2023 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. Problems marked with a (∗) require approximate integral answers; any answer to a starred problem that is within five percent of the exact answer will be scored correct; all other problems require exact answers.

(1) $4422 \div 6 =$ ______

(2) $2\frac{5}{8} =$ ______ % (decimal)

(3) $\frac{4}{5} \times \frac{5}{6} =$ ______ (fraction)

(4) $76\% =$ ______ (fraction)

(5) $2022 - 2023 =$ ______

(6) $14 \times 23 + 14 \times 47 =$ ______

(7) DCCXLIX = ______

(8) $2005 \times 5 - 2005 =$ ______

(9) $4\frac{1}{4}\% =$ ______ (fraction)

(10) $49 \times 125 =$ ______

(11) MDII + CX = ______

(12) $26^2 =$ ______

(13) $2001 \times 15 - 15 =$ ______

*(14) $2153 + 1620 + 1921 + 5316 =$ ______

(15) $85 \times 105 =$ ______

(16) The mean of 23, 27, 35, and 31 is ______

(17) $3\frac{1}{4} \times 16 =$ ______

(18) 16 is what % of 40? ______

(19) $3 + 9 + 15 + \ldots + 33 =$ ______

(20) $135 \times 12 =$ ______

(21) The sum of the positive integral divisors of 95 is ______

(22) $\mathrm{LCM}(35, 55) \times \mathrm{GCD}(35, 55) =$ ______

(23) The number of prime divisors of 80 is ______

(24) The LCM of 34 and 85 is ______

(25) MMDCXXV ÷ CLXXV = ______

(26) $275 \times 11 =$ ______

(27) How many elements are in $\{x \mid 30 < x < 40, \text{ where } x \in \{\text{Primes}\}\}$? ______

*(28) $\sqrt{224} \times \sqrt{325} =$ ______

(29) $315_6 =$ ______ $_{10}$

(30) $0.666\ldots \times .272727\ldots =$ ______ (fraction)

(31) If $\frac{3}{4x} = \frac{2}{5}$, then $x = \frac{A}{B}$. A is ______

(32) The slope of the line through the points $(5, -3)$ and $(2, 1)$ is ______ (fraction)

(33) $5\frac{2}{3} - 4\frac{5}{12} =$ ______ (fraction)

(34) If $24^2 - 20^2 = 11k$, then $k =$ ______

(35) A quart is what % of a cup? ______ %

(36) $(3 \times 19 + 24) \div 9$ has a remainder of ______

(37) The set $\{l, i, n, e, a, r\}$ has ______ 4-elements subsets

(38) $12^2 + 4^2 =$ ______

(39) If $f(x) = x^2 - 10x + 25$, then $f(37) =$ ______

(40) $0.2353535\ldots =$ ______ (fraction)

(41) Set A has 4 elements, set B has 7 elements, and $A \cap B$ has 3 elements, then $A \cup B$ has ________ elements

*(42) $4\frac{2}{3} \times 1423 \div 14 =$ ________

(43) $1^2 + 1^2 + 2^2 + 3^2 + 5^2 + 8^2 + 13^2 =$ ________

(44) Let $(27x - 23)^2 = ax^2 + bx + c$. Find $a + b + c$. ________

(45) $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} =$ ________ (fraction)

(46) $65_{10} =$ ________$_7$

(47) The slope of the line $\frac{1}{7}x + \frac{1}{2}y = \frac{2}{3}$ is ________ (fraction)

(48) If $\sqrt{50} - \sqrt{18} = \sqrt{x}$, then $x =$ ________

(49) $4^2 + 3 =$ ________$_7$

(50) 13.3 is ________ % of 20.

(51) $43 \times 47 =$ ________

(52) How many integers between 3 and 28 are relatively prime to 28? ________

(53) $-2(-3) - (-4) + [-6 - (-7)] =$ ________

(54) How many positive integers less than 18 are relatively prime to 18? ________

(55) Which of the following is a pentagonal number: 20, 21, or 22? ________

*(56) $(248 \times 53)^2 \div (47 \times 289) =$ ________

(57) $5^3 \times 2^5 =$ ________

(58) If A is 70% of B and B is 80% of C, then A is what percent of C? ________ %

(59) If $A^3 \div A^k \times A^{-5} = A^6$ and $A > 1$, then $k =$ ________

(60) If $x - y = 3$ and $xy = 2$, then $x^3 - y^3 =$ ________

(61) If $3^x = 27$, then $3^{2x} =$ ________

(62) If $|2x - 1| = 5$ and $x < 0$, then $x =$ ________

(63) If $75 \times 34 = 15 \times y$, then $y =$ ________

(64) The number of distinct diagonals in a regular octagon is ________

(65) The side opposite 30° in a right triangle is $2\frac{3}{8}$ cm. The hypotenuse is ________ cm (decimal)

(66) If $\frac{x+5}{x-5} + \frac{x-5}{x+5}$ is written as the mixed number $A\frac{B}{C}$, then $B =$ ________

(67) If 13, b, 85 are the integral sides of a right triangle then the area of the triangle is ________

(68) For $kx^2 + 30x + 25 = 0$ to have equal roots, k has to have a value of ________

(69) Find the area of a triangle with side lengths of 11 cm, 60 cm, and 61 cm. ________ cm^2

*(70) $\sqrt{6543210} =$ ________

(71) Let $\frac{6!}{4!} = \frac{(x+1)!}{x!}$. Find x. ________

(72) If $\log_x 216 = 3$, then $x =$ ________

(73) The sum of the roots $(2x + 5)^2 - 1 = 0$ is ________

(74) $(4 + 7\text{i})(3 - 5\text{i}) = a + b\text{i}$. Find $a - b$. ________

(75) $42^2 + (40^2 - 2^2) =$ ________

(76) Find the modulus of $12 - 5\text{i}$. ________

(77) The largest integer such that $4x + 3 < 2$ is ________

(78) 24% of $208\frac{1}{3}$ is ________

(79) $32_6 \div 5_6 \times 4_6 =$ ________$_6$

(80) The 11th term of $3, 8, 13, 18, \ldots$ is ________

(81) The area of a sector with radius 8 in. is 16π sq. in. Then the central angle of this sector is ________$^\circ$

(82) $121 \times 411 =$ ________

(83) $\frac{(x^2 + 4x + 4)(x^2 - 5x + 6)}{(x^2 - 4)(x - 3)} = x +$ ________

*(84) $(2\pi^2) \times (3\pi^3) =$ ________

(85) The first four exact digits of the decimal for $\frac{71}{330}$ are 0. ________

(86) $\tan\left(\frac{\pi}{3}\right) \times \cot\left(\frac{\pi}{6}\right) =$ ________

(87) The volume of a rectangular based pyramid with a base width of 5 in., a base length of 12 in., and a height 13 in. is ________ cu. in.

(88) Find the sum of all positive integers x such that $3x - 1 \leq 23$. ________

(89) How much time has past from 3:45pm to 4:00pm in one day? ________ seconds

(90) $0.454545\ldots_8 =$ ________$_{10}$ (fraction)

(91) $\sec[\cos^{-1}(.3)] =$ ________ (fraction)

(92) $\begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 4 & 2 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$. Find $a + b + c + d$. ________

(93) A golf store has white, yellow, pink, and orange balls. How many different packs of 3 balls can the store package? ________

(94) $2\sin 165^\circ \cos 165^\circ =$ ________ (fraction)

(95) Three coins are flipped. What is the probability of getting at least one head? ________ (fraction)

(96) 95° F = ________ $^\circ$ C

(97) $f(x) = 5x^3 + 4x^2 + 3x - 2$ divided by $x + 1$ has a remainder of ________

*(98) $(3.14)^e \times (2.718)^\pi =$ ________

(99) If $f(x) = 3x^4 - 2x^3 + x^2$, then $f''(1) =$ ________

(100) Truncate $5\sqrt{6}$ to the nearest tenth. ________

(101) $\displaystyle\int_2^4 (2x + 4)\,dx =$ ________

(102) Find the slope of the line tangent to $y = 2x^2 + 3x - 2$ at $(-1, -3)$. ________

(103) $\displaystyle\lim_{x\to 4} \frac{x^2 + x - 20}{x - 4} =$ ________

(104) If $h(x)$ is the slant asymptote of $f(x) = \dfrac{x^2 - 3x + 1}{x - 3}$, then $h(1) =$ ________

(105) $1213 \times 14 =$ ________

(106) $f'(x) = 2$, $f(1) = 3$, find $f(4)$. ________

(107) If $f(x) = \dfrac{3}{1 - x}$, then $f^{-1}(2) =$ ________ (fraction)

(108) The sum of the critical values of $f(x) = x^3 - 3x + 1$ is ________

(109) The radius of the inscribed circle of a 6, 8, 10, right triangle is ________

(110) $47631259 \div 8$ has a remainder of ________

(111) $1^3 - 2^3 + 3^3 - 4^3 + 5^3 =$ ________

*(112) 3210 miles/hour = ________ feet/second