The University Interscholastic League
Number Sense Test ● HS A ● 2022

Directions: Do not turn this page until the person conducting this test 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 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.

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

STOP -- WAIT FOR SIGNAL!

(1) $122 \times 5 =$ _____

(2) $2\frac{1}{3} + 3\frac{1}{2} =$ _____ (mixed number)

(3) $1.62 \div 0.3 =$ _____ (decimal)

(4) $\frac{2}{5} - \frac{4}{7} =$ _____

(5) $12^3 =$ _____

(6) $23 \times 52 - 23 \times 29 =$ _____

(7) $\frac{4}{5} =$ _____ (per cent)

(8) 48 is x % of 160. Find x. _____

(9) $2 \times (3 + 5) \div (7 - 11) =$ _____

*(10) $10722 + 20522 + 2122 =$ _____

(11) 3 gallons = _____ pints

(12) The GCD(12,40) + LCM(12, 40) = _____

(13) $14 \times 31 =$ _____

(14) A 15% tip on a $34.00 dinner bill is $ _____

(15) $\frac{10}{11} + \frac{11}{10} =$ _____ (mixed number)

(16) The mode of 2, 5, 1, 5, 2, 1, 3, 4, 1 is _____

(17) The number of positive integral divisors of 40 is __

(18) $33 \times 27 =$ _____

(19) $107205 \div 6$ has a remainder of _____

*(20) $701 \times 205 \times 22 =$ _____

(21) If $3x + 4 = 1$, then $4x - 3 =$ _____

(22) $42^2 + 16^2 =$ _____

(23) If $8^{(x)} = 12.8$, then $8^{(x-2)} =$ _____

(24) The multiplicative inverse of 2.5 is _____

(25) $[17 + 25 \times 20 - 22)] \div 3$ has a remainder of ____

(26) Given, 4:9 = x:12. Find 3x. _____

(27) $\sqrt{324} + \sqrt{225} =$ _____

(28) 0.1333... = _____ (proper fraction)

(29) 95 written in base 6 is _____ $_6$

*(30) $152722 \div 123 =$ _____

(31) If $x + 4y = 8$ and $x - 2y = 6$, then $y =$ _____

(32) Let A ={a, u, s, t, i, n}, B = {b, o, i, s, e}, and C = {c, a, r, s, o, n}. How many unique elements are in $(A \cap B) \cup C$? _____

(33) $|1 - 7| - |2 + 5| - 22 =$ _____

(34) The product of the coefficients of $(2x - y)^2$ is ____

(35) Given: 1, 3, 6, 10, 15, p, q, r, 45, ... r = _____

(36) The sum of the product of the roots taken two at a time of $x^3 - 3x^2 - 13x + 15 = 0$ is _____

(37) $22 \times 28 =$ _____

(38) How long is it between the end of Jan. 6, 2022 and the end of Feb. 5, 2022? _____ days

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

*(40) $\sqrt{225271} =$ _____

(41) The area of a circle is 9π cm^2. The circumference of the circle is _____ π cm

(42) If $x + y < 4$ and $y > 1$, then $x <$ _____

(43) The abscissa of the x-intercept of the line $2x - 5y = 10$ is _____

(44) If $A^k \div A^{-3} \times A^5 = A^4$ and $A > 1$, then k = _____

(45) $19^2 + 19 =$ _____

(46) $55^2 + 54^2 =$ _____

(47) $31^{13} \div 13$ has a remainder of _____

(48) $(205_8 - 107_8) \times 2_8 =$ _____ 8

(49) The measure of an inscribed angle is $k°$. The measure of its intercepted arc is $75°$. Find k. _____

*(50) $(1875) \div (0.625) =$ _____

(51) If y varies directly with x, and y = 6 when x = 2, then x = _____ when y = 9.

(52) Let $2\frac{4}{m} \times n\frac{1}{11} = 10$, where m, n are natural numbers. Find m + n. _____

(53) Let $(1 - 2i)(3 - 4i) = a + bi$. Find a. _____

(54) $\frac{10!}{8!\ 2!} =$ _____

(55) The coefficient of the xy^2 term in the expansion of $(x + 2y)^3$ is _____

(56) The vertex of $y = 3x^2 - 2x - 1$ is (h, k). h = _____

(57) Two elements from the set {w, h, i, t, e} are drawn randomly, without replacement. The probability that both are vowels is _____%

(58) $7 + 11 + 18 + 29 + 47 + 76 + ... + 199 =$ _____

(59) The sum of the third triangular number and the second hexagonal number is _____

*(60) $\sqrt[3]{20221715} =$ _____

(61) $9 + 35 \times 32 =$ _____

(62) $222 \times \frac{2}{27} =$ _____ (mixed number)

(63) $\sum_{1}^{3} (-1)^k (k^2) =$ _____

(64) If $(2x^2 - 5x + k) \div (x - 5)$ has a remainder of 2, then k = _____

(65) $\sin\left(\frac{5\pi}{6}\right) + \cos\left(\frac{2\pi}{3}\right) =$ _____

(66) $\begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix} \times \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$. Find a. _____

(67) The first four digits of the decimal for $\frac{5}{66}$ base 7 is 0._____ base 7

(68) Let (x, y) be the rectangular coordinate for the polar coordinate $(1, -\frac{\pi}{2})$. x = _____

(69) Let $f(x) = x^2 - 2x + 1$ and $g(x) = 3 - x$. Find $f(g(-1))$. _____

*(70) 2 tons = _____ ounces

(71) The domain of $y^2 = 9 - x^2$ is $m \le x \le n$. n = _____

(72) $\lim_{x \to \infty} \frac{2x - 3}{x} =$ _____

(73) Let $f(x) = 4x^3 - 3x^2 - 2x$. Find $f''(-1)$. _____

(74) The y-intercept of the line tangent to $y = 2x^2 - 5x - 3$ at x = 3 is y = _____

(75) The horizontal asymptote of $y = \frac{3x + 2}{1 - 4x}$ is y = _____

(76) $\int_{-2}^{2} (x^3 + 1)\, dx =$ _____

(77) The maximum value of $f(x) = 4x - 3x^2$ is _____

(78) If $f(x) = \frac{3x + 2}{4} - 5$, then $f^{-1}(1) =$ _____

(79) $3^3 - 4^3 + 5^3 - 6^3 =$ _____

*(80) 8.333...% of $(4166 \div \frac{7}{12}) =$ _____

University Interscholastic League - Number Sense Answer Key HS ● Invitation A ● 2022
*number) x − y means an integer between x and y inclusive
NOTE: If an answer is of the type like $\frac{2}{3}$ it cannot be written as a repeating decimal

(1) 610

(2) $5\frac{5}{6}$

(3) 5.4

(4) $-\frac{6}{35}$

(5) 1,728

(6) 529

(7) 80

(8) 30

(9) −4

*(10) 31,698 — 35,034

(11) 24

(12) 124

(13) 434

(14) 5.10

(15) $2\frac{1}{110}$

(16) 1

(17) 8

(18) 891

(19) 3

*(20) 3,003,435 — 3,319,585

(21) −7

(22) 2,020

(23) .2, $\frac{1}{5}$

(24) .4, $\frac{2}{5}$

(25) 0

(26) 16

(27) 33

(28) $\frac{2}{15}$

(29) 235

*(30) 1,180 — 1,303

(31) $\frac{1}{3}$

(32) 7

(33) −23

(34) −16

(35) 36

(36) −13

(37) 616

(38) 30

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

*(40) 451 — 498

(41) 6

(42) 3

(43) 5

(44) −4

(45) 380

(46) 5,941

(47) 5

(48) 174

(49) 37.5, $\frac{75}{2}$, $37\frac{1}{2}$

*(50) 2,850 — 3,150

(51) 3

(52) 13

(53) −5

(54) 45

(55) 12

(56) $\frac{1}{3}$

(57) 10

(58) 510

(59) 12

*(60) 259 — 286

(61) 1,129

(62) $16\frac{4}{9}$

(63) −6

(64) −23

(65) 0

(66) 7

(67) 0505

(68) 0

(69) 9

*(70) 60,800 — 67,200

(71) 3

(72) 2

(73) −30

(74) −21

(75) −.75, $-\frac{3}{4}$

(76) 4

(77) $\frac{4}{3}$, $1\frac{1}{3}$

(78) $\frac{22}{3}$, $7\frac{1}{3}$

(79) −128

*(80) 566 — 624