

# The University Interscholastic League

## Number Sense Test • HS Regional • 2020

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

Final \_\_\_\_\_

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

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

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

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!**

- |  |   |
|--|---|
| <p>(1) <math>41720 - 18420 =</math> _____</p> <p>(2) <math>417 + 1820 =</math> _____</p> <p>(3) <math>3.5 \times 1.1 =</math> _____ (decimal)</p> <p>(4) <math>\frac{3}{16} =</math> _____ % (decimal)</p> <p>(5) <math>\frac{3}{4} + \frac{7}{8} =</math> _____ (improper fraction)</p> <p>(6) <math>4\frac{1}{7} + 4\frac{1}{8} =</math> _____ (mixed number)</p> <p>(7) <math>4.18 - 17.4 =</math> _____ (decimal)</p> <p>(8) MDCCXVIII = _____ (Arabic Numeral)</p> <p>(9) The GCD of 56 and 84 is _____</p> <p>*(10) <math>4182 + 4170 + 1817 + 2020 =</math> _____</p> <p>(11) <math>17 \times 71 =</math> _____</p> <p>(12) The mode of {1, 1, 2, 3, 5, 2, 1, 3, 4, 7} is _____</p> <p>(13) <math>23^2 =</math> _____</p> <p>(14) DCCXIV — CDXVIII = _____ (Arabic Numeral)</p> <p>(15) 17 is what percent of 85? _____ %</p> <p>(16) <math>41718 \div 6</math> has a remainder of _____</p> <p>(17) <math>8\frac{3}{5} \times 5\frac{1}{4} =</math> _____ (mixed number)</p> | <p>(18) <math>53^2 \div 4</math> has a remainder of _____</p> <p>(19) 18% of <math>277\frac{7}{9} =</math> _____</p> <p>*(20) <math>417 \times 2041 \div 820 =</math> _____</p> <p>(21) <math>3\frac{1}{5}</math> is the square root of _____ (decimal)</p> <p>(22) <math>(4 - 18 \times 4 - 17) \div 16</math> has a remainder of _____</p> <p>(23) 75% of a yard less <math>\frac{1}{2}</math> of a foot = _____ inches</p> <p>(24) <math>42 \times 47 =</math> _____</p> <p>(25) How many subsets containing 3 elements or less does the set {r,e,g,i,o,n} have? _____</p> <p>(26) <math>\sqrt{289} + \sqrt{324} =</math> _____</p> <p>(27) <math>123 \times 14 =</math> _____</p> <p>(28) The ratio of the length to the width of a rectangle is 7:4. The perimeter is 44". The width is _____ "</p> <p>(29) <math>52^2 =</math> _____</p> <p>*(30) <math>(59 \div 3 \times 24 \div 4)^2 =</math> _____</p> <p>(31) <math>(4)(13)(11)(k) = 40,404</math>. k = _____</p> <p>(32) Let <math>86 = p + q</math>, where <math>q = p + 14</math>. Find q. _____</p> <p>(33) If <math>3.08333... \times k = 1</math>, then k = _____</p> |
|--|---|

- (34)  $\sqrt[3]{2197} =$  \_\_\_\_\_
- (35) The largest root of  $(2x - 3)^2 = \frac{4}{9}$  is \_\_\_\_\_
- (36)  $1797 \times 3 + 18 =$  \_\_\_\_\_
- (37) If  $a = 23$  and  $b = 14$ , then  $a^2 - 6ab + 9b^2 =$  \_\_\_\_\_
- (38)  $1B8_{12} =$  \_\_\_\_\_  $_{10}$
- (39)  $4\frac{1}{6}$  is \_\_\_\_\_ % less than 5
- \*(40)  $3\frac{1}{17} \times 47820 \div 13 =$  \_\_\_\_\_
- (41)  $(202)^3 =$  \_\_\_\_\_
- (42) If  $8^{(x-1)} = 12\frac{1}{4}$ , then  $8^{(x)} =$  \_\_\_\_\_
- (43) Let  $x + y = 17$  and  $x - y = 18$ . Find  $x^2 - y^2$ . \_\_\_\_\_
- (44)  $(i)^{18} \times (i)^{17} \div (i)^{20} = a\sqrt{b}$ , where  $a, b \in \{-1, 1\}$ . Find  $b - a$ . \_\_\_\_\_
- (45) The median on the hypotenuse of a 9-40-41 cm triangle is \_\_\_\_\_ cm (decimal)
- (46) The fourth pentagonal number is \_\_\_\_\_
- (47) The product of the roots of  $(5x - 2)^3 = 0$  is \_\_\_\_\_
- (48)  $345_7 \times 11_7 =$  \_\_\_\_\_  $_7$
- (49) The 5-digit number 17k18 is divisible by 6. How many positive digits, k, exist? \_\_\_\_\_
- \*(50)  $\sqrt{325} \times \sqrt{253} \times \sqrt{532} =$  \_\_\_\_\_
- (51)  $(21)^3 - (22)^3 =$  \_\_\_\_\_
- (52)  $\frac{5}{8}$  mile = \_\_\_\_\_ yards
- (53) How many integers between 4 and 30 are relatively prime to 30? \_\_\_\_\_
- (54) The first 4 digits of the decimal of  $\frac{5}{66}$  is 0. \_\_\_\_\_
- (55)  ${}_6P_3 + {}_6C_3 =$  \_\_\_\_\_
- (56) If  $234_b = 94$ , then  $123_b =$  \_\_\_\_\_
- (57) If 8, 8, and x are the integral sides of a triangle, then the least value of x is \_\_\_\_\_
- (58)  $417 \times 131 =$  \_\_\_\_\_
- (59) How many lines exist given eight coplanar points such that no three points are collinear? \_\_\_\_\_
- \*(60)  $(41)^4 = 38 \times$  \_\_\_\_\_
- (61) The shortest distance between (1, -1) and  $8x + 15y = 17$  is \_\_\_\_\_
- (62)  $(185)^2 =$  \_\_\_\_\_
- (63)  $\sin^{-1}(\cos \frac{5\pi}{6}) = k\pi$  rad. Find  $k < 0$ . \_\_\_\_\_
- (64) Given: 1, 1, 4, 9, 25, ... 441, k, 3025, ... .  $k =$  \_\_\_\_\_
- (65) Round  $(\sqrt{6} + \sqrt{7})$  to the nearest tenth. \_\_\_\_\_
- (66)  $21 \times \frac{22}{25} =$  \_\_\_\_\_ (mixed number)
- (67) The sum of the reciprocals of all of the positive divisors of 30 is \_\_\_\_\_
- (68) How many different 6-letter code words can be constructed using the letters ELEVEN? \_\_\_\_\_
- (69)  $0.3121212\dots$  base 5 = \_\_\_\_\_ base 10 (fraction)
- \*(70) 1,380 miles per hour = \_\_\_\_\_ feet per second
- (71) The first four digits of the decimal for  $\frac{12}{220}$  base 3 is 0. \_\_\_\_\_ base 3
- (72) If  $f(x) = \frac{x-3}{6} - 10$ , then  $f^{-1}(15) =$  \_\_\_\_\_
- (73) Let  $f'(x) = 6x$  and  $f(-1) = 3$ . Find  $f(-3)$ . \_\_\_\_\_
- (74)  $1718 \times 101 =$  \_\_\_\_\_
- (75)  $8 + 2x \equiv 4 \pmod{6}$ , where  $2 \leq x \leq 6$ .  $x =$  \_\_\_\_\_
- (76) Find the sum of the squares of the roots of  $4x^2 + 7x - 11 = 0$ . \_\_\_\_\_
- (77)  $\lim_{x \rightarrow \infty} \frac{3x^2 - 2x + 1}{x^2 + 4} =$  \_\_\_\_\_
- (78)  $\int_1^3 x^2 dx =$  \_\_\_\_\_
- (79) The sum of the product of the roots taken two at a time of  $2x^4 - 13x^3 + 28x^2 - 23x + 6 = 0$  is \_\_\_\_\_
- \*(80) The length of the altitude of an equilateral triangle with a perimeter of 510 cm is \_\_\_\_\_ cm

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS • Regional • 2020

\*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) 23,300            | (18) 1                | (34) 13                                  | (59) 28                                      |
| (2) 2,237             | (19) 50               | (35) $\frac{11}{6}, 1\frac{5}{6}$        | *(60) 70,645 — 78,080                        |
| (3) 3.85              | *(20) 987 — 1,089     | (36) 5,409                               | (61) $\frac{24}{17}, 1\frac{7}{17}$          |
| (4) 18.75             | (21) 10.24            | (37) 361                                 | (62) 34,225                                  |
| (5) $\frac{13}{8}$    | (22) 11               | (38) 284                                 | (63) $-\frac{1}{3}$                          |
| (6) $8\frac{15}{56}$  | (23) 21               | (39) $\frac{50}{3}, 16\frac{2}{3}$       | (64) 1,156                                   |
| (7) — 13.22           | (24) 1,974            | *(40) 10,690 — 11,814                    | (65) 5.1, $\frac{51}{10}, 5\frac{1}{10}$     |
| (8) 1,718             | (25) 42               | (41) 8,242,408                           | (66) $18\frac{12}{25}$                       |
| (9) 28                | (26) 35               | (42) 98                                  | (67) 2.4, $\frac{12}{5}, 2\frac{2}{5}$       |
| *(10) 11,580 — 12,798 | (27) 1,722            | (43) 306                                 | (68) 120                                     |
| (11) 1,207            | (28) 8                | (44) 0                                   | (69) $\frac{79}{120}$                        |
| (12) 1                | (29) 2,704            | (45) 20.5, $\frac{41}{2}, 20\frac{1}{2}$ | *(70) 1,923 — 2,125                          |
| (13) 529              | *(30) 13,228 — 14,620 | (46) 22                                  | (71) 0121                                    |
| (14) 296              | (31) 7                | (47) .064, $\frac{8}{125}$ ,             | (72) 153                                     |
| (15) 20               | (32) 50               | (48) 4125                                | (73) 27                                      |
| (16) 0                | (33) $\frac{12}{37}$  | (49) 3                                   | (74) 173,518                                 |
| (17) $45\frac{3}{20}$ |                       | *(50) 6,284 — 6,944                      | (75) 4                                       |
|                       |                       | (51) — 1,387                             | (76) 8.5625, $\frac{137}{16}, 8\frac{9}{16}$ |
|                       |                       | (52) 1,100                               | (77) 3                                       |
|                       |                       | (53) 7                                   | (78) $\frac{26}{3}, 8\frac{2}{3}$            |
|                       |                       | (54) 0757                                | (79) 14                                      |
|                       |                       | (55) 140                                 | *(80) 140 — 154                              |
|                       |                       | (56) 51                                  |  |
|                       |                       | (57) 1                                   |  |
|                       |                       | (58) 54,627                              |  |