

**The University Interscholastic League
Number Sense Test • HS B • 2024**

Contestant's Number _____

Final _____

2nd _____

1st _____

**Read directions carefully
before beginning test**

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

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!

- | | |
|--|--|
| <p>(1) $210 - 309 + 2024 =$ _____</p> <p>(2) $2024 \div 4 =$ _____</p> <p>(3) $(5.6)(5 + 6) =$ _____ (decimal)</p> <p>(4) $3.09 + 2\frac{1}{10} =$ _____</p> <p>(5) $32 \times 35 =$ _____</p> <p>(6) $13^3 =$ _____</p> <p>(7) The LCM of 28 and 64 is _____</p> <p>(8) $\frac{3}{8} =$ _____ % (decimal)</p> <p>(9) $10620324 \div 11$ has a remainder of _____</p> <p>*(10) 2 hours 15 minutes = _____ seconds</p> <p>(11) MMCCCXXIV — DL = _____ (Arabic Numeral)</p> <p>(12) $31 \times \frac{31}{34} =$ _____ (mixed number)</p> <p>(13) \$22.50 plus 8% tax is \$ _____</p> <p>(14) $2 \div (10 - 30) \times 9 + (20 - 24) =$ _____</p> <p>(15) $53 \times 53 =$ _____</p> <p>(16) $52 \times 52 =$ _____</p> <p>(17) $(53 \times 53) - (52 \times 52) =$ _____</p> <p>(18) $54^2 - 48^2 = 51 \times$ _____</p> | <p>(19) The number of integers between 1 and 15 which are relatively prime to 15 is _____</p> <p>*(20) $1623 + 2024 \times 28 =$ _____</p> <p>(21) Round $\sqrt{2}$ to the nearest hundredths place. _____</p> <p>(22) If $\frac{19}{33} = ababab\dots$, then $a + b =$ _____</p> <p>(23) Twenty-one thousand twenty-four plus thirty thousand nine hundred twenty-four is _____</p> <p>(24) $[2 + 10 \times 30 - k] \div 7$ has remainder 6, where $0 < k < 9$. $k =$ _____</p> <p>(25) 210 base 8 is written as _____ base 10</p> <p>(26) $104 \times 107 =$ _____</p> <p>(27) Let $P = \{p, r, i, m, e, s\}$. How many three member subsets of P are there? _____</p> <p>(28) Find x if $\frac{1}{x} + \frac{1}{5} = \frac{1}{2}$. _____</p> <p>(29) How many integers between 17 and 85 are divisible by 9? _____</p> <p>*(30) $\sqrt{309210} =$ _____</p> <p>(31) $3092 \times 8 + 64 =$ _____</p> <p>(32) $5B6 = [3(15 - B)]^2$. Find B, $B > 0$. _____</p> <p>(33) If $f(x) = x^3 + 6x^2 + 12x + 8$, then $f(8) =$ _____</p> |
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- (34) Given: 1, 1, 3, 5, 6, 12, p, q, 15, Find pq. _____
- (35) Three numbers are in the ratio of 2:3:4. If their sum is 63, then the smaller number is _____
- (36) 7 is what per cent of 28? _____ %
- (37) 7.84 is what per cent of 28? _____ %
- (38) 53% of 28 is _____
- (39) Let $\frac{x+7}{x-3} + \frac{x-3}{x+7} = 2\frac{B}{C}$. Find B. _____
- *(40) $\sqrt[3]{210309} \times \sqrt{309210} =$ _____
- (41) $(405)^2 =$ _____
- (42) The positive geometric mean of 4 and 9 is _____
- (43) The coefficient of the x^2y^3 term of $(2x - y)^5$ is _____
- (44) Find the sum of the reciprocals of the first seven triangular numbers. _____
- (45) $7^4 - 1 =$ _____ 7
- (46) $210_4 + 23_4 =$ _____ 2
- (47) If $\sqrt{9\sqrt{8\sqrt{x+7}}} = 6$, then $x =$ _____
- (48) The product of the roots of $2x^2 + 3x = 5$ is _____
- (49) $(10^3 - 4^3) \div (6) =$ _____
- *(50) $17^3 =$ _____
- (51) Let $x - y = 9$ and $2x + y = 30$. Find y. _____
- (52) $2311_4 \div 11_4$ has a remainder of _____
- (53) If $f(x) = 2x - \log_4(x)$, then $f(16) =$ _____
- (54) $16 + 4 + 1 + 0.25 + \dots =$ _____
- (55) $(5^7 + 6^7 + 8) \div 11$ has a remainder of _____
- (56) Three pennies are tossed in the air. The probability all three pennies land showing tails is _____ %
- (57) The 11th term of 1, 3, 6, 11, 18, 29, ... is 130. The 10th term is _____
- (58) If the sides of an equilateral triangle are $2\sqrt{3}$ inches long, then its altitude length is _____ "
- (59) Let $11\frac{3}{m} \times n\frac{4}{5} = 32$, where m, n are natural numbers. Find mn. _____
- *(60) $27^3 \div 9^6 \times 3^{10} =$ _____
- (61) $32^{11} \div 23$ has a remainder of _____
- (62) $\sqrt{41}_6 =$ _____ 6
- (63) 2 rods = _____ feet
- (64) $\sec^2(60^\circ) - \tan^2(60^\circ) =$ _____
- (65) $12^\circ = k\pi$ radians. $k =$ _____
- (66) The fifth pentagonal number is _____
- (67) If $(\sqrt[n]{a^4})(\sqrt[5]{a^6}) = (\sqrt[15]{a^k})$, where n and k are relatively prime, then $k =$ _____
- (68) Let $B = \begin{bmatrix} 1 & 3 \\ 6 & 10 \end{bmatrix}$. Find $|B|$. _____
- (69) Find $g(f(-\frac{1}{2}))$ when $f(x) = 2x - 3$ and $g(x) = 3x - 1$. _____
- *(70) $(75 \times 75) \div (25 \times 25 \times 25) \times (75 \times 25) =$ _____
- (71) If $f(x) = \frac{5}{8} - \frac{2x}{5}$ and $f^{-1}(x) = ax + b$, then $b =$ _____
- (72) Let $g(x) = 2x^2 - \frac{x}{2} - 2$. Find $g'(-2)$. _____
- (73) Find x, $11 \leq x \leq 19$, if $3x + 6 \cong 8 \pmod{10}$. _____
- (74) $h(x) = -x^3 - 3x^2 + 2$ has a local minimum at (a, b). $a + b =$ _____
- (75) Let (x, y) be the focus of $y - 2 = 3(x - 5)^2$. $y =$ _____
- (76) $\int \frac{3\pi}{4} (2\sin(x)\cos(x)) dx =$ _____
- (77) The line tangent to $f(x) = \frac{x^2}{2} + 3x - 1$ at point $(-6, -1)$ has y-intercept at $y =$ _____
- (78) Given: 4, 9, 25, 49, k, 169, 289,.... . Find k. _____
- (79) $309 \times 16 =$ _____
- *(80) $797 \div (87.5\% \times \frac{7}{10}) =$ _____

University Interscholastic League - Number Sense Answer Key HS • Invitation B • 2024

*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

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| (1) 1,925 | (19) 7 | (34) 220 | (59) 14 |
| (2) 506 | *(20) 55,381 — 61,209 | (35) 14 | *(60) 2,078 — 2,296 |
| (3) 61.6 | (21) 1.41 | (36) 25 | (61) 1 |
| (4) 5.19, $\frac{519}{100}$, $5\frac{19}{100}$ | (22) 12 | (37) 28 | (62) 5 |
| (5) 1,120 | (23) 51,948 | (38) 14.84, $\frac{371}{25}$, $14\frac{21}{25}$ | (63) 33 |
| (6) 2,197 | (24) 2 | (39) 100 | (64) 1 |
| (7) 448 | (25) 136 | *(40) 31,415 — 34,721 | (65) $\frac{1}{15}$ |
| (8) 37.5 | (26) 11,128 | (41) 164,025 | (66) 35 |
| (9) 0 | (27) 20 | (42) 6 | (67) 38 |
| *(10) 7,695 — 8,505 | (28) $\frac{10}{3}$, $3\frac{1}{3}$ | (43) — 40 | (68) — 8 |
| (11) 1,774 | (29) 8 | (44) 1.75, $\frac{7}{4}$, $1\frac{3}{4}$ | (69) — 13 |
| (12) $28\frac{9}{34}$ | *(30) 529 — 583 | (45) 6666 | *(70) 642 — 708 |
| (13) 24.30 | (31) 24,800 | (46) 101111 | (71) 1.5625, $\frac{25}{16}$, $1\frac{9}{16}$ |
| (14) — 4.9, — $\frac{49}{10}$,
— $4\frac{9}{10}$ | (32) 7 | (47) — 3 | (72) — 8.5, — $\frac{17}{2}$,
— $8\frac{1}{2}$ |
| (15) 2,809 | (33) 1,000 | (48) — 2.5, — $\frac{5}{2}$, — $2\frac{1}{2}$ | (73) 14 |
| (16) 2,704 | | (49) 156 | (74) — 4 |
| (17) 105 | | *(50) 4,668 — 5,158 | (75) $\frac{25}{12}$, $2\frac{1}{12}$ |
| (18) 12 | | (51) 4 | (76) 0 |
| | | (52) 1 | (77) — 19 |
| | | (53) 30 | (78) 121 |
| | | (54) $\frac{64}{3}$, $21\frac{1}{3}$ | (79) 4,944 |
| | | (55) 8 | *(80) 1,237 — 1,366 |
| | | (56) 12.5, $\frac{25}{2}$, $12\frac{1}{2}$ | |
| | | (57) 101 | |
| | | (58) 3 | |