The University Interscholastic League
Number Sense Test ● HS Regional ● 2019

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!

(1) $301 + 412 + 413 =$ _____

(2) $3 \times 12 + 3 \times 13 =$ _____

(3) $301 \div 4 =$ _____ (mixed number)

(4) $2019 - 301 - 413 =$ _____

(5) $412 + 413 + 414 + 415 + 416 =$ _____

(6) 12 is what percent of 8? _____%

(7) $\frac{5}{9} - \frac{9}{10} =$ _____ (proper fraction)

(8) $81 \div 4\frac{1}{2} =$ _____

(9) $1,111,111 = 123456 \times 9 + k.$ $k =$ _____

*(10) $3014 + 1241 + 3201 + 9 =$ _____

(11) $3^4 \div (12 - 3) \times 14 =$ _____

(12) The LCM of 36 and 84 is _____

(13) $4\frac{1}{3} + 20\frac{1}{9} =$ _____

(14) $2.70 is 6.75% tax on $_____

(15) The multiplicative inverse of -3.1 is _____

(16) $\sqrt[3]{2197} =$ _____

(17) $12 \times 413 =$ _____

(18) The mode of 3, 0, 1, 4, 1, 2, 4, 1, and 3 is _____

(19) The number of prime numbered calendar days in the month of April is _____

*(20) $301412 \div 413 =$ _____

(21) $2889 \times 11 + 121 =$ _____

(22) The average of 17, 31, and k is 36. Find k. _____

(23) 413 base 10 is _____ base 5

(24) 36 inches $\times$ 12 feet $\times$ 2 yards = _____ cubic yards

(25) $(41 \times 24 - 13) \div 5$ has a remainder of _____

(26) $(64)^{\frac{2}{3}} =$ _____

(27) 24% of 36 is 48% of _____

(28) Find the smallest prime number p, where $p > 13$ and $4p + 7$ is a prime number. _____

(29) $35_7 =$ _____ ${}_9$

*(30) $41 \times 12 \times 13 =$ _____

(31) Let $(18x - 13)(18x - 13) = ax^2 + bx + c.$ Find $a + b + c.$ _____

(32) If $(4x + 1)^2 = ax^2 + bx + c$, then $a - b - c =$ ____

(33) Two numbers have a sum of 36, a product of 320, and a positive difference of _____

(34) If $|4x - 13| = 2x$ and $0 < x < 6$, then $x =$ _____

(35) Set A has 13 elements, A ∩ B has 4 elements, and A ∪ B has 20 elements. B has _____ elements

(36) What number added to twelve gives the same result as the number times four? _____

(37) $1213_4 =$ _____ 2

(38) How many integers between 8 and 88 are divisible by 8? _____

(39) The units digit of $27^{(37)}$ is _____

*(40) $12^5 \div 6^3 \div 3^2 =$ _____

(41) The sum of the roots of $3x^2 + 13x - 10 = 0$ is _____

(42) If $7^{(x-1)} = 70$, then $7^{(x+1)} =$ _____

(43) Evaluate $8(xy)^{\frac{1}{3}}$ if x = 16 and y = 4. _____

(44) $78^2 - 82^2 =$ _____

(45) $41_5 - 24_5 - 13_5 =$ _____ 5

(46) $72 \times 1111 =$ _____

(47) $(i)^{19} = a\sqrt{b}$, where a,b ∈ {− 1, 1}. a − b = _____

(48) A container holding 4 gallons 3 quarts 2 pints of liquid is divided into 5 equal containers. How many pints are in each of the smaller containers? _____

(49) $4_6 \times 1213_6 =$ _____ 6

*(50) $\sqrt{31214} =$ _____

(51) log 6 − log 6000 = _____

(52) The roots of $x^3 + 2x^2 - 5x - 6 = 0$ are d, e, and f. Find (d + e)(e + f)(f + d). _____

(53) $214 \times 314 =$ _____

(54) 210 ° = _____ π radians

(55) $9 \times \frac{11}{16} =$ _____ (mixed number)

(56) Given: 3, 2, 4, 5, 8, 12, k, 30,... . k = _____

(57) $\sqrt{63} \times \sqrt{112} =$ _____

(58) The simplified coefficient of the x^2y^3 term in the expansion of $(3x + 2y)^5$ is _____

(59) Let $(a - 7i)^2 = -24 - 70i$. Find a. _____

*(60) $\left(100 \times \frac{\sqrt{5}-1}{2}\right)^3 =$ _____

(61) The sum of the product of the roots taken 2 at a time of $2x^4 - 13x^3 + 28x^2 - 23x + 6 = 0$ is _____

(62) $\frac{3}{4} + \frac{3}{16} + \frac{3}{64} + \frac{3}{256} + ... =$ _____

(63) 95° F = _____ ° C

(64) $\cos(\text{Arcsin}(\frac{4}{5})) =$ _____

(65) Let $18^8 \div 36 = (2^x)(9^y)$. Find x + y = _____

(66) $\cos(112°) = \sin A$, 180° < A < 270°. A = _____ °

(67) In how many ways can Peter, Paul, and Mary be seated in row of 5 chairs? _____

(68) Change $\frac{9}{25}$ to a base 5 decimal. _____ base 5

(69) If 6 men can do a job in 5 days, then 10 men working at the same rate can do it in _____ days

*(70) The volume of a cone with a diameter of 12" and a height of 16" is _____ cu. in.

(71) Let $f(x) = 4x^2 - x - 3$. Find f(f(− 1)). _____

(72) How many integers greater than 420 but less than 1357 exist? _____

(73) If $314_b = 256$, then $412_b =$ _____

(74) Let $f(x) = 5x^3 - 4x^2 - 3x + 2$. Find f ″(− 1). _____

(75) $\lim\limits_{x \to \infty} \frac{x - \cos(x)}{x} =$ _____

(76) $\begin{vmatrix} 4 & 13 \\ 20 & 19 \end{vmatrix} =$ _____

(77) 0.131313... base 4 = _____ base 4 (fraction)

(78) $\int_{-1}^{3} (2x + 1)\, dx =$ _____

(79) $1213 \times 14 =$ _____

*(80) 976.666 ÷ 58.333 × 41.666 = _____

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS ● Regional ● 2019
*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) 1,126

(2) 75

(3) $75\frac{1}{4}$

(4) 1,305

(5) 2,070

(6) 150

(7) $-\frac{31}{90}$

(8) 18

(9) 7

*(10) 7,092 — 7,838

(11) 126

(12) 252

(13) $\frac{220}{9}, 24\frac{4}{9}$

(14) $40.00

(15) $-\frac{10}{31}$

(16) 13

(17) 4,956

(18) 1

(19) 10

*(20) 694 — 766

(21) 31,900

(22) 60

(23) 3,123

(24) 8

(25) 1

(26) 16

(27) 18

(28) 19

(29) 28

*(30) 6,077 — 6,715

(31) 25

(32) 7

(33) 4

(34) $\frac{13}{6}, 2\frac{1}{6}$

(35) 11

(36) 4

(37) 1100111

(38) 9

(39) 7

*(40) 122 — 134

(41) $-\frac{13}{3}, -4\frac{1}{3}$

(42) 3,430

(43) 32

(44) — 640

(45) — 1

(46) 79,992

(47) 0

(48) 8

(49) 5300

*(50) 168 — 185

(51) — 3

(52) 4

(53) 67,196

(54) $\frac{7}{6}, 1\frac{1}{6}$

(55) $6\frac{3}{16}$

(56) 19

(57) 84

(58) 720

(59) 5

*(60) 224,265 — 247,871

(61) 14

(62) 1

(63) 35

(64) .6, $\frac{3}{5}$

(65) 13

(66) 202

(67) 60

(68) .14

(69) 3

*(70) 574 — 633

(71) 11

(72) 936

(73) 335

(74) — 38

(75) 1

(76) — 184

(77) $\frac{13}{33}$

(78) 12

(79) 16,982

*(80) 663 — 732