

# The University Interscholastic League Number Sense Test • HS District • 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) <math>322 + 327 + 2024 =</math> _____</p> <p>(2) <math>3\frac{2}{7} - 2\frac{2}{3} =</math> _____</p> <p>(3) <math>(5.6)(7 + 8) =</math> _____</p> <p>(4) <math>\frac{5}{8} \div \frac{4}{5} =</math> _____</p> <p>(5) <math>31^2 =</math> _____</p> <p>(6) <math>3.58333\dots =</math> _____ (improper fraction)</p> <p>(7) The LCM of 98 and 56 is _____</p> <p>(8) <math>\frac{4}{5} =</math> _____ %</p> <p>(9) <math>322327 \div 9</math> has a remainder of _____</p> <p>*(10) <math>(2024 - 327) \times 22 =</math> _____</p> <p>(11) If CDs cost \$4.75 each or a 3-pack for \$12.95, then how much is saved by buying a 3-pack? \$ _____</p> <p>(12) <math>\sqrt[3]{2744} =</math> _____</p> <p>(13) 8% tax on \$322.00 is \$ _____</p> <p>(14) <math>3 \div (2 - 7) \times 2 + 2 - 3 =</math> _____</p> <p>(15) 12.5% of 96 is _____</p> <p>(16) <math>\frac{5}{8}</math> of 96 is _____</p> <p>(17) 0.75 times 96 is _____</p> | <p>(18) There are _____ positive integral factors of 36</p> <p>(19) <math>33\frac{1}{3}\%</math> of 20% of 15 is _____</p> <p>*(20) <math>300(\sqrt{2} + \sqrt{7}) =</math> _____</p> <p>(21) Find digit <math>B &gt; 0</math>, such that <math>B32 - 32B = 405</math>. _____</p> <p>(22) If <math>\frac{29}{33} = ababab\dots</math>, then <math>a + b =</math> _____</p> <p>(23) Write thirty-two and two-fifths million two thousand twenty-four in digits. _____</p> <p>(24) <math>[3 + 22 \times 3 - 27] \div 4</math> has a remainder of _____</p> <p>(25) <math>8\frac{3}{7} \times 8\frac{4}{7} =</math> _____ (mixed number)</p> <p>(26) <math>[\{t,r,i\} \cup \{q,u,a,d\}] \cap [\{b,i\} \cup \{p,e,n,t\}]</math> contains how many distinct elements? _____</p> <p>(27) 322 base 7 is written as _____ base 10</p> <p>(28) If <math>\frac{1}{7} + \frac{1}{x} = \frac{1}{3}</math>, then <math>x =</math> _____</p> <p>(29) <math>0.727272\dots =</math> _____ (fraction)</p> <p>*(30) <math>\sqrt{3222724} =</math> _____</p> <p>(31) <math>5993 \times 7 + 49 =</math> _____</p> <p>(32) If <math>f(x) = 4x^2 + 20x + 25</math>, then <math>f(15) =</math> _____</p> <p>(33) The multiplicative inverse of 0.24 is _____</p> |
|--|---|

- (34) Given: 2, 0, 3, 2, 5, 4, 7, p, q, 8, 13, ... Find pq. \_\_\_\_\_
- (35) 202 base 10 is written as \_\_\_\_\_ base 4
- (36) The cost of 15 pints at 32¢ each is \$ \_\_\_\_\_
- (37) The cost of 17 pints at 32¢ each is \$ \_\_\_\_\_
- (38) The cost of 8.5 pints at 32¢ each is \$ \_\_\_\_\_
- (39) Let  $\frac{x+11}{x-8} + \frac{x-8}{x+11} = 2\frac{B}{C}$ . Find B. \_\_\_\_\_
- \*(40)  $\sqrt[3]{322272024} =$  \_\_\_\_\_
- (41)  $(309)^2 =$  \_\_\_\_\_
- (42) The positive geometric mean of 4 and 16 is \_\_\_\_\_
- (43) The simple interest on \$322.00 at 7% for two years is \$ \_\_\_\_\_
- (44) The arithmetic mean of 22, 27, and 24 is \_\_\_\_\_
- (45)  $54^2 + 66^2 =$  \_\_\_\_\_
- (46)  $(2^5 + 7^5 - 2) \div 9$  has a remainder of \_\_\_\_\_
- (47)  $(4x - 3y)^2 = ax^2 + bxy + cy^2$  and  $a + b - c =$  \_\_\_\_\_
- (48) The product of the roots of  $3x^2 - 4x = 7$  is \_\_\_\_\_
- (49)  $327_8 + 322_8 - 24_8 =$  \_\_\_\_\_ 8
- \*(50)  $3272024 \div 322 =$  \_\_\_\_\_
- (51) The 11<sup>th</sup> term of 1, 1, 2, 3, 5, 8, ... is 89. The 12<sup>th</sup> term is \_\_\_\_\_
- (52)  $(11^3 - 13^3) \div (11 - 13) =$  \_\_\_\_\_
- (53)  $\frac{1}{28} + \frac{1}{70} + \frac{1}{130} =$  \_\_\_\_\_
- (54)  $25 + 10 + 4 + 1.6 + \dots =$  \_\_\_\_\_
- (55) If  $\sqrt{12 + \sqrt{8 + \sqrt{x - 8}}} = 4$ , then  $x =$  \_\_\_\_\_
- (56) Two dice are rolled. Find the odds that the sum of the numbers is less than 4. \_\_\_\_\_
- (57) Let  $3\frac{2}{m} \times n\frac{2}{23} = 20$ , where m, n are natural numbers. Find  $n - m$ . \_\_\_\_\_
- (58)  $2024_6 \div 3_6$  has a remainder of \_\_\_\_\_
- (59) Let  $4^5 \times 8^3 \div 128 = 2^k$ . Find k. \_\_\_\_\_
- \*(60)  $125^2 \div 25^3 \times 5^5 =$  \_\_\_\_\_
- (61)  $\sin\left(\frac{17\pi}{6}\right) =$  \_\_\_\_\_
- (62) If  $(\sqrt[3]{a^{22}})(\sqrt[3]{a^{27}}) = (\sqrt[n]{a^k})$ , where n and k are relatively prime, then k = \_\_\_\_\_
- (63) The fifth hexagonal number is \_\_\_\_\_
- (64)  $f(x) = \frac{x+1}{2-3x} - 4$  and  $f^{-1}(5) =$  \_\_\_\_\_
- (65) If  $x = 7$  and  $y = -6$ , then  $(x + y)(x^2 - xy + y^2) =$  \_\_\_\_\_
- (66) The 2<sup>nd</sup> pentagonal number minus the 4<sup>th</sup> pentagonal number is \_\_\_\_\_
- (67) If  $h(x) = x^2 - 3$  and  $g(x) = x - 1$ , then  $h(g(0)) =$  \_\_\_\_\_
- (68) Change  $\frac{12}{25}$  to a base 5 decimal. \_\_\_\_\_ 5
- (69)  $24^9 \div 17$  has a remainder of \_\_\_\_\_
- \*(70) A Jedi rocket traveling at a rate of 5280 miles per hour is traveling \_\_\_\_\_ feet per second
- (71) Find k,  $0 \leq x \leq 22$ , if  $11^4 + 2^6 \cong k \pmod{22}$ . \_\_\_\_\_
- (72) Let  $h(x) = 3x^2 + 2x + 1$ . Find  $h'(-4)$ . \_\_\_\_\_
- (73)  $2\frac{2}{3}$  fathoms = \_\_\_\_\_ inches
- (74) Let (a, b) be an inflection point for  $h(x) = 2x^3 - 3x + 5$ . Find a + b. \_\_\_\_\_
- (75)  $x^2 + y^2 = 4y$  has area of  $k\pi$  sq. units and  $k =$  \_\_\_\_\_
- (76)  $\int_{-1}^2 (x - 3) dx =$  \_\_\_\_\_
- (77) The domain of  $f(x) = \frac{\sqrt{3x-5}}{\sqrt{7-2x}}$  is  $w \leq x < y$  and  $x \in \text{Reals}$ . Find  $w + y$ . \_\_\_\_\_
- (78) Given: 8, 12, 20, 28, k, 52, 68, ... . Find k. \_\_\_\_\_
- (79)  $322 \times 327 =$  \_\_\_\_\_
- \*(80)  $322 \times 571.428 =$  \_\_\_\_\_

**DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST****University Interscholastic League - Number Sense Answer Key HS • District • 2024**\*number)  $x - y$  means an integer between  $x$  and  $y$  inclusiveNOTE: If an answer is of the type like  $\frac{2}{3}$  it cannot be written as a repeating decimal

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|---|---|-------------------------------------|---|
| (1) 2,673                                 | (18) 9                                  | (34) 66                             | (59) 12                                   |
| (2) $\frac{13}{21}$                       | (19) 1                                  | (35) 3022                           | *(60) 2,969 — 3,281                       |
| (3) 84                                    | *(20) 1,158 — 1,278                     | (36) 4.80                           | (61) $.5, \frac{1}{2}$                    |
| (4) $.78125, \frac{25}{32}$               | (21) 7                                  | (37) 5.44                           | (62) 49                                   |
| (5) 961                                   | (22) 15                                 | (38) 2.72                           | (63) 45                                   |
| (6) $\frac{43}{12}$                       | (23) 32,402,024                         | (39) 361                            | (64) $\frac{17}{28}$                      |
| (7) 392                                   | (24) 2                                  | *(40) 652 — 719                     | (65) 127                                  |
| (8) 80                                    | (25) $72\frac{12}{49}$                  | (41) 95,481                         | (66) — 17                                 |
| (9) 1                                     | (26) 2                                  | (42) 8                              | (67) — 2                                  |
| *(10) 35,468 — 39,200                     | (27) 163                                | (43) 45.08                          | (68) .22                                  |
| (11) 1.30                                 | (28) $5.25, \frac{21}{4}, 5\frac{1}{4}$ | (44) $\frac{73}{3}, 24\frac{1}{3}$  | (69) 10                                   |
| (12) 14                                   | (29) $\frac{8}{11}$                     | (45) 7,272                          | *(70) 7,357 — 8,131                       |
| (13) 25.76                                | *(30) 1,706 — 1,884                     | (46) 7                              | (71) 9                                    |
| (14) $-2.2, -\frac{11}{5}, -2\frac{1}{5}$ | (31) 42,000                             | (47) — 17                           | (72) — 22                                 |
| (15) 12                                   | (32) 1,225                              | (48) $-\frac{7}{3}, -2\frac{1}{3}$  | (73) 192                                  |
| (16) 60                                   | (33) $\frac{25}{6}, 4\frac{1}{6}$       | (49) 625                            | (74) 5                                    |
| (17) 72                                   |   | *(50) 9,654 — 10,669                | (75) 4                                    |
|   |   | (51) 144                            | (76) $-7.5, -\frac{15}{2}, -7\frac{1}{2}$ |
|   |   | (52) 433                            | (77) $\frac{31}{6}, 5\frac{1}{6}$         |
|   |   | (53) $\frac{3}{52}$                 | (78) 44                                   |
|   |   | (54) $\frac{125}{3}, 41\frac{2}{3}$ | (79) 105,294                              |
|   |   | (55) 72                             | *(80) 174,800 — 193,199                   |
|   |   | (56) $\frac{1}{11}$                 |   |
|   |   | (57) — 1                            |   |
|   |   | (58) 1                              |   |