The University Interscholastic League
Number Sense Test • HS A • 2019

Final _____ _____

Contestant's Number _____ 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!

(1) $111 - 209 + 219 =$ _____

(2) $201 + 911 - 129 =$ _____

(3) $209 \times 11 =$ _____

(4) $29^2 =$ _____

(5) $15 + 24 + 33 + 42 + 51 =$ _____

(6) $\frac{3}{8} =$ _____ **% (decimal)**

(7) $45 + 67 + 89 =$ _____

(8) $90 \div 3\frac{1}{3} =$ _____

(9) MMXIX = _____

***(10)** $111 + 2019 + 902 + 9102 =$ _____

(11) If 1 gram = .04 oz., 1200 grams = _____ oz.

(12) $\frac{7}{2(5^3)} =$ _____ **(decimal)**

(13) $6\frac{1}{8} - 2\frac{3}{4} =$ _____ **(mixed number)**

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

(15) $35 + 30 \div 25 \times (20 - 15) =$ _____

(16) $56^2 - 64^2 = 8 \times$ _____

(17) The smallest prime number greater than 47 is ____

(18) 11129 ÷ 6 has a remainder of _____

(19) $1.30 is 6.5% tax on $ _____

***(20)** 902111 ÷ 2019 = _____

(21) $1993 \times 7 + 49 =$ _____

(22) 15% of 60 is 25% of _____

(23) The product of the roots of $2x^2 - 3x - 4 = 0$ is ___

(24) $(3^3 + 6 \times 9) \div 4$ has a remainder of _____

(25) $1600 = [2(16 + k)]^2$. Find $k \geq 0$. _____

(26) $15 \times 52 =$ _____

(27) If $f(x) = x^3 - 3x^2$ then $f(5) =$ _____

(28) Two numbers have a sum of 21, a product of 98, and a positive difference of _____

(29) $56_8 =$ _____ $_7$

***(30)** $\sqrt{111209} =$ _____

(31) If $(3x + 5)(3x - 5) = ax^2 + bx + c$ then $a + b + c =$ _____

(32) The set {p,o,w,e,r} has _____ proper subsets

(33) The sum of the positive integral divisors of 40 is___

(34) $52 \times 58 =$ _____

(35) The discriminant of $x^2 - 4x + 2$ is _____

(36) A nonagon has how many sides? _____

(37) How many positive integers less than 36 are relatively prime to 36? _____

(38) $6\frac{1}{8} \div 1\frac{3}{4} =$ _____ (mixed number)

(39) If $2^{2x} = 32$, then x = _____

*(40) $142.857 \times 138 =$ _____

(41) The x-intercept of $2x - 3y = 4$ is (a, b). Find a. ___

(42) The lengths of the legs of a right triangle are 7" and 24". The hypotenuse length is _____"

(43) Evaluate $16(xy)^{\frac{1}{2}}$ if x = 4 and y = 9. _____

(44) $5^7 \div 9$ has a remainder of _____

(45) $(234_6)(5_6) =$ _____ $_6$

(46) Find x, $x < 0$, if $|3x - 5| = 7$. _____

(47) $(i)^{14} = a\sqrt{b}$, where $a,b \in \{-1, 1\}$. Find a. _____

(48) A ribbon 2 yards 2 feet 9 inches long is cut into 3 equal pieces. How long is each piece? _____ "

(49) $1 + 3 + 5 + 7 + ... + 19 + 21 =$ _____

*(50) $14 \times 21 \times 28 \times 35 =$ _____

(51) If ${}_8C_n = 56$, then the largest value of n is _____

(52) The roots of $2x^3 - 9x^2 + 10x - 3 = 0$ are d, e, and f. Find $(d + e)(e + f)(f + d)$. _____

(53) $\log_2(16) = \log_8($_____$)$

(54) $235_8 =$ _____ $_2$

(55) $8 \times \frac{13}{15} =$ _____ (mixed number)

(56) Given: 2,5,10,17,26,37,k,65,... . k = _____

(57) The probability of losing is 48%. The odds of winning is _____ (improper fraction)

(58) Find the sum of the reciprocals of the first eight triangular numbers. _____

(59) $555 \times \frac{6}{37} =$ _____

*(60) $\left(\frac{\sqrt{5}+1}{2}\right) \times 10^3 =$ _____

(61) How many ways can 5 people be seated in a circle of 6 chairs? _____

(62) If A = [3 5] and B = $\begin{bmatrix} 5 \\ 3 \end{bmatrix}$ then AB = [x]. x = ____

(63) $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \frac{1}{81} + ... =$ _____

(64) If $\sin(38°) = \cos(A)$ and A is in QI then A = _____°

(65) Let $15^5 \div 5 = (3^x)(5^y)$. Find y — x = _____

(66) $40°\ C =$ _____ ° F

(67) If 5 men can do a job in 5 days working together, then how long would it take 1 man to do the same job? _____ day(s)

(68) Change $\frac{7}{16}$ to a base 4 decimal. _____ base 4

(69) The harmonic mean of the roots of $2x^3 - 9x^2 + 10x - 3 = 0$ is _____

*(70) $(24)^4 =$ _____

(71) Find x, $0 \leq x \leq 4$, if $2x - 4 \equiv 6 \pmod 8$. _____

(72) How many positive 2-digit numbers end in 2? ____

(73) If $31_b = 19$ then $13_b =$ _____

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

(75) $\lim_{x \to \infty} \frac{7x}{x-7} =$ _____

(76) $\int_{-2}^{2} (x^4)\, dx =$ _____

(77) 0.0303... base 5 = _____ base 5 (fraction)

(78) $6^2 - 5^2 + 4^2 - 3^2 + 2^2 - 1 =$ _____

(79) $347 \times 16 =$ _____

*(80) $444 \div 555 \times 666 =$ _____

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS • Invitation A • 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) 121

(2) 983

(3) 2,299

(4) 841

(5) 165

(6) 37.5

(7) 201

(8) 27

(9) 2,019

***(10) 11,528 — 12,740**

(11) 48

(12) .028

(13) $3\frac{3}{8}$

(14) 13

(15) 41

(16) — 120

(17) 53

(18) 5

(19) $20.00

***(20) 425 — 469**

(21) 14,000

(22) 36

(23) — 2

(24) 1

(25) 4

(26) 780

(27) 50

(28) 7

(29) 64

***(30) 317 — 350**

(31) — 16

(32) 31

(33) 90

(34) 3,016

(35) 8

(36) 9

(37) 12

(38) $3\frac{1}{2}$

(39) 2.5, $\frac{5}{2}$, $2\frac{1}{2}$

***(40) 18,729 — 20,699**

(41) 2

(42) 25

(43) 96

(44) 5

(45) 2102

(46) $-\frac{2}{3}$

(47) — 1

(48) 35

(49) 121

***(50) 273,714 — 302,526**

(51) 5

(52) 21

(53) 4,096

(54) 10011101

(55) $6\frac{14}{15}$

(56) 50

(57) $\frac{13}{12}$

(58) $\frac{16}{9}$, $1\frac{7}{9}$

(59) 90

***(60) 1,538 — 1,698**

(61) 120

(62) 30

(63) .5, $\frac{1}{2}$

(64) 52

(65) — 1

(66) 104

(67) 25

(68) .13

(69) .9, $\frac{9}{10}$

***(70) 315,188 — 348,364**

(71) 1

(72) 9

(73) 9

(74) 26

(75) 7

(76) 12.8, $\frac{64}{5}$, $12\frac{4}{5}$

(77) $\frac{1}{13}$

(78) 21

(79) 5,552

***(80) 507 — 559**