The University Interscholastic League
Number Sense Test • HS A • 2023

Final _____ _____

Contestant's Number _____ 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 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.

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STOP -- WAIT FOR SIGNAL!

(1) $2023 \times 4 =$ _____

(2) $\frac{1}{2} \div \frac{5}{8} =$ _____ **(fraction)**

(3) $236 - 632 =$ _____

(4) $202.3 + 32.02 =$ _____ **(decimal)**

(5) $31^2 =$ _____

(6) $85\% =$ _____ **(fraction)**

(7) $25 \times 16 =$ _____

(8) $20.23 \times 10^2 + 1 =$ _____

(9) $714 \div 7 \div 2 =$ _____

***(10)** $31 + 309 \times 311 =$ _____

(11) $75 \times 75 =$ _____

(12) $3^0 + 3 \times 3 - 3 =$ _____

(13) Which is larger, $\frac{4}{13}$ or $\frac{3}{14}$? _____

(14) 12 square feet = _____ square inches

(15) $1 + 2 + 3 + 4 + ... + 38 + 39 =$ _____

(16) $(202 + 317) \div 4$ has a remainder of _____

(17) $(9 + 6)(54 + 18) =$ _____

(18) 16% of 6 is _____% of 48

(19) $42^2 - 38^2 = 8 \times$ _____

***(20)** $172023 \div 218 =$ _____

(21) The LCM of 24, 48, and 80 is _____

(22) $72 \times 15 =$ _____

(23) Let A = 4, B = 6, and C = 8. Find (BC) ÷ A. _____

(24) If x = 4, then $x^4 - 4x^2 + 4 =$ _____

(25) The simple interest on $800 at 8% for 3 months is $ _____

(26) $213_7 =$ _____ 10

(27) 57 x 57 = _____

(28) 13332 ÷ 101 = _____

(29) $1996 \times 4 + 16 =$ _____

***(30)** $\sqrt{(256)(145)} =$ _____

(31) $8\frac{1}{4} \times 4\frac{3}{4} =$ _____ **(mixed number)**

(32) 24 has _____ positive integral divisors

(33) $5\frac{1}{6} \times 6\frac{1}{5} =$ _____ **(mixed number)**

(34) The smallest root of $x^2 - 5x + 6 = 0$ is _____

(35) 22 dogs bark at cats, 17 bark at birds, and 9 bark at both. How many dogs were there? _____

(36) $[14 \times 10 + 73] \div 4$ has a remainder of _____

(37) How many integers between 3 and 33 are relatively prime to 33? _____

(38) Given: 2, 3, 5, 7, 11, p, 17, 19, r,... . $p + r$ = _____

(39) $6^2 \div 3^2 \times 1.5^2$ = _____

*(40) $142 \times 39 \times 138$ = _____

(41) $(1^5 + 3^5) \div 4$ has a remainder of _____

(42) $6^2 - 1$ = _____ 6

(43) 125 has how many positive integral divisors? _____

(44) Let k be the smallest 3-digit number divisible by 6. Find k. _____

(45) 103×102 = _____

(46) $16 \times \frac{19}{22}$ = _____ (mixed number)

(47) If $x < 0$ and $|2x - 1| = 15$, then x = _____

(48) The sum of the roots of $x^3 + 6x^2 + 12x + 8 = 0$ is _____

(49) Let $3\frac{3}{m} \times n\frac{1}{3} = 12$, where m, n are natural numbers. Find mn. _____

*(50) 187.5×31.4 = _____

(51) $46^2 + 45^2$ = _____

(52) 34×74 = _____

(53) $31_5 \times 4_5 + 20_5$ = _____ 5

(54) If $(3 + 4i)(2 - i) = (a + bi)$, then a = _____

(55) $4 + 5 + 9 + 14 + 23 + 37 + ... + 157 + 254$ = ___

(56) The measure of an interior angle of a regular n-gon is 108° and its number of sides is _____

(57) A decagon has how many distinct diagonals? _____

(58) If $\sum_{k=1}^{n} (-1)^k(k^2) = -91$, then n = _____

(59) $12^{25} \div 13$ has a remainder of _____

*(60) 0.35×1102023 = _____

(61) $\frac{4 \times 5! + 5 \times 4!}{4!}$ = _____

(62) If $\sqrt{20} + \sqrt{45} = \sqrt{x}$, then x = _____

(63) The harmonic mean of the roots of $x^3 - 6x^2 + 11x - 6 = 0$ is _____

(64) $\log_3(\log_3 27)$ = _____

(65) If $f(x) = 3x$ and $g(x) = x + 4$, then $g(f(2))$ = _____

(66) If $xy = 2$ and $x + y = 5$ then $x^3 + y^3$ = _____

(67) $223_4 \times 11_4$ = _____ 4

(68) The middle term in the expansion of $(2x - 1)^4$ is px^qy^r. The sum of p,q, and r is _____

(69) Given: 2, 6, 10, 14, b, d, f , ..., 38 ... . d = _____

*(70) $\sqrt[3]{32027010}$ = _____

(71) The area of the ellipse $2x^2 + 8y^2 = 16$ is $k\pi$. Find k. _____

(72) $(8, \frac{\pi}{3})$ are polar coordinates for (x, y). x = _____

(73) $\lim_{x \to 4} \frac{x^3 - 64}{x - 4}$ = _____

(74) Change $\frac{11}{36}$ to a base 6 decimal. _____ 6

(75) $f(x) = \frac{3x + 1}{4}$ and $f^{-1}(-2)$ = _____

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

(77) Three coins are tossed, what is the probability of not getting a head? _____

(78) $(301)^3$ = _____

(79) The third nonagonal number is _____

*(80) $7.777... \times 18 \times 10^2$ = _____

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS ● Invitation A ● 2023

***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) 8,092

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

(3) — 396

(4) 234.32

(5) 961

(6) $\frac{17}{20}$

(7) 400

(8) 2,024

(9) 51

***(10) 91,324 — 100,936**

(11) 5,625

(12) 7

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

(14) 1,728

(15) 780

(16) 3

(17) 1,080

(18) 2

(19) 40

***(20) 750 — 828**

(21) 240

(22) 1,080

(23) 12

(24) 196

(25) 16.00

(26) 108

(27) 3,249

(28) 132

(29) 8,000

***(30) 184 — 202**

(31) $39\frac{3}{16}$

(32) 8

(33) $32\frac{1}{30}$

(34) 2

(35) 30

(36) 1

(37) 18

(38) 36

(39) 9

***(40) 726,032 — 802,456**

(41) 0

(42) 55

(43) 4

(44) 102

(45) 10,506

(46) $13\frac{9}{11}$

(47) — 7

(48) — 6

(49) 15

***(50) 5,594 — 6,181**

(51) 4,141

(52) 2,516

(53) 244

(54) 10

(55) 660

(56) 5

(57) 35

(58) 13

(59) 12

***(60) 366,423 — 404,993**

(61) 25

(62) 125

(63) $\frac{18}{11}$, $1\frac{7}{11}$

(64) 1

(65) 10

(66) 95

(67) 3113

(68) 28

(69) 22

***(70) 302 — 333**

(71) 4

(72) 4

(73) 48

(74) .15

(75) — 3

(76) 0

(77) .125, $\frac{1}{8}$

(78) 27,270,901

(79) 24

***(80) 13,300 — 14,700**

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Number Sense Test • HS B • 2023

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(1) $315 \div 9 =$ _____

(2) $2102 \times 3 =$ _____

(3) $210.23 - 311.23 =$ _____

(4) $3112 + 2113 =$ _____

(5) $23^2 =$ _____

(6) $\frac{13}{20} =$ _____ %

(7) $123 \times 11 =$ _____

(8) $210 \div 10^2 - 1 =$ _____ (decimal)

(9) $2\frac{2}{3} + 3\frac{3}{4} =$ _____ (mixed number)

***(10)** $23 + 229 \times 24 =$ _____

(11) $12 \times 141 =$ _____

(12) $32 + 8 \times 2 - 4 \times 8 =$ _____

(13) MMXXIII × II = _____ (Arabic Numeral)

(14) The smallest prime divisor of 21^2 is _____

(15) $\frac{5}{4}$ is _____ % of 10

(16) 90 ÷ 0.090909... has a remainder of _____

(17) $(6^2 \times 5^2 \times 4) \div (6 \times 4) =$ _____

(18) $\frac{2}{3}$ of 6 feet 9 inches _____ inches

(19) $44^2 - 36^2 = 40 \times$ _____

***(20)** $210 \times 311 + 2023 =$ _____

(21) $(210 + 2023) \div 4$ has a remainder of _____

(22) 20 — 40% of 60 is _____

(23) $77^2 + 63^2 =$ _____

(24) If $x = 3$, then $x^4 - 4x^2 + 4 =$ _____

(25) The discriminant of $x^2 - 7x + 6 = 0$ is _____

(26) 81 base 10 = _____ base 5

(27) 54 x 54 = _____

(28) $4\frac{3}{5} \times 6\frac{3}{5} =$ _____ (mixed number)

(29) The area of an equilateral triangle with side length 6" is $k\sqrt{3}$ sq. in. Find k. _____

***(30)** $\sqrt{(325)(225)} =$ _____

(31) 0.0252525... = _____ (proper fraction)

(32) 41 x 49 = _____

(33) $8\frac{5}{9} \times 9\frac{5}{8} =$ _____ (mixed number)

(34) $14^2 \div 7^2 \times 3.5^2 =$ _____

(35) $\sqrt{32} \div \sqrt{72} =$ _____

(36) $2197 \times 3 + 9 =$ _____

(37) The positive geometric mean of 14 and 4 is $2\sqrt{k}$ and k is _____

(38) Given: $2 + 4 + 6 + 8 + \ldots + 56 + 58 =$ _____

(39) The sum of the product of two and some number and 8 equals the sum of the number and 7. The number is _____

*(40) 311 gallons of ice cream = _____ cups of ice cream

(41) $23 \times 83 =$ _____

(42) Let $x = 2 - y$ and $2y = x + 7$. Find x. _____

(43) $7^4 - 1 =$ _____ 7

(44) Given: 1,2,5,4,9,6,13,k,17, ... Find k. _____

(45) $(3^3 + 6^3) \div 9$ has a remainder of _____

(46) $31 \times \frac{14}{17} =$ _____ (mixed number)

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

(48) The product of the roots of $x^3 + 6x^2 + 12x + 8 = 0$ is _____

(49) Find the sum of the reciprocals of the first eight triangular numbers. _____

*(50) $39 \times 139 + 40 \times 139 =$ _____

(51) $0.1444... + 0.111... =$ _____

(52) $\frac{1}{5} + \frac{1}{25} + \frac{1}{125} + ... =$ _____

(53) $(42_8 + 57_8) \times 3_8 =$ _____ 8

(54) If $(3 - 4i)(1 + 2i) = (a + bi)$, then $a + b =$ _____

(55) $(2 + 6 + 8 + 14 + 22 + 36) +$
$(58 + 94 + 152 + 246 + 398) =$ _____

(56) If $f(x) = 2x - \log_4(x)$, then $f(16) =$ _____

(57) 2401 has how many positive integral divisors? ____

(58) $60^{16} \div 31$ has a remainder of _____

(59) A regular n-gon has an exterior angle of measure 22.5 degress and has how many sides? _____

*(60) $\sqrt[3]{21031123} =$ _____

(61) $\frac{6\times7! - 7\times6!}{6!} =$ _____

(62) If $\sqrt{27} + \sqrt{75} = \sqrt{x}$, then $x =$ _____

(63) The harmonic mean of the arithmetic mean of {4,16} and the geometric mean of {4,16} is _____

(64) $\csc(\sin^{-1}(\frac{1}{2})) =$ _____

(65) A square is to a triangle as an octagon is to a polygon of _____ sides

(66) If $xy = 1$ and $x + y = 7$ then $x^3 + y^3 =$ _____

(67) $2023_4 \div 3_4$ has a remainder of _____ 4

(68) The second term in the expansion of $(2x + y)^5$ is px^qy^r. The sum of p,q, and r is _____

(69) $\begin{bmatrix} x \\ 4 \end{bmatrix} - \begin{bmatrix} 3 \\ y \end{bmatrix} = \begin{bmatrix} 8 \\ 6 \end{bmatrix}$ and y = _____

*(70) $5.444... \times 26.1 \times 10^2 =$ _____

(71) If $f(x) = \frac{5x+8}{7x+4}$, then $f^{-1}(-1) =$ _____

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

(73) The maximum value of $2x^2 + y = 8$ is _____

(74) Change .23 base 5 to a base 10 fraction. _____

(75) Four pennies are tossed, what are the odds of getting all tails? _____

(76) $(401)^3 =$ _____

(77) Let $f(x) = 1 - x^2$. Find $f[f(-2) - f(2)]$. _____

(78) If $f(x) = x^2 + 2x - 1$, then $f'(4) =$ _____

(79) $222 \times \frac{2}{27} =$ _____ (mixed number)

*(80) $0.444... \times 10^3 \times 125^{(-1)} \times 900 =$ _____

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NOTE: If an answer is of the type like $\frac{2}{3}$ it cannot be written as a repeating decimal

(1) 35

(2) 6,306

(3) — 101

(4) 5,225

(5) 529

(6) 65

(7) 1,353

(8) 1.1

(9) $6\frac{5}{12}$

***(10) 5,244 — 5,794**

(11) 1,692

(12) 16

(13) 4,046

(14) 3

(15) 12.5, $\frac{25}{2}$, $12\frac{1}{2}$

(16) 0

(17) 150

(18) 54

(19) 16

***(20) 63,967 — 70,699**

(21) 1

(22) — 4

(23) 9,898

(24) 49

(25) 25

(26) 311

(27) 2,916

(28) $30\frac{9}{25}$

(29) 9

***(30) 257 — 283**

(31) $\frac{5}{198}$

(32) 2,009

(33) $82\frac{25}{72}$

(34) 49

(35) $\frac{2}{3}$

(36) 6,600

(37) 14

(38) 870

(39) — 1

***(40) 4,728 — 5,224**

(41) 1,909

(42) — 1

(43) 6666

(44) 8

(45) 0

(46) $25\frac{9}{17}$

(47) — 120

(48) — 8

(49) $\frac{16}{9}$, $1\frac{7}{9}$

***(50) 10,432 — 11,530**

(51) $\frac{23}{90}$

(52) .25, $\frac{1}{4}$

(53) 363

(54) 13

(55) 1,036

(56) 30

(57) 5

(58) 2

(59) 16

***(60) 263 — 289**

(61) 35

(62) 192

(63) $\frac{80}{9}$, $8\frac{8}{9}$

(64) 2

(65) 6

(66) 322

(67) 1

(68) 85

(69) — 2

***(70) 13,500 — 14,920**

(71) — 1

(72) 2

(73) 8

(74) $\frac{13}{25}$

(75) $\frac{1}{15}$

(76) 64,481,201

(77) 1

(78) 10

(79) $16\frac{4}{9}$

***(80) 3,040 — 3,360**

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Number Sense Test ● HS District ● 2023

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(1) $2023 - 320 =$ _____

(2) $2021 + 2223 + 2425 =$ _____

(3) $2023 \times 6 =$ _____

(4) $325 \div 9 =$ _____ **(mixed number)**

(5) $16^2 =$ _____

(6) $\frac{17}{25} =$ _____ **%**

(7) $30 + 24 \div 18 \times 12 - 6 =$ _____

(8) $3\frac{2}{5}\% =$ _____ **(fraction)**

(9) **4 square yards =** _____ **square feet**

***(10)** $32020 + 32025 + 2023 =$ _____

(11) $2\frac{1}{3} + 5\frac{1}{6} =$ _____

(12) **MCXI — DLV =** _____ **(Arabic Numeral)**

(13) $4\frac{1}{3}\%$ **of 1500 is** _____

(14) $42 \times 15 =$ _____

(15) $1 + 4 + 7 + 10 + ... + 25 + 28 =$ _____

(16) **1.4 is** _____ **% of 28.**

(17) **The negative reciprocal of 1.125 is** _____

(18) $28^2 - 32^2 = 30 \times$ _____

(19) **1 gram = .04 oz. and 32 oz. =** _____ **grams**

***(20)** $(17 \times 23)^2 =$ _____

(21) **The LCM of 15, 18, and 45 is** _____

(22) $40 + 40\%$ **of 40 is** _____

(23) **The average speed of a car traveling 150 miles in 2.5 hours is** _____**mph**

(24) **The discriminant of** $x^2 - 4x - 12 = 0$ **is** _____

(25) $8\frac{1}{3} \times 8\frac{2}{3} =$ _____

(26) **The smallest root of** $x^2 - 4x - 12 = 0$ **is** _____

(27) **59 x 59 =** _____

(28) $\frac{3}{8}\%$ **of 16 is** $\frac{2}{5}\%$ **of** _____

(29) **102 base 10 is written as** _____ **base 7**

***(30)** $\sqrt{32025} =$ _____

(31) $(9^3 - 1) \div (9 - 1) =$ _____

(32) **If** $y - x = 8$ **and** $x + y = 4$**, then** $xy =$ _____

(33) $4\frac{3}{7} \times 7\frac{3}{4} =$ _____ **(mixed number)**

(34) **The slope of the line** $5x - 6y = 7$ **is** _____

(35) $10\frac{1}{8} \times 8\frac{2}{5}$ = _____

(36) 0.05333... = _____ (proper fraction)

(37) How many integers less than 35 are relatively prime to 35? _____

(38) 44_8 = _____ 4

(39) $32^2 \div 16^2 \times 8^2$ = _____

*(40) $1095 \times 905 - 899 \times 901$ = _____

(41) 325_9 = _____ 3

(42) $1591 \times 9 + 81$ = _____

(43) $(36)^{(1.5)}$ = _____

(44) $7^3 - 7$ = _____ 7

(45) 107×109 = _____

(46) 2023×14 = _____

(47) $(6x - 5)^2 = ax^2 + bx + c$ and $a + b + c$ = _____

(48) The set {s,q,u,a,r,e} has _____ 4-elements subsets

(49) $13 \times \frac{15}{19}$ = _____ (mixed number)

*(50) 5714.28×78 = _____

(51) $44^2 + 65^2$ = _____

(52) $123^{19} \div 7$ has a remainder of _____

(53) Let $5\frac{3}{m} \times n\frac{1}{2} = 14$, where m, n are natural numbers. Find $m + n$. _____

(54) The sum of the product of the roots taken two at a time of $x^3 + 6x^2 + 12x + 8 = 0$ is _____

(55) $(4 + 11 + 15 + 26 + 41) + (67 + 108 + 175 + 283 + 458)$ = _____

(56) $\log_5 3 - \log_5 8 = \log_5$ _____

(57) A nonagon has how many distinct diagonals? ____

(58) If $(1 - 3i)(5 + 7i) = (a + bi)$, then $a + b$ = _____

(59) The probability of drawing a prime digit from the set of positive digits is _____

*(60) $\sqrt[3]{202325203}$ = _____

(61) $12 \times 6! - 32 \times 5!$ = _____

(62) $(\cos\frac{\pi}{6})(\cos\frac{\pi}{3}) - (\sin\frac{\pi}{6})(\sin\frac{\pi}{3})$ = _____

(63) The harmonic mean of the roots of $x^3 - 6x^2 + 11x - 6 = 0$ is _____

(64) Let $\det\begin{vmatrix} 1 & 3 \\ x & -5 \end{vmatrix} = \det\begin{vmatrix} 2 & x \\ -4 & 6 \end{vmatrix}$. Find x. _____

(65) If the fourth term in the expansion of $(2x + 3y)^5$ is $cx^a y^b$, then $a + b + c$ = _____

(66) If $xy = -4$ and $x + y = -3$ then $x^3 + y^3$ = _____

(67) $(0 + i)^{26}$ = _____

(68) A triangle has sides of 3, 6, and x. $x + 1 >$ _____

(69) Given: 1, 5, 7, 9, 10, d, f , 15, ... Find $d + f$. _____

*(70) 62.5% of 24 yards = _____ inches

(71) If $f(x) = x^3 + 6x^2 + 12x + 8$, then $f'(1)$ = _____

(72) $999 \times \frac{14}{37} \times \frac{16}{27}$ = _____

(73) Find x, $7 \leq x \leq 13$, if $3x + 1 \cong 35 \pmod 7$. _____

(74) The graph of $y = \frac{x + 2}{5x^2 - 1}$ has _____ asymptotes

(75) $f(x) = \frac{2x + 3}{5} + 7$ and $f^{-1}(11)$ = _____

(76) $\lim_{x \to \infty} \frac{\sin(x)}{x}$ = _____

(77) $\int_0^{\pi} \sin(x)\, dx$ = _____

(78) $\sum_{x=1}^{3} (-x)^x$ = _____

(79) Round $(\sqrt{3} + \sqrt{5} + \sqrt{7})$ to the tenths place. ___

*(80) 75 miles/hour = _____ feet/second

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University Interscholastic League - Number Sense Answer Key HS ● District ● 2023
***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) 1,703

(2) 6,669

(3) 12,138

(4) $36\frac{1}{9}$

(5) 256

(6) 68

(7) 40

(8) $\frac{17}{500}$

(9) 36

***(10) 62,765 — 69,371**

(11) 7.5, $\frac{15}{2}$, $7\frac{1}{2}$

(12) 556

(13) 65

(14) 630

(15) 145

(16) 5

(17) $-\frac{8}{9}$

(18) — 8

(19) 800

***(20) 145,237 — 160,525**

(21) 90

(22) 56

(23) 60

(24) 64

(25) $\frac{650}{9}$, $72\frac{2}{9}$

(26) — 2

(27) 3,481

(28) 15

(29) 204

***(30) 171 — 187**

(31) 91

(32) — 12

(33) $34\frac{9}{28}$

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

(35) 85.05, $\frac{1701}{20}$, $85\frac{1}{20}$

(36) $\frac{4}{75}$

(37) 24

(38) 210

(39) 256

***(40) 171,928 — 190,024**

(41) 100212

(42) 14,400

(43) 216

(44) 660

(45) 11,663

(46) 28,322

(47) 1

(48) 15

(49) $10\frac{5}{19}$

***(50) 423,429 — 467,999**

(51) 6,161

(52) 4

(53) 7

(54) 12

(55) 1,188

(56) .375, $\frac{3}{8}$

(57) 27

(58) 18

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

***(60) 558 — 616**

(61) 4,800

(62) 0

(63) $\frac{18}{11}$, $1\frac{7}{11}$

(64) $-\frac{17}{7}$, $-2\frac{3}{7}$

(65) 1,085

(66) — 63

(67) — 1

(68) 4

(69) 24

***(70) 513 — 567**

(71) 27

(72) 224

(73) 9

(74) 3

(75) 8.5, $\frac{17}{2}$, $8\frac{1}{2}$

(76) 0

(77) 2

(78) — 24

(79) 6.6

***(80) 105 — 115**

The University Interscholastic League
Number Sense Test • HS Regional • 2023

Final _____ _____

Contestant's Number _____ 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 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.

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STOP -- WAIT FOR SIGNAL!

(1) $2122 \times 20 =$ _____

(2) $815 - 729 =$ _____

(3) $2021.22 + 202.3 =$ _____ **(decimal)**

(4) $23 \div 3\frac{1}{2} =$ _____ **(mixed number)**

(5) $20 \times 21 + 20 \times 22 + 20 \times 23 =$ _____

(6) $22^2 =$ _____

(7) $5 - 10 \times 15 \div 20 + 25 =$ _____

(8) $21.22 \times 10^2 - 2 =$ _____

(9) $5.555... =$ _____ **(improper fraction)**

***(10)** $20 + 2122 \times 23 =$ _____

(11) The GCD of 28, 35, and 63 is _____

(12) 202121 ÷ 9 has a remainder of _____

(13) Which is smaller $\frac{-3}{4}$ or $\frac{5}{-6}$? _____

(14) $124 \times 15 =$ _____

(15) $(420 + 421 + 422) \div 4$ has a remainder of _____

(16) $\frac{1}{4} + \frac{1}{6} + \frac{1}{8} =$ _____

(17) $(3^2 \times 6^2 \times 9) \div (6 \times 3) =$ _____

(18) If 9 dits cost \$12.00, then 6 dits will cost \$ _____

(19) $23 \times 32 =$ _____

***(20)** $892 \times 213 =$ _____

(21) The cost of filling up a 22 gallon tank at \$3.49 a gallon is \$_____

(22) $124 \div 25 =$ _____ **(decimal)**

(23) How many prime numbers divide 180? _____

(24) If $x = 22$, then $x^2 - 4x + 4 =$ _____

(25) $2122_4 =$ _____ **10**

(26) $10\frac{4}{7} \times 10\frac{3}{7} =$ _____ **(mixed number)**

(27) $0.41666... + 0.8333... =$ _____

(28) $\frac{4}{7}$% of 14 is $\frac{2}{3}$% of _____

(29) $1492 \times 8 + 8^2 =$ _____

***(30)** $420212 \div 223 =$ _____

(31) 43 x 47 = _____

(32) $6\frac{2}{3} \times 9\frac{2}{3} =$ _____ **(mixed number)**

(33) $[17 + 4 \times 7 + 8] \div 6$ has a remainder of _____

(34) Given: 1, 1, 3, 5, 6, 12, p, r, 15, 35,... . p — r = ____

(35) How many integers less than or equal to 21 are relatively prime to 21? _____

(36) 40 cars use gas, 18 cars use electricity, and 12 cars use both. How many cars are there? _____

(37) $8\frac{3}{5} \times 5\frac{3}{8}$ = _____

(38) Given: $4 + 7 + 10 + 13 + ... + 43 + 46$ = _____

(39) $3x^2 + kx + 4 = 0$ and the sum of its roots is 5. Find k. _____

***(40)** $\sqrt{4222023}$ = _____

(41) The median of an isoceles trapezoid is 2'. If the longer base is 2.5', then the shorter base is _____"

(42) $(4^7 + 2^7) \div 6$ has a remainder of _____

(43) 422_9 = _____ 3

(44) Let $y = 3 - x$ and $x = y - 3$. Find x. _____

(45) 3^6 has how many positive integral divisors? _____

(46) $5^4 - 3$ = _____ 5

(47) ${}_8P_4 \div {}_8P_1$ = _____

(48) 2122×13 = _____

(49) Let $4\frac{1}{m} \times n\frac{1}{13} = 22$, where m, n are natural numbers. Find $m + n$. _____

***(50)** $636.363636... \times 765$ = _____

(51) $\frac{1}{6} + \frac{1}{36} + \frac{1}{216} + ...$ = _____

(52) $22_6 \times 4_6 - 23_6$ = _____ 6

(53) $73^2 - 74^2$ = _____

(54) Let $4^{(6x)} = 4096$. Find $4^{(2x)}$. _____

(55) $36^2 + 44^2$ = _____

(56) The measure of an exterior angle of a regular n-gon is 60° and its number of sides is _____

(57) Two dice are rolled. What is the probability that the sum of the faces is 2, 3, or 12? _____

(58) $50^{13} \div 13$ has a remainder of _____

(59) $\sum_{k=1}^{20} (-1)^k(k^2)$ = _____

***(60)** 422 laps around a circle is _____ radians

(61) The area of the ellipse $16x^2 + 25y^2 = 400$ is $k\pi$. Find k. _____

(62) If $xy = 5$ and $x + y = -5$ then $x^3 + y^3$ = _____

(63) If $2\sqrt{50} + \sqrt{32} = \sqrt{x}$, then x = _____

(64) $2122_4 \div 3_4$ has a remainder of _____ 4

(65) $\sec(\cos^{-1}(-\frac{1}{2}))$ = _____

(66) The total surface area of a right circular cylinder with height 10' and diameter 4' is _____ π sq. ft.

(67) $\frac{5\times7! - 7\times5!}{5!}$ = _____

(68) $(6 - bi)^2 = 11 - 60i$ and b = _____

(69) $666 \times \frac{11}{37} \times \frac{4}{9}$ = _____

***(70)** $\sqrt[3]{20212223}$ = _____

(71) The remainder when $x^3 + 6x^2 + 12x + 8 = 0$ is divided by $x + 2$ is _____

(72) Change .14 base 5 to a base 10 decimal. _____

(73) The smallest value in the domain of $y = \sqrt{4 - x^2}$, where $y \in \{Reals\}$, is _____

(74) Let $f'(x) = 4x$ and $f(1) = 0$. Find $f(-1)$. _____

(75) $\int_0^{\pi} \sin^2(x)\,dx = k\pi$ and k = _____

(76) Given: 0, 2, 4, 7, 10, d, e , f, 11 ... . Find $e + f$. ____

(77) $(501)^3$ = _____

(78) $7^{-1} + 7^{-2} + 7^{-3}$ = _____

(79) Round $(\sqrt{10} - \sqrt{8} + \sqrt{2})$ to the tenths place. ___

***(80)** $0.08333... \times 7.111 \times 10^4$ = _____

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University Interscholastic League - Number Sense Answer Key HS ● Regional ● 2023

***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) 42,440

(2) 86

(3) 2,223.52

(4) $6\frac{4}{7}$

(5) 1,320

(6) 484

(7) 22.5, $\frac{45}{2}$, $22\frac{1}{2}$

(8) 2,120

(9) $\frac{50}{9}$

***(10) 46,385 — 51,267**

(11) 7

(12) 8

(13) $-\frac{5}{6}$

(14) 1,860

(15) 3

(16) $\frac{13}{24}$

(17) 162

(18) 8.00

(19) 736

***(20) 180,497 — 199,495**

(21) 76.78

(22) 4.96

(23) 3

(24) 400

(25) 154

(26) $110\frac{12}{49}$

(27) 1.25, $\frac{5}{4}$, $1\frac{1}{4}$

(28) 12

(29) 12,000

***(30) 1,791 — 1,978**

(31) 2,021

(32) $64\frac{4}{9}$

(33) 5

(34) — 12

(35) 12

(36) 46

(37) $46\frac{9}{40}$

(38) 375

(39) — 15

***(40) 1,953 — 2,157**

(41) 18

(42) 0

(43) 110202

(44) 0

(45) 7

(46) 4442

(47) 210

(48) 27,586

(49) 8

***(50) 462,478 — 511,159**

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

(52) 105

(53) — 147

(54) 16

(55) 3,232

(56) 6

(57) $\frac{1}{9}$

(58) 11

(59) 210

***(60) 2,519 — 2,784**

(61) 20

(62) — 50

(63) 392

(64) 1

(65) — 2

(66) 48

(67) 203

(68) 5

(69) 88

***(70) 259 — 286**

(71) 0

(72) .36

(73) — 2

(74) 0

(75) .5, $\frac{1}{2}$

(76) 30

(77) 125,751,501

(78) $\frac{57}{343}$

(79) 1.7

***(80) 5,630 — 6,222**

The University Interscholastic League
Number Sense Test ● HS State ● 2023

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(1) $1715 \div 5 =$ _____

(2) $\frac{7}{8} \times \frac{2}{3} \times \frac{12}{13} =$ _____

(3) $1718 + 2023 =$ _____

(4) $2023 - 1718 =$ _____

(5) $18^2 =$ _____

(6) $48\% =$ _____ **(fraction)**

(7) $15 + 9 \div (3 - 12) \times 6 =$ _____

(8) $1.718 \times 10^3 - 5 =$ _____

(9) $3\frac{1}{4} + 4\frac{4}{5} =$ _____ **(mixed number)**

***(10)** $396 \times 404 =$ _____

(11) $17 \times 23 - 20 \times 23 =$ _____

(12) DXVIII + MMXXIII = _____ **(Arabic Numeral)**

(13) $520 \times 15 =$ _____

(14) The negative reciprocal of 2.222... is _____

(15) $(320 + 281 + 715) \div 3$ has a remainder of _____

(16) $4 + 5 + 6 + 7 + ... + 17 + 18 =$ _____

(17) 75% of 2 pounds 12 ounces is _____ ounces

(18) _____ is $5\frac{1}{3}\%$ of 18

(19) $27^2 - 23^2 = 5 \times$ _____

***(20)** $(1718 + 2023) \div 5 =$ _____

(21) $59^2 =$ _____

(22) $2022 \times 25 =$ _____

(23) 70 — 80% of 90 is _____

(24) If $x = 21$, then $x^2 - 6x + 9 =$ _____

(25) 85 base 10 = _____ base 6

(26) The average speed of a car traveling 279 miles in $4\frac{1}{2}$ hours is _____mph

(27) $8\frac{5}{7} \times 8\frac{2}{7} =$ _____

(28) $\frac{5}{6}\%$ of 20 is $\frac{2}{3}\%$ of _____

(29) $1898 \times 2 + 4 =$ _____

***(30)** $516171 \div 823 =$ _____

(31) 0.1454545... = _____ **(proper fraction)**

(32) $11\frac{5}{6} \times 6\frac{5}{11} =$ _____ **(mixed number)**

(33) Given: 1, 7, 18, 34, p, r, 112,... . $p + r =$ _____

(34) Let $k^2 \div 9^2 \times 4.5^2 = 81$. Find k. _____

(35) $4\frac{3}{7} \times 14\frac{1}{4} =$ _____ **(mixed number)**

(36) $[16 + 17 \times 18 + 23] \div 5$ has a remainder of _____

(37) 222_8 = _____ 4

(38) Let $2x^2 + kx - 12 = 0$. The sum of its roots is $-2\frac{1}{2}$ when k = _____

(39) How many integers between 5 and 24 are relatively prime to 24? _____

*(40) $\sqrt{5161718}$ = _____

(41) $9114 \div 93$ = _____

(42) Let $y = x - 2$ and $3x = y + 1$. Find y. _____

(43) The roots of $2x^3 - 3x^2 - 3x + 2 = 0$ are R_1 and R_2. Find $R_1 + R_2 - R_1R_2$. _____

(44) $(2^5 + 11^5 + 5) \div 13$ has a remainder of _____

(45) $6^4 - 2$ = _____ 6

(46) 3125 has how many positive integral divisors? ____

(47) $14 \times \frac{15}{17}$ = _____ (mixed number)

(48) $(\frac{1}{3} + 1 + 1\frac{1}{3} + 2\frac{1}{3} + 3\frac{2}{3}) +$
$(6 + 9\frac{2}{3} + 15\frac{2}{3} + 25\frac{1}{3})$ = _____

(49) 1817×16 = _____

*(50) $28 \times 139 + 21 \times 280$ = _____

(51) $37^{12} \div 23$ has a remainder of _____

(52) Let $7\frac{1}{m} \times n\frac{2}{5} = 48$, where m, n are natural numbers. Find $m - n$. _____

(53) $(4x - 7)^2 = ax^2 + bx + c$ and $a + b + c$ = _____

(54) If the third term in the expansion of $(3x + 2y)^4$ is cx^ay^b, then $a + b + c$ = _____

(55) If $(5 + 2i)(3 - 7i) = (a + bi)$, then $a + b$ = _____

(56) Let $7^{(2.5)} = a\sqrt{b}$ in simplified form. Find a. _____

(57) $\sum_{k=1}^{24} (-1)^k(k^2)$ = _____

(58) $33^2 + 74^2$ = _____

(59) $(a + 2i)^2 = 5 + 12i$ and a = _____

*(60) $\sqrt[3]{51617182023}$ = _____

(61) Find the odds that an integer picked at random between 31 and 59 is prime. _____

(62) If $\sqrt{27} + \sqrt{108} = \sqrt{x}$, then x = _____

(63) $1718_9 \div 5_9$ has a remainder of _____ 9

(64) If 3 p's = 4 q's and 2 q's = 5 r's, then 1 p = ____ r's

(65) $P(x) = 6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$. The harmonic mean of the roots is $\frac{k}{35}$ and k = _____

(66) If $xy = -4$ and $x + y = 5$ then $x^3 + y^3$ = _____

(67) $20 \times 4! + 16 \times 6!$ = _____

(68) The $\det \begin{vmatrix} -2 & 1 \\ x & 3 \end{vmatrix} = \det \begin{vmatrix} 3 & -1 \\ 4 & -2 \end{vmatrix}$ and x = _____

(69) Given: 1, 1, 3, 5, 9, 15, 25, 41, k, 109, ... k = _____

*(70) 817161 cubic inches = _____ gallons

(71) $\sec(\sin^{-1}(0.6))$ = _____

(72) Let $k = 2\sqrt{3} + 4\sqrt{5}$. Round k to the nearest tenths place. _____

(73) The remainder when $x^3 - 5x^2 + 15x - 6 = 0$ is divided by $x + 1$ is _____

(74) Change .52 base 7 to a base 10 fraction. _____

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

(76) Polar coordinates $(4, \frac{2\pi}{3})$ are converted to Cartesian coordinates (x, y) and x = _____

(77) $\int_0^{2\pi} 2\cos^2(x)\,dx = k\pi$, where k = _____

(78) $24^8 \div 6^4$ has a remainder of _____

(79) $(202)^3$ = _____

*(80) $0.555... \times 10^3 \times 25^{(-1)} \times 90$ = _____

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University Interscholastic League - Number Sense Answer Key HS ● State ● 2023

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NOTE: If an answer is of the type like $\frac{2}{3}$ it cannot be written as a repeating decimal

(1) 343

(2) $\frac{7}{13}$

(3) 3,741

(4) 305

(5) 324

(6) $\frac{12}{25}$

(7) 9

(8) 1,713

(9) $8\frac{1}{20}$

***(10) 151,985 — 167,983**

(11) — 69

(12) 2,541

(13) 7,800

(14) — .45, $-\frac{9}{20}$

(15) 2

(16) 165

(17) 33

(18) .96, $\frac{24}{25}$

(19) 40

***(20) 711 — 785**

(21) 3,481

(22) 50,550

(23) — 2

(24) 324

(25) 221

(26) 62

(27) $\frac{3538}{49}$, $72\frac{10}{49}$

(28) 25

(29) 3,800

***(30) 596 — 658**

(31) $\frac{8}{55}$

(32) $76\frac{25}{66}$

(33) 136

(34) 18

(35) $63\frac{3}{28}$

(36) 0

(37) 2102

(38) 5

(39) 6

***(40) 2,159 — 2,385**

(41) 98

(42) — 2.5, $-\frac{5}{2}$, $-2\frac{1}{2}$

(43) 2.5, $\frac{5}{2}$, $2\frac{1}{2}$

(44) 5

(45) 5554

(46) 6

(47) $12\frac{6}{17}$

(48) $\frac{196}{3}$, $65\frac{1}{3}$

(49) 29,072

***(50) 9,284 — 10,260**

(51) 9

(52) — 4

(53) 9

(54) 220

(55) 0

(56) 49

(57) 300

(58) 6,565

(59) 3

***(60) 3,538 — 3,909**

(61) $\frac{5}{22}$

(62) 243

(63) 3

(64) $\frac{10}{3}$, $3\frac{1}{3}$

(65) 24

(66) 185

(67) 12,000

(68) — 4

(69) 67

***(70) 3,361 — 3,714**

(71) 1.25, $\frac{5}{4}$, $1\frac{1}{4}$

(72) 12.4

(73) — 27

(74) $\frac{37}{49}$

(75) 225

(76) — 2

(77) 2

(78) 0

(79) 8,242,408

***(80) 1,900 — 2,100**