The University Interscholastic League
Number Sense Test • HS A • 2020

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) $2020 + 110 - 20 =$ _____

(2) $1957 \div 19 =$ _____

(3) $3.8 \times 1.1 =$ _____ (decimal)

(4) $16^2 =$ _____

(5) $1\frac{4}{5} =$ _____ %

(6) $2\frac{2}{3} + 3\frac{5}{6} =$ _____ (mixed number)

(7) The LCM of 48 and 63 is _____

(8) $(5 + 10) - 15 \times 20 \div 25 =$ _____

(9) $3\frac{1}{4} \times 3\frac{3}{4} =$ _____

***(10)** $1967 + 7196 + 6719 - 9671 =$ _____

(11) $18 \times 81 =$ _____

(12) 3 quarts — 3 pints = _____ cups

(13) 20% of 40 minus 60 = _____

(14) 110220 ÷ 3 has a remainder of _____

(15) If 4 ♥'s cost $2.14, then 6 ♥'s cost $ _____

(16) MCDLXIX = _____ (Arabic Number)

(17) 19 is what percent less than 25? _____%

(18) $48^2 =$ _____

(19) 24% of $137\frac{1}{2} =$ _____

***(20)** $396 \times 501 - 2020 =$ _____

(21) How many subsets containing 2 or 3 elements does the set {f,o,u,r} have? _____

(22) $2\frac{1}{2}$ is the square root of _____ (decimal)

(23) $3^5 =$ _____

(24) $(110 \times 22 + 20) \div 8$ has a remainder of _____

(25) $1895 \times 5 + 25 =$ _____

(26) The sum of the solutions of $|x - 1| = 2$ is _____

(27) 213 base 4 is _____ in base 10

(28) Find the ratio of the perimeter of a 2" x 3" rectangle to its area. _____

(29) Let $(27x - 19)^2 = ax^2 + bx + c$. $a + b + c =$ ____

***(30)** 2 hours 14 minutes 7 seconds = _____ seconds

(31) $(111)(13)(k) = 141{,}414$. $k =$ _____

(32) Let $87 = p + q$, where $p = q + 13$. Find q. _____

(33) Find the smallest integer k, where $k > 1$, such that $5k + 2$ is a perfect cube. _____

(34) 2.3444... = _____ (mixed number)

(35) $6^7 \div 7$ has a remainder of _____

(36) A regular unagon has how many sides? _____

(37) If $a = 3$, $9a^2 + 6ab + b^2 = 36$, and $b > -6$, then $b =$ _____

(38) The largest root of $(x - 2)^2 = \frac{4}{9}$ is _____

(39) $3\frac{1}{4}$ is _____ % greater than 3

*(40) $56 \times 67 \times 78 =$ _____

(41) $(44)^3 - (43)^3 =$ _____

(42) If $16 \times 4^6 \div 64^2 = 4^k$, then $k =$ _____

(43) The circumference of a circle is 17π inches. Its diameter is _____ inches

(44) How many lines exist given 7 coplanar points such that no three points are collinear? _____

(45) $(i)^{31} = a\sqrt{b}$, where $a,b \in \{-1,1\}$. Find $a + b$. ___

(46) $23_6 \times 4_6 + 15_6 =$ _____ $_6$

(47) The 4-digit number 23K7 is divisible by 11. k = ___

(48) The measure of an inscribed angle of a circle is m times the measure of its intercepted arc. m = _____

(49) $(107)^3 =$ _____

*(50) $\sqrt{110220} =$ _____

(51) $5 + 7 + 12 + 19 + 31 + ... + 131 + 212 =$ _____

(52) $324 \times 123 =$ _____

(53) $3! + 4! - 5! =$ _____

(54) The first 4 digits of the decimal of $\frac{8}{45}$ is 0._____

(55) If $\log_9(x) = 1.5$, then $\log_3(x) =$ _____

(56) If $212_b = 173$, then $106_b =$ _____

(57) How many two-digit numbers exist such that their digits are prime numbers? _____

(58) $(14)^2 + (28)^2 =$ _____

(59) The length of the altitude to the hypotenuse of a 5' – 12' – 13' triangle is _____ ft

*(60) $(24)^4 = 25 \times$ _____

(61) $20 \times \frac{23}{24} =$ _____ (mixed number)

(62) Find the sum of all positive integers x such that $4x + 3 \leq 12$. _____

(63) $\cos^{-1}(\sin \frac{3\pi}{4}) =$ _____ π rad

(64) Change $0.0444..._8$ to a base 10 fraction. _____

(65) The shortest distance between (– 1, 1) and $4x + 3y - 5 = 0$ is _____

(66) Round $(\sqrt{5} + \sqrt{3})$ to the nearest tenth. _____

(67) The sum of the reciprocals of all of the positive divisors of 15 is _____

(68) How many positive integers less than or equal to 45 are relatively prime to 45? _____

(69) Two dice are rolled. The probability that the sum is greater than 8 is _____ %

*(70) 500 sheets of paper are $2\frac{1}{8}$" thick. How many sheets of paper are $\frac{1}{2}$" thick? _____

(71) $\lim_{x \to \infty} \frac{x + 1}{2x^2 - 1} =$ _____

(72) Find the sum of the reciprocals of the first ten triangular numbers. _____

(73) Let $f'(x) = 2x$ and $f(1) = 1$. Find $f(3)$. _____

(74) If $f(x) = 3x - 1$, then $f^{-1}[f(2)] =$ _____

(75) $12 + 3x \equiv 69 \pmod{36}$, where $0 \leq x \leq 9$. x = ____

(76) Find the sum of the squares of the roots of $4x^2 - 27x - 7 = 0$. _____

(77) The first four digits of the decimal for $\frac{8}{33}$ is 0.____

(78) If $f(x) = 2x^3 + 3x^2 - 2x - 3$, then $f''(-1) =$ _____

(79) $314 \times 18 =$ _____

*(80) $1{,}150 \times 1{,}125 =$ _____

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS ● Invitation A ● 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) 2,110

(2) 103

(3) 4.18

(4) 256

(5) 180

(6) $6\frac{1}{2}$

(7) 1,008

(8) 3

(9) 12.1875, $\frac{195}{16}$, $12\frac{3}{16}$

***(10) 5,901 — 6,521**

(11) 1,458

(12) 6

(13) — 52

(14) 0

(15) $3.21

(16) 1,469

(17) 24

(18) 2,304

(19) 33

***(20) 186,558 — 206,194**

(21) 10

(22) 6.25

(23) 243

(24) 0

(25) 9,500

(26) 2

(27) 39

(28) $\frac{5}{3}$, $1\frac{2}{3}$

(29) 64

***(30) 7,645 — 8,449**

(31) 98

(32) 37

(33) 5

(34) $2\frac{31}{90}$

(35) 6

(36) 11

(37) — 3

(38) $\frac{8}{3}$, $2\frac{2}{3}$

(39) $\frac{25}{3}$, $8\frac{1}{3}$

***(40) 278,024 — 307,288**

(41) 5,677

(42) 2

(43) 17

(44) 21

(45) — 2

(46) 155

(47) 8

(48) .5, $\frac{1}{2}$

(49) 1,225,043

***(50) 316 — 348**

(51) 548

(52) 39,852

(53) — 90

(54) 1777

(55) 3

(56) 87

(57) 16

(58) 980

(59) $\frac{60}{13}$, $4\frac{8}{13}$

***(60) 12,608 — 13,934**

(61) $19\frac{1}{6}$

(62) 3

(63) .25, $\frac{1}{4}$

(64) $\frac{1}{14}$

(65) 1.2, $\frac{6}{5}$, $1\frac{1}{5}$

(66) 4

(67) 1.6, $\frac{8}{5}$, $1\frac{3}{5}$

(68) 24

(69) $\frac{250}{9}$, $27\frac{7}{9}$

***(70) 112 — 123**

(71) 0

(72) $\frac{20}{11}$, $1\frac{9}{11}$

(73) 9

(74) 2

(75) 7

(76) 49.0625, $\frac{785}{16}$, $49\frac{1}{16}$

(77) 2424

(78) — 6

(79) 5,652

***(80) 1,229,063 — 1,358,437**