

# The University Interscholastic League Number Sense Test • HS State • 2024

Final \_\_\_\_\_

2nd \_\_\_\_\_

1st \_\_\_\_\_

Score \_\_\_\_\_  
Initials \_\_\_\_\_

Contestant's Number \_\_\_\_\_

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.

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

**STOP -- WAIT FOR SIGNAL!**

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|--|--|
| <p>(1) <math>5 \times 15 + 2024 =</math> _____</p> <p>(2) <math>24 \div \frac{2}{3} - 15.5 =</math> _____</p> <p>(3) <math>\frac{7}{9} \div \frac{2}{3} =</math> _____</p> <p>(4) <math>\frac{7}{8} =</math> _____ (decimal)</p> <p>(5) <math>5^3 - 15^2 + 24 =</math> _____</p> <p>(6) <math>0.8333\dots =</math> _____ (proper fraction)</p> <p>(7) <math>666 \times \frac{2}{37} =</math> _____</p> <p>(8) <math>\text{MMXXIV} + \text{XV} \times \text{V} =</math> _____ (Arabic Numeral)</p> <p>(9) Which is larger, <math>\frac{7}{12}</math> or <math>0.58</math>? _____</p> <p>*(10) <math>4202 \times 51 - 5 =</math> _____</p> <p>(11) If hankies cost \$1.50 each or a dozen for \$15.75, then how much is saved by buying a dozen? \$ _____</p> <p>(12) <math>24 \div (20 - 16) + 12 - 8 \times 4 =</math> _____</p> <p>(13) <math>155 \times 14 =</math> _____</p> <p>(14) <math>54 \times 54 =</math> _____</p> <p>(15) <math>\frac{1}{27} - \frac{1}{9} - \frac{1}{3} =</math> _____</p> <p>(16) <math>3 + 5 + 7 + 9 + \dots + 19 + 21 =</math> _____</p> <p>(17) <math>25 \times 64 =</math> _____</p> | <p>(18) <math>26.25 \times 64 =</math> _____</p> <p>(19) <math>102\frac{1}{2} \times 64 =</math> _____</p> <p>*(20) <math>2024 \times (\sqrt{15} + \sqrt{5}) =</math> _____</p> <p>(21) <math>39 \times 31 =</math> _____</p> <p>(22) <math>4\frac{2}{3} \div 2\frac{4}{9} =</math> _____</p> <p>(23) <math>40 - 60\%</math> of 80 is _____</p> <p>(24) <math>0.5151515\dots =</math> _____ (fraction)</p> <p>(25) If <math>f(x) = 16x^2 - 40x + 25</math>, then <math>f(15) =</math> _____</p> <p>(26) <math>63 \times 24 =</math> _____</p> <p>(27) Write five and three-fifths million two thousand twenty-four in digits. _____</p> <p>(28) <math>10\frac{5}{7} \times 10\frac{2}{7} =</math> _____ (mixed number)</p> <p>(29) 515 base 10 is written as _____ base 5</p> <p>*(30) <math>\sqrt{5504122} =</math> _____</p> <p>(31) <math>51.5 - 20.24 =</math> _____ (decimal)</p> <p>(32) If <math>x + y = 15</math> and <math>x - y = 5</math>, then <math>x^2 + y^2 =</math> _____</p> <p>(33) The reciprocal of <math>-6\frac{2}{3}</math> is _____ (decimal)</p> <p>(34) <math>[51 + 5 \times 20 - 24] \div 7</math> has a remainder of _____</p> |
|--|--|

- (35)  $\sqrt[3]{13824} =$  \_\_\_\_\_
- (36)  $3906 \times 6 - 36 =$  \_\_\_\_\_
- (37) How many integers greater than 12 and less than or equal to 72 are divisible by 8? \_\_\_\_\_
- (38) Given: 2, 3, 5, 4, 6, 10, 6, 9, 15, p, q, r, 10, 15, 25, ....  
Find  $p + q + r$ . \_\_\_\_\_
- (39) Find the digit  $B > 0$ , such that  $39B9 = [9(13 - B)]^2$ .  $B =$  \_\_\_\_\_
- \*(40)  $\sqrt[3]{515} \times \sqrt{515} \times 515 =$  \_\_\_\_\_
- (41)  $\frac{2}{45} =$  \_\_\_\_\_% (mixed number)
- (42)  $(7^5 + 3^5 - 2) \div 10$  has a remainder of \_\_\_\_\_
- (43) 2401 has how many positive integral divisors? \_\_\_\_\_
- (44) The arithmetic mean of the set {5, 15, 24, k} is 16. Find k. \_\_\_\_\_
- (45) If  $3x + y = 5$  and  $x - 2y = 5$ , then  $x =$  \_\_\_\_\_
- (46)  $123_4 \times 2_4 =$  \_\_\_\_\_<sub>2</sub>
- (47)  $(2! \times 3! \times 5!) \div (4! \times 6!) =$  \_\_\_\_\_
- (48) Two dice are rolled. The probability that the sum of the top faces is greater than 10 is \_\_\_\_\_%
- (49) Let  $R_1$  and  $R_2$  be the roots of  $(2x - 3)^2 = 5$ . Find  $R_1 + R_2 - R_1 \times R_2$ . \_\_\_\_\_
- \*(50)  $13141524 \div 515 =$  \_\_\_\_\_
- (51)  $114 - 17\frac{1}{2} - 22.25 =$  \_\_\_\_\_
- (52)  $114 + 17.5 - 22\frac{1}{4} =$  \_\_\_\_\_
- (53)  $114.25 + 17\frac{1}{2} + 22 =$  \_\_\_\_\_
- (54)  $2 + 7 + 9 + 16 + 25 + 41 + 66 + m + 173 + n + 453 =$  \_\_\_\_\_
- (55) If  $f(x) = 3x + \log_4(x)$ , then  $f(8) =$  \_\_\_\_\_
- (56)  $4\frac{1}{5}$  is what percent more than  $3\frac{1}{2}$ ? \_\_\_\_\_%
- (57)  $513_6 - 1415_6 + 2024_6 =$  \_\_\_\_\_<sub>6</sub>
- (58)  $48 + 32 + 21.333... + 14.222... + ... =$  \_\_\_\_\_
- (59)  $37^{12} \div 23$  has a remainder of \_\_\_\_\_
- \*(60)  $(10\pi^2 - 1)^2 =$  \_\_\_\_\_
- (61)  $\begin{bmatrix} 2 & 5 \\ 3 & -7 \end{bmatrix} \times \begin{bmatrix} 1 & -6 \\ 3 & 10 \end{bmatrix} = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$ .  $b + c =$  \_\_\_\_\_
- (62)  $\tan\left(\frac{\pi}{3}\right) \times \tan\left(\frac{5\pi}{3}\right) =$  \_\_\_\_\_
- (63) 2.5 fathoms = \_\_\_\_\_ inches
- (64) If  $300^\circ = k\pi$  radians, then  $k =$  \_\_\_\_\_
- (65) 0.43 base 5 = \_\_\_\_\_ base 10 (decimal)
- (66) Which element of {21, 35, 45} is both a triangular number and a hexagonal number? \_\_\_\_\_
- (67)  $\log_2(32) - \log_5(25) = \log_3(x)$  and  $x =$  \_\_\_\_\_
- (68) If  $x = 5$  and  $y = 15$ , then  $(x - y)(x^2 + xy + y^2) =$  \_\_\_\_\_
- (69)  $\sqrt{1000}_4 =$  \_\_\_\_\_<sub>4</sub>
- \*(70)  $(4 + 5 + 6 + ... + 11 + 12 + 13)^2 =$  \_\_\_\_\_
- (71) If  $f(x) = \frac{5x}{6} + \frac{3}{4}$  and  $f^{-1}(x) = ax + b$ , then  $a + b =$  \_\_\_\_\_
- (72) Let  $f(x) = \sin(2x)$ . Find  $f''\left(\frac{\pi}{12}\right)$ . \_\_\_\_\_
- (73) Find the sum of the squares of the diagonals of a parallelogram with side lengths 7 and 11. \_\_\_\_\_
- (74)  $h(x) = (x + 3)^{\frac{1}{2}}$  has a relative minimum at  $x =$  \_\_\_\_\_
- (75)  $\int_1^2 \int_3^4 xy \, dy \, dx =$  \_\_\_\_\_
- (76) The axis of symmetry of the graph of  $f(x) = 5x^2 + 15x - 24$  is  $x =$  \_\_\_\_\_
- (77) Given: 5, 1, 4, -3, 7, -10, 17, k, 44, ... .  $k =$  \_\_\_\_\_
- (78)  $(402)^3 =$  \_\_\_\_\_
- (79)  $28146 \times 111 =$  \_\_\_\_\_
- \*(80) 93.75% of 51524 = \_\_\_\_\_

**DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST**

**University Interscholastic League - Number Sense Answer Key HS • State • 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

- |   |                                      |  |  |
|---|--------------------------------------|--|--|
| (1) 2,099                               | (18) 1,680                           | (35) 24                                      | (57) 1122                                  |
| (2) $20.5, \frac{41}{2}, 20\frac{1}{2}$ | (19) 6,560                           | (36) 23,400                                  | (58) 144                                   |
| (3) $\frac{7}{6}, 1\frac{1}{6}$         | *(20) 11,747 — 12,982                | (37) 8                                       | (59) 9                                     |
| (4) .875                                | (21) 1,209                           | (38) 40                                      | *(60) 9,068 — 10,021                       |
| (5) — 76                                | (22) $\frac{21}{11}, 1\frac{10}{11}$ | (39) 6                                       | (61) 20                                    |
| (6) $\frac{5}{6}$                       | (23) — 8                             | *(40) 88,996 — 98,363                        | (62) — 3                                   |
| (7) 36                                  | (24) $\frac{17}{33}$                 | (41) $4\frac{4}{9}$                          | (63) 180                                   |
| (8) 2,099                               | (25) 3,025                           | (42) 8                                       | (64) $\frac{5}{3}, 1\frac{2}{3}$           |
| (9) $\frac{7}{12}$                      | (26) 1,512                           | (43) 5                                       | (65) .92                                   |
| *(10) 203,583 —<br>225,011              | (27) 5,602,024                       | (44) 20                                      | (66) 45                                    |
| (11) 2.25                               | (28) $110\frac{10}{49}$              | (45) $\frac{15}{7}, 2\frac{1}{7}$            | (67) 27                                    |
| (12) — 14                               | (29) 4030                            | (46) 110110                                  | (68) — 3,250                               |
| (13) 2,170                              | *(30) 2,229 — 2,463                  | (47) $\frac{1}{12}$                          | (69) 20                                    |
| (14) 2,916                              | (31) 31.26                           | (48) $\frac{25}{3}, 8\frac{1}{3}$            | *(70) 6,864 — 7,586                        |
| (15) — $\frac{11}{27}$                  | (32) 125                             | (49) 2                                       | (71) .3, $\frac{3}{10}$                    |
| (16) 120                                | (33) — .15                           | *(50) 24,242 — 26,793                        | (72) — 2                                   |
| (17) 1,600                              | (34) 1                               | (51) $74.25, \frac{297}{4}, 74\frac{1}{4}$   | (73) 340                                   |
|   |                                      | (52) $109.25, \frac{437}{4}, 109\frac{1}{4}$ | (74) — 3                                   |
|   |                                      | (53) $153.75, \frac{615}{4}, 153\frac{3}{4}$ | (75) $5.25, \frac{21}{4}, 5\frac{1}{4}$    |
|   |                                      | (54) 1,179                                   | (76) — 1.5, — $\frac{3}{2}, -1\frac{1}{2}$ |
|   |                                      | (55) $25.5, \frac{51}{2}, 25\frac{1}{2}$     | (77) — 27                                  |
|   |                                      | (56) 20                                      | (78) 64,964,808                            |
|   |                                      |  | (79) 3,124,206                             |
|   |                                      |  | *(80) 45,889 — 50,718                      |