | (26) If $2197 = [3(7 + k) + 1]^3$, then $k =$ _____ |
| (6) $4\frac{4}{5}\% =$ _____ (fraction) | (27) If $6x - y = 9$ and $x + 3y = 11$, then $y =$ _____ |
| (7) $-(-3)(2) - (-4)(-3) + (-5)^2 =$ _____ | (28) $\sqrt{40 \times 160}$ _____ |
| (8) Which is smaller $-\frac{8}{11}$ or $-\frac{7}{9}$? $=$ _____ | (29) $37^2 - 23^2 =$ _____ |
| (9) $5\frac{1}{4} - 2\frac{2}{3} =$ _____ (fraction) | (30) $7\frac{3}{4} \times 7\frac{1}{4} =$ _____ (fraction) |
| (10) $(-8) - 9 - (-10) =$ _____ | (31) If $ 8x - 5 = 3x + 1$, then the product of the solutions for this equation is _____ (fraction) |
| (11) $\text{LCM}(35, 55) \times \text{GCD}(35, 55) =$ _____ | (32) If 6 pens cost \$9.30 then 4 pens cost \$ _____ |
| (12) 75% of 4 feet 8 inches = _____ inches. | (33) The total number of 1-element subsets and 4-element subsets of the set $\{r, o, u, n, d\}$ is _____ |
| (13) 9% of $133\frac{1}{3} =$ _____ | (34) The set $\{f, i, v, e\}$ has _____ proper subsets |
| (14) The multiplicative inverse of -2.6 is _____ | (35) $(22 + 45 \times 37) \div 6$ has a remainder of _____ |
| (15) $0.44 \times 150 =$ _____ | (36) $24.242424\dots =$ _____ (fraction) |
| (16) The average of 16, 21, 15, 19, and x is 18. $x =$ _____ | (37) If $A \cap B$ has 8 elements, set B has 6 elements, and $A \cup B$ has 18 elements, then set A has _____ elements |
| (17) $4 \times 12 \div 3 - 11 =$ _____ | (38) If $kx^2 - x - 12 = 0$ and the product of the roots is -2 , then $k =$ _____ |
| (18) $2021 \times 21 - 21 =$ _____ | (39) $27 + 6 + 1 =$ _____ base 3. |
| (19) $25 \times 93 =$ _____ | (40) $103 \times 104 =$ _____ |
| (20) $43^2 =$ _____ | |
| (21) $\frac{13}{80} =$ _____ (decimal) | |

- (41) $\frac{5! - 3!}{4!} =$ _____ (fraction)
- (42) $5 \times 5! + 30 \times 4! =$ _____
- (43) The measure of an interior angle of a regular decagon is _____ degrees
- (44) The largest root of $x^2 + x - 30 = 0$ is _____
- (45) Find the number of integer solutions to this inequality $|2x - 25| < 12$. _____
- (46) Which of the following is a pentagonal number: 20, 21, or 22? _____
- (47) The length of a rectangle is 3 times the width. If the perimeter is 48 inches, then the area of the rectangle is _____ sq. inches.
- (48) The product of the roots of $(2x - 3)(x + 4) = 0$ is _____
- (49) The area of a circle is 32π sq. in. The diameter of this circle is $a\sqrt{b}$ in., where $a > 1$. Find $a + b$. _____
- (50) A square based prism has a base side length of $2'$ and a height $5'$. Its volume is _____ ft^3
- (51) $19^2 \times 76^3 \div 38^4 =$ _____
- (52) $(115^3 - 5^3) \div (115^2 + 115 \times 5 + 5^2) =$ _____
- (53) $(0.125)(13^2 - 11^2) =$ _____
- (54) Find the total surface area of a square pyramid with a base edge 6 cm and height 4 cm. _____
- (55) If $x + y = -2$ and $xy = 5$, then $x^3 + y^3 =$ _____
- (56) A container has 2 gallons, 2 quarts, and 2 pints of water in it. How many pints are left in the container if 5 quarts and 7 pints are poured out? _____ (pints)
- (57) Find the slope of a line perpendicular to the line containing the points $(-2, -1)$ and $(3, 4)$. _____
- (58) A is 10% more than B and B is 20% more than C . A is what % more than C ? _____ %
- (59) The smallest integer such that $e \times n > 100$ is _____
- (60) If $2^{3x} \div 4^{2x} = 8$, then $x =$ _____
- (61) $1110_4 \div 3_4 =$ _____ $_4$
- (62) ${}_{11}C_6 \div {}_{11}P_6 =$ _____ (fraction)
- (63) $4 + \frac{8}{3} + \frac{16}{9} + \frac{32}{27} + \dots =$ _____
- (64) The 8th hexagonal number is the same as the k -th triangular number. $k =$ _____
- (65) 3 cubic yards equals _____ cubic feet
- (66) The smaller leg of a $30^\circ - 60^\circ - 90^\circ$ right triangle is $2\sqrt{3}$ cm. The other leg is _____ cm.
- (67) The roots of $x^3 + 2x^2 - 5x - 6 = 0$ are $d, e,$ and f . Find $(d + e)(e + f)(f + d)$. _____
- (68) The maximum value of the function $f(x) = 5 + 6x - 3x^2$ is _____
- (69) Find the largest integer value of x that satisfies the inequality $\frac{x + 1}{x^2 + x - 20} \leq 0$. $x =$ _____
- (70) If $\log_x 1728 = 3$, then $x =$ _____
- (71) The sum of the coefficients in the expansion of $(2x + 3y)^5$ is _____
- (72) $(8i - 15)(8i + 15) =$ _____
- (73) The simplified coefficient of the x^3y^3 term in the expansion of $(x + 2y)^6$ is _____
- (74) If $9! = 2^a \times 3^b \times 5^c \times 7^d$, then $a =$ _____
- (75) If $(111)(65)(k) = 404040$, then $k =$ _____
- (76) If $\frac{6!}{3! + 4!} \equiv x \pmod{7}$ for $0 \leq x \leq 6$, then $x =$ _____
- (77) If $(3i - 2) \div (3i + 2) = a + bi$, then $b =$ _____
- (78) $423 \times 425 =$ _____
- (79) If 6 men can do a job in 5 days, then 10 men working at the same rate can do it in _____ days.
- (80) $\sin(125^\circ) = \cos(A)$ and $90^\circ < A < 360^\circ$, then $A =$ _____ $^\circ$
- (81) The period of $y = 5 - 2 \cos\left(\frac{1}{35}\pi x - 35\pi\right)$ is _____
- (82) Change $0.6333\dots_7$ to a base 7 fraction. _____
- (83) The number of distinct diagonals of a 10 sided regular polygon is _____
- (84) If $\begin{bmatrix} 1 & 2 \\ -4 & -3 \end{bmatrix} \times \begin{bmatrix} 3 & 4 \\ -2 & -1 \end{bmatrix} = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$, then $bd =$ _____
- (85) If $2 \sec^2 34^\circ - 2 = 3$, then $\tan^2 34^\circ =$ _____ (fraction)
- (86) If $2 \log_4(3x - 1) = 3$ and $x > \frac{1}{3}$, then $x =$ _____
- (87) If $3^{(x+1)} = 81$, then $9^{(x-1)} =$ _____
- (88) The distance between the line $3x + 4y = 5$ and the point $(1, 1)$ is _____ (decimal)
- (89) The greatest integer function is written as $f(x) = [x]$. Find $\left[\pi + \frac{\sqrt{5} + 1}{2}\right]$. _____
- (90) If $\log_3(2) + 2 \log_3(x) - \log_3(5) = \log_3(14)$ then $x^2 =$ _____

- (91) $4^1 - 4^0 + 4^{-1} - 4^{-2} + \dots =$ _____ (fraction)
- (92) $f(x) = 5 - 2x$ and $g(x) = 2 + 5x$. $f(g(-1)) =$ _____
- (93) The largest prime number less than $6!$ is _____
- (94) $609^2 =$ _____
- (95) $1 + 2^2 + 3^3 + 4^4 =$ _____
- (96) $\lim_{x \rightarrow \infty} \left(\frac{3x^2 - x + 6}{4x^2 - 9} \right) =$ _____
- (97) $f'(x) = 7.5$, $f(8) = 12$, find $f(16)$. _____
- (98) $f(x) = x + \frac{1}{x}$ has _____ asymptotes
- (99) A pair of dice is thrown. The odds that the sum is a multiple of 5 is _____
- (100) The 125-th term of $3, 7, 11, 15, \dots$ is _____
- (101) $\frac{1}{10} + \frac{1}{40} + \frac{1}{88} + \frac{1}{154} =$ _____
- (102) $\int_{-2}^2 x^2 dx =$ _____ (fraction)
- (103) The largest number in the domain of $y^2 = 4 - x^2$ is _____
- (104) $999 \times \frac{7}{27} \times \frac{7}{37} =$ _____