

# The University Interscholastic League Number Sense Test • HS State • 2020

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>2050 - 202 =</math> _____</p> <p>(2) <math>6834 \div 17 =</math> _____</p> <p>(3) <math>\frac{7}{15} \times \frac{10}{21} =</math> _____</p> <p>(4) <math>50220 \div 9</math> has a remainder of _____</p> <p>(5) The LCM of 52 and 24 is _____</p> <p>(6) <math>3\frac{2}{5} + 6\frac{4}{9} =</math> _____ (mixed number)</p> <p>(7) <math>0.1875 =</math> _____ (proper fraction)</p> <p>(8) <math> 8 - 1  - 5 -  1 - 9  +  4 - 7  =</math> _____</p> <p>(9) <math>5 + 10 \div 15 \times (20 - 25) =</math> _____</p> <p>*(10) <math>5220 + 522 + 2052 - 2205 =</math> _____</p> <p>(11) <math>7 \times 23 + 26 \times 7 =</math> _____</p> <p>(12) Which is larger, 0.6 or <math>\frac{7}{12}</math>? _____</p> <p>(13) <math>MMXX \times V =</math> _____ (Arabic Numeral)</p> <p>(14) 24 is what percent of 20? _____%</p> <p>(15) 170 less 30% of 170 is _____</p> <p>(16) <math>58^2 =</math> _____</p> <p>(17) <math>2020 \div 6</math> has a remainder of _____</p> <p>(18) <math>42^2 =</math> _____</p> | <p>(19) <math>2\frac{2}{5}</math> is the square root of _____ (decimal)</p> <p>*(20) <math>518 \times 7491 =</math> _____</p> <p>(21) <math>\sqrt[3]{2197} =</math> _____</p> <p>(22) <math>(14 + 15 \times 16 - 17) \div 6</math> has a remainder of _____</p> <p>(23) <math>1292 \times 8 + 64 =</math> _____</p> <p>(24) <math>A = \{a,c,u,t,e\}</math>, <math>O = \{o,b,t,u,s,e\}</math> and <math>R = \{r,i,g,h,t\}</math>.<br/><math>(A \cup R) \cap O</math> contains _____ distinct element(s)</p> <p>(25) How many subsets containing less than 4 elements does the set <math>\{s,q,u,a,r,e\}</math> have? _____</p> <p>(26) The sum of the solutions of <math> 2x + 1  = 3</math> is _____</p> <p>(27) <math>2A_2</math> base 12 is _____ in base 10</p> <p>(28) 85 is what percent less than 102? _____%</p> <p>(29) Find the ratio of a rectangle's area to its perimeter if the length is 8" and the width 6". _____ in</p> <p>*(30) <math>(48 \div 7 \times 24 \div 3)^2 =</math> _____</p> <p>(31) Let <math>(53x - 34)^2 = ax^2 + bx + c</math>. <math>a + b + c =</math> _____</p> <p>(32) <math>111 \times 502 =</math> _____</p> <p>(33) If <math>x - y = 13</math> and <math>x + y = 9</math>, then <math>x =</math> _____</p> <p>(34) <math>5.0222\dots =</math> _____ (mixed number)</p> <p>(35) Given: 3, 9, 12, 21, 33, m, 87, n, ... . <math>m + n =</math> _____</p> |
|---|--|

- (36) 3.2 is \_\_\_\_\_ % greater than  $2\frac{1}{5}$
- (37)  $2 + 6 + 8 + 14 + 22 + \dots + 152 + 246 =$  \_\_\_\_\_
- (38) 502 base 10 = \_\_\_\_\_ base 11
- (39) Find the smallest integer  $k$ , where  $k > 1$ , such that  $7k + 4$  is a perfect square. \_\_\_\_\_
- \*(40)  $20\frac{2}{5} \times 50220 \div 17 =$  \_\_\_\_\_
- (41)  $(105)^3 =$  \_\_\_\_\_
- (42) A 7-digit number 502202k is divisible by 11.  $k =$  \_\_\_\_\_
- (43) Round  $(\sqrt{2} + \sqrt{3} - \sqrt{5})$  to the tenths place. \_\_\_\_\_
- (44) Given  $P$  coplanar points such that no three points are collinear, only 66 lines exist.  $P =$  \_\_\_\_\_
- (45) The seventh pentagonal number is \_\_\_\_\_
- (46) 120 feet per minute = \_\_\_\_\_ inches per second
- (47) If  $502_b = 322$  then  $205_b =$  \_\_\_\_\_
- (48)  $63^2 + 24^2 =$  \_\_\_\_\_
- (49)  $31^{11} \div 11$  has a remainder of \_\_\_\_\_
- \*(50)  $\sqrt{50220} \times \sqrt{626} =$  \_\_\_\_\_
- (51) Given the sequence 3,6,11,17,26,k,45,... .  $k =$  \_\_\_\_\_
- (52) How many integers between 6 and 52 are relatively prime to 52? \_\_\_\_\_
- (53) The simplified coefficient of the fourth term of the expansion of  $(2x - y)^5$  is \_\_\_\_\_
- (54) If  $(x, y)$  is the midpoint of the segment with endpoints  $(-1, 9)$  and  $(7, -5)$ , then  $x + y =$  \_\_\_\_\_
- (55) If  $\log_8(x) = 2$ , then  $\log_4(x) =$  \_\_\_\_\_
- (56)  ${}_{10}P_2 =$  \_\_\_\_\_
- (57) Let 7, 12, and  $x$  be the integral sides of a triangle. Find the greatest value of  $x$ . \_\_\_\_\_
- (58) The side lengths of a right triangle are 9 ft, 40 ft and 41 ft. The length of the altitude to the hypotenuse is \_\_\_\_\_ ft
- (59)  $888 \times \frac{4}{37} =$  \_\_\_\_\_
- \*(60)  $14 \times 28 \times 42 \times 56 =$  \_\_\_\_\_
- (61)  $5152 \times 17 =$  \_\_\_\_\_
- (62)  $16 \times \frac{20}{23} =$  \_\_\_\_\_ (mixed number)
- (63) The odds of winning the game is 3 to 5. The probability of losing the game is \_\_\_\_\_ %
- (64) Round  $\sin(\frac{11\pi}{3})$  to the nearest tenth. \_\_\_\_\_
- (65) Truncate  $(\sqrt{2} + \sqrt{5})$  to the hundredth. \_\_\_\_\_
- (66) The focus point of  $\frac{(x-1)^2}{9} - \frac{(y+3)^2}{16} = 1$  is  $(x, y)$ , where  $x > 0$ . Find  $x$ . \_\_\_\_\_
- (67) Find the sum of all negative integers  $x$  such that  $3x + 5 \geq -8$ . \_\_\_\_\_
- (68)  $(245)^2 =$  \_\_\_\_\_
- (69) How many triangles can be formed using any three vertices of a regular septagon? \_\_\_\_\_
- \*(70) 2,640 feet at 6 in/sec takes \_\_\_\_\_ minutes
- (71)  $\lim_{x \rightarrow -1} (\frac{x+1}{x^2-1}) =$  \_\_\_\_\_
- (72) If  $f(x) = \frac{2x-5}{3} - 7$ , then  $f^{-1}(11) =$  \_\_\_\_\_
- (73) The sum of the reciprocals of all of the positive divisors of 18 is \_\_\_\_\_
- (74) The first four digits of the decimal for  $\frac{14}{40}$  base 5 is 0. \_\_\_\_\_ base 5
- (75) Find  $k$ , if  $\left| \frac{2}{4} - \frac{2k}{6} \right| = 8$ . \_\_\_\_\_
- (76) The maximum value of  $y = -5x^2 + 3$  is \_\_\_\_\_
- (77)  $\int_0^3 (x-6) dx =$  \_\_\_\_\_
- (78)  $\prod_{k=1}^3 (2 - k^2) =$  \_\_\_\_\_
- (79) Find the sum of the squares of the roots of  $5x^2 + 2x - 3 = 0$ . \_\_\_\_\_
- \*(80) The length of the height of an equilateral triangle with a perimeter of 423 cm is \_\_\_\_\_ cm

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

**University Interscholastic League - Number Sense Answer Key HS • State • 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) 1,848                       | (19) 5.76                          | (36) $\frac{500}{11}, 45\frac{5}{11}$ | *(60) 875,885 —<br>968,083                       |
| (2) 402                         | *(20) 3,686,322 —<br>4,074,354     | (37) 638                              | (61) 87,584                                      |
| (3) $\frac{2}{9}$               | (21) 13                            | (38) 417                              | (62) $13\frac{21}{23}$                           |
| (4) 0                           | (22) 3                             | (39) 3                                | (63) 62.5, $\frac{125}{2}, 62\frac{1}{2}$        |
| (5) 312                         | (23) 10,400                        | *(40) 57,251 — 63,277                 | (64) $-.9, -\frac{9}{10}$                        |
| (6) $9\frac{38}{45}$            | (24) 3                             | (41) 1,157,625                        | (65) 3.65, $\frac{73}{20}, 3\frac{13}{20}$       |
| (7) $\frac{3}{16}$              | (25) 42                            | (42) 8                                | (66) 6   |
| (8) $-3$                        | (26) $-1$                          | (43) .9                               | (67) $-10$                                       |
| (9) $\frac{5}{3}, 1\frac{2}{3}$ | (27) 410                           | (44) 12                               | (68) 60,025                                      |
| *(10) 5,310 — 5,868             | (28) $\frac{50}{3}, 16\frac{2}{3}$ | (45) 70                               | (69) 35  |
| (11) 343                        | (29) $\frac{12}{7}, 1\frac{5}{7}$  | (46) 24                               | *(70) 84 — 92                                    |
| (12) $.6, \frac{3}{5}$          | *(30) 2,859 — 3,159                | (47) 133                              | (71) $-.5, -\frac{1}{2}$                         |
| (13) 10,100                     | (31) 361                           | (48) 4,545                            | (72) 29.5, $\frac{59}{2}, 29\frac{1}{2}$         |
| (14) 120                        | (32) 55,722                        | (49) 9                                | (73) $\frac{13}{6}, 2\frac{1}{6}$                |
| (15) 119                        | (33) 11                            | *(50) 5,327 — 5,887                   | (74) 2111  |
| (16) 3,364                      | (34) $5\frac{1}{45}$               | (51) 34                               | (75) $.5, \frac{1}{2}$                           |
| (17) 4                          | (35) 195                           | (52) 21                               | (76) 3   |
| (18) 1,764                      |                                    | (53) $-40$                            | (77) $-13.5, -\frac{27}{2},$<br>$-13\frac{1}{2}$ |
|                                 |                                    | (54) 5                                | (78) 14  |
|                                 |                                    | (55) 3                                | (79) 1.36, $\frac{34}{25}, 1\frac{9}{25}$        |
|                                 |                                    | (56) 90                               | *(80) 117 — 128                                  |
|                                 |                                    | (57) 18                               |  |
|                                 |                                    | (58) $\frac{360}{41}, 8\frac{32}{41}$ |  |
|                                 |                                    | (59) 96                               |  |