The University Interscholastic League
Number Sense Test ● HS State ● 2023

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) $1715 \div 5 =$ _____

(2) $\frac{7}{8} \times \frac{2}{3} \times \frac{12}{13} =$ _____

(3) $1718 + 2023 =$ _____

(4) $2023 - 1718 =$ _____

(5) $18^2 =$ _____

(6) $48\% =$ _____ **(fraction)**

(7) $15 + 9 \div (3 - 12) \times 6 =$ _____

(8) $1.718 \times 10^3 - 5 =$ _____

(9) $3\frac{1}{4} + 4\frac{4}{5} =$ _____ **(mixed number)**

***(10)** $396 \times 404 =$ _____

(11) $17 \times 23 - 20 \times 23 =$ _____

(12) DXVIII + MMXXIII = _____ **(Arabic Numeral)**

(13) $520 \times 15 =$ _____

(14) The negative reciprocal of 2.222... is _____

(15) $(320 + 281 + 715) \div 3$ has a remainder of _____

(16) $4 + 5 + 6 + 7 + ... + 17 + 18 =$ _____

(17) 75% of 2 pounds 12 ounces is _____ ounces

(18) _____ is $5\frac{1}{3}\%$ of 18

(19) $27^2 - 23^2 = 5 \times$ _____

***(20)** $(1718 + 2023) \div 5 =$ _____

(21) $59^2 =$ _____

(22) $2022 \times 25 =$ _____

(23) 70 — 80% of 90 is _____

(24) If $x = 21$, then $x^2 - 6x + 9 =$ _____

(25) 85 base 10 = _____ base 6

(26) The average speed of a car traveling 279 miles in $4\frac{1}{2}$ hours is _____mph

(27) $8\frac{5}{7} \times 8\frac{2}{7} =$ _____

(28) $\frac{5}{6}\%$ of 20 is $\frac{2}{3}\%$ of _____

(29) $1898 \times 2 + 4 =$ _____

***(30)** $516171 \div 823 =$ _____

(31) 0.1454545... = _____ **(proper fraction)**

(32) $11\frac{5}{6} \times 6\frac{5}{11} =$ _____ **(mixed number)**

(33) Given: 1, 7, 18, 34, p, r, 112,... . $p + r =$ _____

(34) Let $k^2 \div 9^2 \times 4.5^2 = 81$. Find k. _____

(35) $4\frac{3}{7} \times 14\frac{1}{4} =$ _____ **(mixed number)**

(36) $[16 + 17 \times 18 + 23] \div 5$ has a remainder of _____

(37) 222_8 = _____ 4

(38) Let $2x^2 + kx - 12 = 0$. The sum of its roots is $-2\frac{1}{2}$ when k = _____

(39) How many integers between 5 and 24 are relatively prime to 24? _____

*(40) $\sqrt{5161718}$ = _____

(41) $9114 \div 93$ = _____

(42) Let $y = x - 2$ and $3x = y + 1$. Find y. _____

(43) The roots of $2x^3 - 3x^2 - 3x + 2 = 0$ are R_1 and R_2. Find $R_1 + R_2 - R_1R_2$. _____

(44) $(2^5 + 11^5 + 5) \div 13$ has a remainder of _____

(45) $6^4 - 2$ = _____ 6

(46) 3125 has how many positive integral divisors? ____

(47) $14 \times \frac{15}{17}$ = _____ (mixed number)

(48) $(\frac{1}{3} + 1 + 1\frac{1}{3} + 2\frac{1}{3} + 3\frac{2}{3}) +$
$(6 + 9\frac{2}{3} + 15\frac{2}{3} + 25\frac{1}{3})$ = _____

(49) 1817×16 = _____

*(50) $28 \times 139 + 21 \times 280$ = _____

(51) $37^{12} \div 23$ has a remainder of _____

(52) Let $7\frac{1}{m} \times n\frac{2}{5} = 48$, where m, n are natural numbers. Find $m - n$. _____

(53) $(4x - 7)^2 = ax^2 + bx + c$ and $a + b + c$ = _____

(54) If the third term in the expansion of $(3x + 2y)^4$ is cx^ay^b, then $a + b + c$ = _____

(55) If $(5 + 2i)(3 - 7i) = (a + bi)$, then $a + b$ = _____

(56) Let $7^{(2.5)} = a\sqrt{b}$ in simplified form. Find a. _____

(57) $\sum_{k=1}^{24} (-1)^k(k^2)$ = _____

(58) $33^2 + 74^2$ = _____

(59) $(a + 2i)^2 = 5 + 12i$ and a = _____

*(60) $\sqrt[3]{51617182023}$ = _____

(61) Find the odds that an integer picked at random between 31 and 59 is prime. _____

(62) If $\sqrt{27} + \sqrt{108} = \sqrt{x}$, then x = _____

(63) $1718_9 \div 5_9$ has a remainder of _____ 9

(64) If 3 p's = 4 q's and 2 q's = 5 r's, then 1 p = ____ r's

(65) $P(x) = 6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$. The harmonic mean of the roots is $\frac{k}{35}$ and k = _____

(66) If $xy = -4$ and $x + y = 5$ then $x^3 + y^3$ = _____

(67) $20 \times 4! + 16 \times 6!$ = _____

(68) The $\det \begin{vmatrix} -2 & 1 \\ x & 3 \end{vmatrix} = \det \begin{vmatrix} 3 & -1 \\ 4 & -2 \end{vmatrix}$ and x = _____

(69) Given: 1, 1, 3, 5, 9, 15, 25, 41, k, 109, ... k = _____

*(70) 817161 cubic inches = _____ gallons

(71) $\sec(\sin^{-1}(0.6))$ = _____

(72) Let $k = 2\sqrt{3} + 4\sqrt{5}$. Round k to the nearest tenths place. _____

(73) The remainder when $x^3 - 5x^2 + 15x - 6 = 0$ is divided by $x + 1$ is _____

(74) Change .52 base 7 to a base 10 fraction. _____

(75) Let $f(x) = (3x + 1)^3$. Find $f'(-2)$. _____

(76) Polar coordinates $(4, \frac{2\pi}{3})$ are converted to Cartesian coordinates (x, y) and x = _____

(77) $\int_0^{2\pi} 2\cos^2(x)\,dx = k\pi$, where k = _____

(78) $24^8 \div 6^4$ has a remainder of _____

(79) $(202)^3$ = _____

*(80) $0.555... \times 10^3 \times 25^{(-1)} \times 90$ = _____

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS ● State ● 2023

***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) 343

(2) $\frac{7}{13}$

(3) 3,741

(4) 305

(5) 324

(6) $\frac{12}{25}$

(7) 9

(8) 1,713

(9) $8\frac{1}{20}$

***(10) 151,985 — 167,983**

(11) — 69

(12) 2,541

(13) 7,800

(14) — .45, $-\frac{9}{20}$

(15) 2

(16) 165

(17) 33

(18) .96, $\frac{24}{25}$

(19) 40

***(20) 711 — 785**

(21) 3,481

(22) 50,550

(23) — 2

(24) 324

(25) 221

(26) 62

(27) $\frac{3538}{49}$, $72\frac{10}{49}$

(28) 25

(29) 3,800

***(30) 596 — 658**

(31) $\frac{8}{55}$

(32) $76\frac{25}{66}$

(33) 136

(34) 18

(35) $63\frac{3}{28}$

(36) 0

(37) 2102

(38) 5

(39) 6

***(40) 2,159 — 2,385**

(41) 98

(42) — 2.5, $-\frac{5}{2}$, $-2\frac{1}{2}$

(43) 2.5, $\frac{5}{2}$, $2\frac{1}{2}$

(44) 5

(45) 5554

(46) 6

(47) $12\frac{6}{17}$

(48) $\frac{196}{3}$, $65\frac{1}{3}$

(49) 29,072

***(50) 9,284 — 10,260**

(51) 9

(52) — 4

(53) 9

(54) 220

(55) 0

(56) 49

(57) 300

(58) 6,565

(59) 3

***(60) 3,538 — 3,909**

(61) $\frac{5}{22}$

(62) 243

(63) 3

(64) $\frac{10}{3}$, $3\frac{1}{3}$

(65) 24

(66) 185

(67) 12,000

(68) — 4

(69) 67

***(70) 3,361 — 3,714**

(71) 1.25, $\frac{5}{4}$, $1\frac{1}{4}$

(72) 12.4

(73) — 27

(74) $\frac{37}{49}$

(75) 225

(76) — 2

(77) 2

(78) 0

(79) 8,242,408

***(80) 1,900 — 2,100**