

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

Contestant's Number _____

Read directions carefully
before beginning test

**DO NOT UNFOLD THIS SHEET
UNTIL TOLD TO BEGIN**

Final _____

2nd _____

1st _____

Score _____

Initials _____

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) $2023 \times 4 =$ _____
- (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) $1 + 2 + 3 + 4 + \dots + 38 + 39 =$ _____
- (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 $(BC) \div A$. _____
- (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) $57 \times 57 =$ _____
- (28) $13332 \div 101 =$ _____
- (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) $103 \times 102 =$ _____
- (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) $187.5 \times 31.4 =$ _____
- (51) $46^2 + 45^2 =$ _____
- (52) $34 \times 74 =$ _____
- (53) $31_5 \times 4_5 + 20_5 =$ _____⁵
- (54) If $(3 + 4i)(2 - i) = (a + bi)$, then $a =$ _____
- (55) $4 + 5 + 9 + 14 + 23 + 37 + \dots + 157 + 254 =$ _____
- (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) $0.35 \times 1102023 =$ _____
- (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) $\lim_{x \rightarrow 4} \frac{x^3 - 64}{x - 4} =$ _____
- (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) $7.777\dots \times 18 \times 10^2 =$ _____

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 | (18) 2 | (34) 2 | (58) 13 |
| (2) $\frac{4}{5}$ | (19) 40 | (35) 30 | (59) 12 |
| (3) -396 | $*(20) \underline{750} - 828$ | (36) 1 | $*(60) \underline{366,423} - 404,993$ |
| (4) 234.32 | (21) 240 | (37) 18 | (61) 25 |
| (5) 961 | (22) 1,080 | (38) 36 | (62) 125 |
| (6) $\frac{17}{20}$ | (23) 12 | (39) 9 | (63) $\frac{18}{11}, 1\frac{7}{11}$ |
| (7) 400 | (24) 196 | $*(40) \underline{726,032} - 802,456$ | (64) 1 |
| (8) 2,024 | (25) 16.00 | (41) 0 | (65) 10 |
| (9) 51 | (26) 108 | (42) 55 | (66) 95 |
| $*(10) \underline{91,324} - 100,936$ | (27) 3,249 | (43) 4 | (67) 3113 |
| (11) 5,625 | (28) 132 | (44) 102 | (68) 28 |
| (12) 7 | $*(30) \underline{184} - 202$ | (45) 10,506 | (69) 22 |
| (13) $\frac{4}{13}$ | (31) $39\frac{3}{16}$ | (46) $13\frac{9}{11}$ | $*(70) \underline{302} - 333$ |
| (14) 1,728 | (32) 8 | (47) -7 | (71) 4 |
| (15) 780 | (33) $32\frac{1}{30}$ | (48) -6 | (72) 4 |
| (16) 3 | | (49) 15 | (73) 48 |
| (17) 1,080 | | $*(50) \underline{5,594} - 6,181$ | (74) .15 |
| | | (51) 4,141 | (75) -3 |
| | | (52) 2,516 | (76) 0 |
| | | (53) 244 | (77) $.125, \frac{1}{8}$ |
| | | (54) 10 | (78) 27,270,901 |
| | | (55) 660 | (79) 24 |
| | | (56) 5 | $*(80) \underline{13,300} - 14,700$ |
| | | (57) 35 | |