

The University Interscholastic League
Number Sense Test • HS B • 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) $315 \div 9 =$ _____
- (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) $MMXXIII \times II =$ _____ (Arabic Numeral)
- (14) The smallest prime divisor of 21^2 is _____
- (15) $\frac{5}{4}$ is _____ % of 10
- (16) $90 \div 0.090909\dots$ 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) $54 \times 54 =$ _____
- (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) $0.0252525\dots =$ _____ (proper fraction)
- (32) $41 \times 49 =$ _____
- (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: $2 + 4 + 6 + 8 + \dots + 56 + 58 =$ _____

(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) $0.\overline{1444} + 0.\overline{1111} =$ _____

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

(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 degrees and has how many sides? _____

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

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

(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 $px^q y^r$. 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) $5.444\dots \times 26.1 \times 10^2 =$ _____

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

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS • Invitation B • 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) 35 | (18) 54 | (34) 49 | (58) 2 |
| (2) 6,306 | (19) 16 | (35) $\frac{2}{3}$ | (59) 16 |
| (3) -101 | *(20) $63,967 - 70,699$ | (36) 6,600 | *(60) $263 - 289$ |
| (4) 5,225 | (21) 1 | (37) 14 | (61) 35 |
| (5) 529 | (22) -4 | (38) 870 | (62) 192 |
| (6) 65 | (23) 9,898 | (39) -1 | (63) $\frac{80}{9}, 8\frac{8}{9}$ |
| (7) 1,353 | (24) 49 | *(40) $4,728 - 5,224$ | (64) 2 |
| (8) 1.1 | (25) 25 | (41) 1,909 | (65) 6 |
| (9) $6\frac{5}{12}$ | (26) 311 | (42) -1 | (66) 322 |
| *(10) $5,244 - 5,794$ | (27) 2,916 | (43) 6666 | (67) 1 |
| (11) 1,692 | (28) $30\frac{9}{25}$ | (44) 8 | (68) 85 |
| (12) 16 | (29) 9 | (45) 0 | (69) -2 |
| (13) 4,046 | *(30) $257 - 283$ | (46) $25\frac{9}{17}$ | *(70) $13,500 - 14,920$ |
| (14) 3 | (31) $\frac{5}{198}$ | (47) -120 | (71) -1 |
| (15) $12.5, \frac{25}{2}, 12\frac{1}{2}$ | (32) 2,009 | (48) -8 | (72) 2 |
| (16) 0 | (33) $82\frac{25}{72}$ | (49) $\frac{16}{9}, 1\frac{7}{9}$ | (73) 8 |
| (17) 150 | | *(50) $10,432 - 11,530$ | (74) $\frac{13}{25}$ |
| | | (51) $\frac{23}{90}$ | (75) $\frac{1}{15}$ |
| | | (52) $.25, \frac{1}{4}$ | (76) 64,481,201 |
| | | (53) 363 | (77) 1 |
| | | (54) 13 | (78) 10 |
| | | (55) 1,036 | (79) $16\frac{4}{9}$ |
| | | (56) 30 | *(80) $3,040 - 3,360$ |
| | | (57) 5 | |