The University Interscholastic League
Number Sense Test • HS A • 2021

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.

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STOP -- WAIT FOR SIGNAL!

(1) $2050 - 202 =$ _____

(2) $6834 \div 17 =$ _____

(3) $\frac{7}{15} \times \frac{10}{21} =$ _____

(4) $50220 \div 9$ has a remainder of _____

(5) The LCM of 52 and 24 is _____

(6) $3\frac{2}{5} + 6\frac{4}{9} =$ _____ (mixed number)

(7) 0.1875 = _____ (proper fraction)

(8) $|8 - 1| - 5 - |1 - 9| + |4 - 7| =$ _____

(9) $5 + 10 \div 15 \times (20 - 25) =$ _____

***(10)** $5220 + 522 + 2052 - 2205 =$ _____

(11) $7 \times 23 + 26 \times 7 =$ _____

(12) Which is larger, 0.6 or $\frac{7}{12}$? _____

(13) MMXXI × V = _____ (Arabic Numeral)

(14) 24 is what percent of 20? _____%

(15) 170 less 30% of 170 is _____

(16) $58^2 =$ _____

(17) $2020 \div 6$ has a remainder of _____

(18) $42^2 =$ _____

(19) $2\frac{2}{5}$ is the square root of _____ (decimal)

***(20)** $518 \times 7491 =$ _____

(21) $\sqrt[3]{2744} =$ _____

(22) 48% of 1.333... = _____ (proper fraction)

(23) 30 pints = _____ gallons

(24) How many days are there from the beginning of 01/09/21 to the end of 03/22/21? _____days

(25) $24^2 + 25^2 =$ _____

(26) The sum of the solutions of $|2x + 1| = 3$ is _____

(27) 1A1 base 11 is _____ in base 10

(28) $|2 - 3| - 5 + |7 - 11 + 13| =$ _____

(29) Find the value of k so that the slope of the line $6x - ky = 2$ is 2. k = _____

***(30)** $(48 \div 7 \times 24 \div 3)^2 =$ _____

(31) $24^2 - 25^2 =$ _____

(32) $111 \times 502 =$ _____

(33) If $3.666... \times k = 1$, then k = _____

(34) If $f(x) = x^2 + 18x + 81$, then $f(21) =$ _____

(35) $451 \times 459 =$ _____

(36) $10\frac{2}{5} \times 10\frac{3}{5} =$ _____

(37) $2 + 6 + 8 + 14 + 22 + ... + 152 + 246 =$ _____

(38) The largest root of $(3x - 2)^2 = \frac{1}{25}$ is _____

(39) $1\frac{1}{2}$ is k % less than 4. k = _____% (decimal)

***(40)** $20\frac{2}{5} \times 50220 \div 17 =$ _____

(41) If $4^{-1} + x^{-1} = 2^{-1}$, then x = _____

(42) If $\sqrt{72} + \sqrt{18} = \sqrt{k}$, then k = _____

(43) $(201)^3 =$ _____

(44) Let $35^2 - 22^2 = 13k$. Find k. _____

(45) The seventh pentagonal number is _____

(46) Given: 2, 5, 11, 23, ..., k, 383 ... . Find k. _____

(47) The length of the median to the hypotenuse of a 3-4-5 right triangle is _____ (decimal)

(48) $63^2 + 24^2 =$ _____

(49) ${}_7C_4 + {}_7P_3 =$ _____

***(50)** $\sqrt{50220} \times \sqrt{626} =$ _____

(51) If $x - y = 6$ and $3x + y = 4$ then $5y =$ _____

(52) Let $(7 + 4i)(7 - 4i) = (a + bi)$. $a + b =$ _____

(53) $21^3 - 20^3 =$ _____

(54) If (x, y) is the midpoint of the segment with endpoints (— 1, 9) and (7, — 5), then $x + y =$ _____

(55) $352_6 \div 5_6 =$ _____ 6

(56) The perimeter of a triangle with side lengths 9, 6, and x units must be greater than _____ units

(57) If $\log_2(8x) = 6$, then x = _____

(58) If $202_b = 100$, then $303_b =$ _____

(59) $666 \times \frac{3}{37} =$ _____

***(60)** $14 \times 28 \times 42 \times 56 =$ _____

(61) The determinant of $\begin{bmatrix} 1 & 3k \\ 4 & 12 \end{bmatrix} = 6$. k = _____

(62) The radius of the inscribed circle of a 3, 4, 5 right triangle is _____ units

(63) Truncate $(\sqrt{2} + \sqrt{5})$ to the hundredth. _____

(64) Round $\sin(\frac{11\pi}{3})$ to the nearest tenth. _____

(65) $12 \times \frac{14}{17} =$ _____ (mixed number)

(66) Two dice are rolled. The odds that the sum of the pips showing on top is less than 5 is _____

(67) $3 + 1.5 + 0.75 + 0.375 + ... =$ _____

(68) $(245)^2 =$ _____

(69) $(52_6 \times 43_6 - 20_6) \div 5$ has a remainder of _____

***(70)** 2,640 feet at 6 in/sec takes _____ minutes

(71) $f'(x) = -2$, $f(1) = 3$, find $f(-2)$. _____

(72) The Greatest Integer Function is written as $f(x) = [x]$. Find $\left[4\left(\frac{\sqrt{5}-1}{2}\right)\right]$. _____

(73) $\sin^3(\frac{\pi}{6}) =$ _____

(74) The first four digits of the decimal for $\frac{14}{40}$ base 5 is 0._____ base 5

(75) 95° Fahrenheit = _____° Celsius

(76) Find the sum of the squares of the roots of $5x^2 + x - 4 = 0$._____

(77) $\int_0^3 (x - 6)\,dx =$ _____

(78) The sixth pentagonal number is _____

(79) If $2 < x < 5$, then $x^2 - 1 <$ _____

***(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 ● Invitation A ● 2021

***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

(2) 402

(3) $\frac{2}{9}$

(4) 0

(5) 312

(6) $9\frac{38}{45}$

(7) $\frac{3}{16}$

(8) — 3

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

***(10) 5,310 — 5,868**

(11) 343

(12) .6, $\frac{3}{5}$

(13) 10,105

(14) 120

(15) 119

(16) 3,364

(17) 4

(18) 1,764

(19) 5.76

***(20) 3,686,322 — 4,074,354**

(21) 14

(22) $\frac{16}{25}$

(23) 3.75, $\frac{15}{4}$, $3\frac{3}{4}$

(24) 73

(25) 1,201

(26) — 1

(27) 232

(28) 5

(29) 3

***(30) 2,859 — 3,159**

(31) — 49

(32) 55,722

(33) $\frac{3}{11}$

(34) 900

(35) 207,009

(36) 110.24, $\frac{2756}{25}$, $110\frac{6}{25}$

(37) 638

(38) $\frac{11}{15}$

(39) 62.5

***(40) 57,251 — 63,277**

(41) 4

(42) 162

(43) 8,120,601

(44) 57

(45) 70

(46) 191

(47) 2.5

(48) 4,545

(49) 245

***(50) 5,327 — 5,887**

(51) — 17.5, — $\frac{35}{2}$, — $17\frac{1}{2}$

(52) 65

(53) 1,261

(54) 5

(55) 44

(56) 18

(57) 8

(58) 150

(59) 54

***(60) 875,885 — 968,083**

(61) .5, $\frac{1}{2}$

(62) 1

(63) 3.65, $\frac{73}{20}$, $3\frac{13}{20}$

(64) — .9, — $\frac{9}{10}$

(65) $9\frac{15}{17}$

(66) .2, $\frac{1}{5}$

(67) 6

(68) 60,025

(69) 2

***(70) 84 — 92**

(71) 9

(72) 2

(73) .125, $\frac{1}{8}$

(74) 2111

(75) 35

(76) 1.64, $\frac{41}{25}$

(77) — 13.5, — $\frac{27}{2}$, — $13\frac{1}{2}$

(78) 51

(79) 24

***(80) 117 — 128**

The University Interscholastic League
Number Sense Test • HS B • 2021

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(1) 41720 — 18420 = _____

(2) 417 + 1820 = _____

(3) 3.5 × 1.1 = _____ (decimal)

(4) $\frac{3}{16}$ = _____% (decimal)

(5) $\frac{3}{4} + \frac{7}{8}$ = _____ (improper fraction)

(6) $4\frac{1}{7} + 4\frac{1}{8}$ = _____ (mixed number)

(7) 4.18 — 17.4 = _____ (decimal)

(8) MDCCXVIII = _____ (Arabic Numeral)

(9) The GCD of 56 and 84 is _____

***(10)** 4182 + 4170 + 1817 + 2020 = _____

(11) 17 × 71 = _____

(12) The mode of {1, 1, 2, 3, 5, 2, 1, 3, 4, 7} is _____

(13) 23^2 = _____

(14) DCCXIV — CDXVIII = _____ (Arabic Numeral)

(15) 17 is what percent of 85? _____%

(16) 41718 ÷ 6 has a remainder of _____

(17) $8\frac{3}{5} \times 5\frac{1}{4}$ = _____ (mixed number)

(18) 53^2 ÷ 4 has a remainder of _____

(19) 18% of $277\frac{7}{9}$ = _____

***(20)** 417 × 2041 ÷ 820 = _____

(21) $3\frac{1}{5}$ is the square root of _____ (decimal)

(22) (14 + 15 × 16 — 17) ÷ 6 has a remainder of ____

(23) 74_8 = _____

(24) The arithmetic mean of 32, 37, and 48 is _____

(25) 555 × $\frac{3}{37}$ = _____

(26) Let 97 = p + q, where p = q + 17. Find q. _____

(27) 265 base 10 equals kAx base 12. Find k + x. _____

(28) 50 is what percent greater than 40? _____%

(29) Find the value of k so that the slope of the line 8x + ky = 2 is — 4. k = _____

***(30)** $(59 \div 3 \times 24 \div 4)^2$ = _____

(31) 0.11222... = _____ (proper fraction)

(32) If (12)(63) = 21k, then k = _____

(33) $7\frac{3}{5} \times 7\frac{2}{5}$ = _____ (mixed number)

(34) $6^6 \div 7$ has a remainder of _____

(35) Given: 3, 9, 12, 21, 33, m, 87, n, ... $m + n$ = _____

(36) $\frac{4^3}{(2^3)(5^2)}$ = _____ (decimal)

(37) The number of positive integral divisors of 84 greater than 4 is _____

(38) If $4\sqrt{3} + \sqrt{75} = \sqrt{k}$, then k = _____

(39) Find the smallest integer k, where $k > 3$, such that $7k + 4$ is a perfect square. _____

***(40)** $3\frac{1}{17} \times 47820 \div 13$ = _____

(41) 352×358 = _____

(42) If $9 \times 3^3 \div 27^2 = 3^k$, then k = _____

(43) Let $x + y = 16$ and $x - y = 21$. Find $x^2 - y^2$. _____

(44) $630_8 - 415_8 + 72_8$ = _____ 8

(45) The cube root of 39,304 is _____

(46) If $\sqrt{a^5} \times \sqrt[3]{a^2} = \sqrt[n]{a^k}$, then k = _____

(47) The product of the roots of $(5x - 2)^3 = 0$ is _____

(48) $(105)^3$ = _____

(49) Given: 3, 4, 6, 8, 12, k, 18, ... k = _____

***(50)** $\sqrt{325} \times \sqrt{253} \times \sqrt{532}$ = _____

(51) The sides of a right triangle are integers. If one leg is 13, then the hypotenuse is _____

(52) $\frac{1+4+9+16+...+49}{1+3+6+10+...+28}$ = _____

(53) Let $f(x) = 2x + \log_3(x)$. Find f(9). _____

(54) The first 4 digits of the decimal of $\frac{5}{66}$ is 0._____

(55) $(4 + 7i)(3 - 5i) = a + bi$. $a + b$ = _____

(56) 0.125 mile = _____ yards

(57) The number of positive proper fractions in lowest terms with a denominator of 26 is _____

(58) 417×131 = _____

(59) How many days are there from the end of 02/07/21 to the beginning of 03/14/21? _____ days

***(60)** $(41)^4 = 38 \times$ _____

(61) Find the sum of all negative integers x such that $2x + 8 \geq 1$. _____

(62) $(185)^2$ = _____

(63) $\sin(105°)\cos(105°)$ = _____

(64) 39×111 = _____

(65) Round $(\sqrt{6} + \sqrt{7})$ to the nearest tenth. _____

(66) $21 \times \frac{22}{25}$ = _____ (mixed number)

(67) The sum of the reciprocals of all of the positive divisors of 30 is _____

(68) How many different 6-letter code words can be constructed using the letters ELEVEN? _____

(69) The determinant of $\begin{bmatrix} 2 & 3 \\ -k & 1.5 \end{bmatrix}$ is 4. k = _____

***(70)** 1,380 miles per hour = _____ feet per second

(71) Change .36, base 7, to a base 10 fraction. _____

(72) 30° Celsius = _____° Fahrenheit

(73) Let $f'(x) = 6x$ and $f(-1) = 3$. Find $f(-3)$. _____

(74) If $f(x) = 2x - 3$ then $f^{-1}[f(4)]$ = _____

(75) If $f(x) = 4 + \frac{3-2x}{5}$, then $f^{-1}(1)$ = _____

(76) The minimum value of $y = 3x^2 - 2$ is _____

(77) 1718×101 = _____

(78) $\int_1^3 x^2\,dx$ = _____

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

***(80)** The length of the altitude of an equilateral triangle with a perimeter of 510 cm is _____ cm

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University Interscholastic League - Number Sense Answer Key HS ● Invitation B ● 2021

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(1) 23,300

(2) 2,237

(3) 3.85

(4) 18.75

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

(6) $8\frac{15}{56}$

(7) — 13.22

(8) 1,718

(9) 28

***(10) 11,580 — 12,798**

(11) 1,207

(12) 1

(13) 529

(14) 296

(15) 20

(16) 0

(17) $45\frac{3}{20}$

(18) 1

(19) 50

***(20) 987 — 1,089**

(21) 10.24

(22) 3

(23) 60

(24) 39

(25) 45

(26) 40

(27) 2

(28) 25

(29) 2

***(30) 13,228 — 14,620**

(31) $\frac{101}{900}$

(32) 36

(33) $56\frac{6}{25}$

(34) 1

(35) 195

(36) .32

(37) 8

(38) 243

(39) 11

***(40) 10,690 — 11,814**

(41) 126,016

(42) — 1

(43) 336

(44) 305

(45) 34

(46) 19

(47) .064, $\frac{8}{125}$,

(48) 1,157,625

(49) 14

***(50) 6,284 — 6,944**

(51) 85

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

(53) 20

(54) 0757

(55) 48

(56) 220

(57) 12

(58) 54,627

(59) 34

***(60) 70,645 — 78,080**

(61) — 6

(62) 34,225

(63) — .25 ,— $\frac{1}{4}$

(64) 4,329

(65) 5.1, $\frac{51}{10}$, $5\frac{1}{10}$

(66) $18\frac{12}{25}$

(67) 2.4, $\frac{12}{5}$, $2\frac{2}{5}$

(68) 120

(69) $\frac{1}{3}$

***(70) 1,923 — 2,125**

(71) $\frac{27}{49}$

(72) 86

(73) 27

(74) 4

(75) 9

(76) — 2

(77) 173,518

(78) $\frac{26}{3}$, $8\frac{2}{3}$

(79) 14

***(80) 140 — 154**

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Number Sense Test ● HS District ● 2021

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(1) $5080 + 911 =$ _____

(2) $2.5 \times 1.6 =$ _____

(3) $1141 - 393 =$ _____

(4) $\frac{4}{5} \div \frac{9}{10} =$ _____

(5) $5.07 - 26.5 =$ _____ **(decimal)**

(6) $\frac{5}{16} =$ _____ **% (mixed number)**

(7) $23^2 =$ _____

(8) $55 \times 6 \div 20 + 4 =$ _____

(9) **Which is larger, 0.8 or** $\frac{9}{11}$**?** _____

***(10)** $721 - 904 + 2919 - 2029 =$ _____

(11) $43^2 =$ _____

(12) **30% of 40 — 30 =** _____

(13) $152^2 \div 8$ **has a remainder of** _____

(14) **The arithmetic mean of 41, 46, and 57 is** _____

(15) **MDCIX + DLXX =** _____ **(Arabic Numeral)**

(16) $54^2 =$ _____

(17) **72% of** $77\frac{7}{9} =$ _____

(18) **2 gallons — 3quarts + 2 pints =** _____ **pints**

(19) $(23 + 23 \times 25 - 28) \div 8$ **has a remainder of** _____

***(20)** $528 \times 1930 \div 731 =$ _____

(21) $1\frac{4}{5}$ **is the square root of** _____ **(decimal)**

(22) $555 \times \frac{5}{37} =$ _____

(23) **How long is it between the beginning of Mar. 22, 2021 and the end of May 1, 2021?** _____**days**

(24) **An angle complementary to 43° measures** _____°

(25) $21^2 + 23^2 =$ _____

(26) **Let** $\frac{3}{8} = \frac{4}{x}$**. Find 6x.** _____

(27) $214 \times 15 =$ _____

(28) $|3 - 2| - 6 + |6 - 20 + 22| =$ _____

(29) **Let** $(71x - 16)^2 = ax^2 + bx + c$**.** $a + b + c =$ _____

***(30)** $(67 \div 5 \times 43 \div 6)^2 =$ _____

(31) **GCD(21, 49) × LCM(21, 49) =** _____

(32) **1.2444... =** _____ **(improper fraction)**

(33) **Given: m, 4, 9, 13, 22, n, 57, ... Find m + n.** _____

(34) The larger root of $(x+1)^2 = \frac{256}{441}$ is _____

(35) If $2.444... \times k = 1$, then k = _____

(36) Find the smallest integer k, where $k < 11$, such that $7k + 4$ is a perfect square. _____

(37) The linear term of $(x-4)^3$ is _____

(38) If $(3x-5)(4x-2) = ax^2 + bx + c$, then $a + b + c$ = _____

(39) $(12)^3 - (13)^3$ = _____

*(40) $38\frac{4}{5} \times 49330 \div 16$ = _____

(41) 0.0141414... = _____ (fraction)

(42) Let $5 \times 25^2 \div 125^3 = 5^k$. k = _____

(43) $(204)^3$ = _____

(44) 994×997 = _____

(45) $33_6 \times 3_6 - 33_6$ = _____ 6

(46) If $\sqrt[3]{a^8} \times \sqrt[4]{a^7} = \sqrt[n]{a^k}$, then n + k = _____

(47) The sum of the roots of $(4x-7)^3 = 0$ is _____

(48) The sum of the product of the roots taken two at a time of $4x^3 - 17x^2 + 16x - 3 = 0$ is _____

(49) The diameter of a sphere is 9 inches. The volume is $k\pi$ cubic inches. k = _____

*(50) $\left(\sqrt[3]{559242}\right)^2$ = _____

(51) If $2x - y = 6$ and $x + 2y = -3$ then 5y = _____

(52) The distance between (— 1, 5) and (— 3, — 9) is d. Find d^2. _____

(53) $25^3 - 24^3$ = _____

(54) The first 4 digits of the decimal of $\frac{7}{22}$ is 0._____

(55) $8 + 5 + 3\frac{1}{8} + 1\frac{61}{64} + ...$ = _____

(56) The vertex of the parabola $y = 40 + 6x - x^2$ is (h, k) and h + k = _____

(57) If 5, 9, and x are the integral sides of a triangle, then the least value of x is _____

(58) $\text{Log}_6(x - 3)$ equals 3 when x equals _____

(59) $444 \times \frac{4}{37} = 4 \times$ _____

*(60) $\sqrt{37 \times 40 \times 43}$ = _____

(61) Find the sum of all positive integers x such that $15 - 3x \geq 5$. _____

(62) The radius of the inscribed circle of a 8-15-17 right triangle is _____ units

(63) How many lines are determined by 9 coplanar points no 3 of which are collinear? _____

(64) 4143×14 = _____

(65) $13 \times \frac{16}{17}$ = _____ (mixed number)

(66) $\frac{3}{8} - \frac{14}{41}$ = _____

(67) How many positive integers less than 60 are relatively prime to 60? _____

(68) A box contains 18 blue chips and and x red chips. The probability of selecting a blue chip is 60%. The odds of a red being selected is _____

(69) $(54_9 \times 63_9 - 72_9) \div 8_9$ has a remainder of _____

*(70) 78 miles per hour = _____ inches per second

(71) $y = \log_3(4x + 5)$. The domain of y is $x >$ _____

(72) The first four digits of the decimal for $\frac{14}{33}$ base 7 is 0._____ base 7

(73) $\sin^3(\frac{7\pi}{6})$ = _____

(74) If $f(x) = \frac{2-3x}{4}$, then $f^{-1}(5)$ = _____

(75) If $f(x) = \frac{2-3x}{4}$, then $f[f^{-1}(5)]$ = _____

(76) Find the sum of the squares of the roots of $6x^2 + x - 5 = 0$._____

(77) 132_8 = _____ 4

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

(79) $\frac{11}{30} - \frac{11}{20} - \frac{11}{12}$ = _____

*(80) $1234 + 2345 + 3456 + 4567 + 5678$ = _____

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University Interscholastic League - Number Sense Answer Key HS ● District ● 2021
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NOTE: If an answer is of the type like $\frac{2}{3}$ it cannot be written as a repeating decimal

(1) 5,991

(2) 4

(3) 748

(4) $\frac{8}{9}$

(5) — 21.43

(6) $31\frac{1}{4}$

(7) 529

(8) 20.5, $\frac{41}{2}$, $20\frac{1}{2}$

(9) $\frac{9}{11}$

***(10) 672 — 742**

(11) 1,849

(12) — 18

(13) 0

(14) 48

(15) 2,179

(16) 2,916

(17) 56

(18) 12

(19) 2

***(20) 1,325 — 1,463**

(21) 3.24

(22) 75

(23) 41

(24) 47

(25) 970

(26) 64

(27) 3,210

(28) 3

(29) 3,025

***(30) 8,762 — 9,683**

(31) 1,029

(32) $\frac{56}{45}$

(33) 40

(34) — $\frac{5}{21}$

(35) $\frac{9}{22}$

(36) 3

(37) 48

(38) — 4

(39) — 469

***(40) 113,644 — 125,606**

(41) $\frac{7}{495}$

(42) — 4

(43) 8,489,664

(44) 991,018

(45) 110

(46) 65

(47) 5.25, $\frac{21}{4}$, $5\frac{1}{4}$

(48) 4

(49) 121.5, $\frac{243}{2}$, $121\frac{1}{2}$

***(50) 6,449 — 7,127**

(51) — 12

(52) 200

(53) 1,801

(54) 3181

(55) $\frac{64}{3}$, $21\frac{1}{3}$

(56) 52

(57) 5

(58) 219

(59) 12

***(60) 240 — 264**

(61) 6

(62) 3

(63) 36

(64) 58,002

(65) $12\frac{4}{17}$

(66) $\frac{11}{328}$

(67) 16

(68) $\frac{2}{3}$

(69) 0

***(70) 1,305 — 1,441**

(71) — $\frac{5}{4}$

(72) 3131

(73) — .125, — $\frac{1}{8}$

(74) — 6

(75) 5

(76) $\frac{61}{36}$, $1\frac{25}{36}$

(77) 1122

(78) — 6

(79) — 1.1, — $\frac{11}{10}$, — $1\frac{1}{10}$

***(80) 16,416 — 18,144**

The University Interscholastic League
Number Sense Test • HS Regional • 2021

Final _____ _____

Contestant's Number _____ 2nd _____ _____

1st _____ _____

Score **Initials**

Read directions carefully before beginning test

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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) $6528 + 949 =$ _____

(2) $4692 \div 23 =$ _____

(3) $4.8 \times 1.5 =$ _____

(4) $56\% =$ _____ **(proper fraction)**

(5) $1 \times 3 - 6 + 10 \div 15 =$ _____

(6) $18 \times 37 + 43 \times 18 =$ _____

(7) $\frac{9}{16} =$ _____ **(decimal)**

(8) $47^2 =$ _____

(9) **Which is larger, 0.75 or** $\frac{5}{7}$**?** _____

***(10)** $68676 + 67668 + 66867 - 66687 =$ _____

(11) $\frac{4}{5} \div \frac{15}{16} =$ _____

(12) $\frac{9}{16} =$ _____**% (mixed number)**

(13) $DCXII \times IX =$ _____ **(Arabic Numeral)**

(14) **24 is what percent of 60?** _____**%**

(15) **2 gallons — 5 quarts + 3 pints =** _____ **pints**

(16) $6\frac{1}{5} \times 3\frac{3}{4} =$ _____**(mixed number)**

(17) $41\frac{2}{3}\%$ **of 48 =** _____

(18) **The cost of driving 180 miles at 18¢ a mile is $** ____

(19) $4\frac{1}{2}$ **is the square root of** _____ **(decimal)**

***(20)** $639 \times 3024 \div 728 =$ _____

(21) $(66 \times 82 - 39 - 14) \div 9$ **has a remainder of** _____

(22) $231 \times 16 =$ _____

(23) **The sum of the roots of** $(5x + 6)(3x - 8)$ **is** _____

(24) **The arithmetic mean of 31, 42, and x is** $33\frac{1}{3}$**.**
Find x. _____

(25) $17^2 + 19^2 =$ _____

(26) **The multiplicative inverse of** $-2\frac{5}{6}$ **is** _____

(27) $203_6 =$ _____ **10**

(28) **36 is what percent less than 240?** _____**%**

(29) **How many days are there from the end of March 27 to the beginning of April 16?** _____

***(30)** $(74 \div 4 \times 32 \div 6)^2 =$ _____

(31) **The sum of the GCD(18, 45) and the LCM(18, 45) is** _____

(32) **If** $3x - y = 5$ **and** $5x + y = 3$**, then** $xy =$ _____

(33) **Given: p, 3, 6, 9, 15, q, r, 63, ...** $p + q + r =$ _____

(34) $27^2 + 68^2 =$ _____

(35) $217 \times 312 =$ _____

(36) $\frac{8^2}{(2^4)\,(5)} =$ _____ **(decimal)**

(37) If $(11x + 16)^2 = ax^2 + bx + c$, then $a + b + c =$ _____

(38) How many subsets containing at least 3 elements does the set {T, E, X, A, S} have? _____

(39) Let P and Q be the roots of $3x^2 + 15x - 42 = 0$. Find $P + Q - PQ$. _____

***(40)** $38\frac{4}{5} \times 49330 \div 16 =$ _____

(41) 0.1545454... = _____ **(fraction)**

(42) $19 \times 29 + 25 =$ _____

(43) The median to the hypotenuse of a 5-12-13 right triangle is _____ **(decimal)**

(44) Let (3, — 1) be the midpoint of a line segment with endpoints (0, 2) and (x, y). Find $x + y$. _____

(45) The digits C and D exists, such that $C43 - 47D = 265$. Find $C + D$. _____

(46) Given: 3, 5, 8, 11, 15, ..., k, 75, ... Find k. _____

(47) $(43_7 - 16_7) \times 4_7 =$ _____ $_7$

(48) $(204)^3 =$ _____

(49) The diameter of a sphere is 3 feet. The volume is $k\pi$ cubic feet. k = _____

***(50)** $\left(\sqrt{5041}\right)^3 =$ _____

(51) $A^{-k} \times A^{-2} \div A^3 = A^4$ and $A > 1$. Find k. _____

(52) How many integers between 5 and 40 are relatively prime to 40? _____

(53) $31^3 - 30^3 =$ _____

(54) If 61 is in base 8, then its positive square root in base 10 is _____

(55) $(2 - 8i)(3 - 7i) = a + bi$. $a + b =$ _____

(56) The vertex of the parabola $y = -2x^2 + 6x + 1$ is (h, k) and k is _____

(57) If $234_b = 94$, then $123_b =$ _____

(58) $\text{Log}_4(x - 2)$ equals 1.5 when x equals _____

(59) $888 \times \frac{2}{37} =$ _____

***(60)** $12 \times 24 \times 36 \times 48 =$ _____

(61) ${}_6P_3 + {}_6C_3 =$ _____

(62) $21 \times \frac{19}{23} =$ _____ **(mixed number)**

(63) A 5-digit number 17k18 is divisible by 6. How many positive digits, k, exist? _____

(64) $\frac{5}{8}$ mile = _____ yards

(65) $\cos(\frac{5\pi}{6}) \times \cos(\frac{7\pi}{6}) =$ _____

(66) $\frac{4}{7} - \frac{23}{43} =$ _____

(67) The shortest distance between (1, — 1) and $8x + 15y = 17$ is _____

(68) A bag contains 5 green chips and x pink chips. The probability of drawing a pink chip is 80%. x = ____

(69) $(44_8 \times 53_8 - 62_8) \div 7_8$ has a remainder of _____

***(70)** 2000 feet per second = _____ miles per hour

(71) $f'(x) = 2x - 1$, $f(1) = -2$, find f(2). _____

(72) The first four digits of the decimal for $\frac{12}{220}$ base 3 is 0._____ base 3

(73) $8 + 2x \equiv 4 \pmod 6$, where $2 \leq x \leq 6$. x = _____

(74) If $f(x) = 1 - \frac{2x + 3}{4}$, then $f^{-1}(5) =$ _____

(75) The sum of the 7th triangular number and the 4th hexagonal number is _____

(76) $\int_1^2 (x^3)\,dx =$ _____

(77) Find the sum of the squares of the roots of $4x^2 + 7x - 11 = 0$. _____

(78) The intersection of the horizontal and vertical asymptotes of $y = (x - 3)^{-1} + 5$ is (x, y). x = _____

(79) Given: 1, 1, 4, 9, 25, ..., 441, k, 3025, ... k = _____

***(80)** $\frac{5}{9} \times 2.22 \times 33.3 \times 444 =$ _____

Revised

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS ● Regional ● 2021

***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) 7,477

(2) 204

(3) 7.2, $\frac{36}{5}$, $7\frac{1}{5}$

(4) $\frac{14}{25}$

(5) $-\frac{7}{3}$, $-2\frac{1}{3}$

(6) 1,440

(7) .5625

(8) 2,209

(9) .75, $\frac{3}{4}$

***(10) 129,698 — 143,350**

(11) $\frac{64}{75}$

(12) $56\frac{1}{4}$

(13) 5,508

(14) 40

(15) 9

(16) $23\frac{1}{4}$

(17) 20

(18) $32.40

(19) 20.25

***(20) 2,522 — 2,787**

(21) 4

(22) 3,696

(23) $\frac{22}{15}$, $1\frac{7}{15}$

(24) 27

(25) 650

(26) $-\frac{6}{17}$

(27) 75

(28) 85

(29) 19

***(30) 9,249 — 10,221**

(31) 99

(32) — 2

(33) 66

(34) 5,353

(35) 67,704

(36) .8

(37) 729

(38) 16

(39) 9

***(40) 113,644 — 125,606**

(41) $\frac{17}{110}$

(42) 576

(43) 6.5

(44) 2

(45) 15

(46) 52

(47) 132

(48) 8,489,664

(49) 4.5, $\frac{9}{2}$, $4\frac{1}{2}$

***(50) 340,016 — 375,806**

(51) — 9

(52) 14

(53) 2,791

(54) 7

(55) — 88

(56) 5.5, $\frac{11}{2}$, $5\frac{1}{2}$

(57) 51

(58) 10

(59) 48

***(60) 472,781 — 522,547**

(61) 140

(62) $17\frac{8}{23}$

(63) 3

(64) 1,100

(65) .75, $\frac{3}{4}$

(66) $\frac{11}{301}$

(67) $\frac{24}{17}$, $1\frac{7}{17}$

(68) 20

(69) 0

***(70) 1,296 — 1,431**

(71) 0

(72) 0121

(73) 4

(74) — 9.5, $-\frac{19}{2}$, $-9\frac{1}{2}$

(75) 56

(76) 3.75, $\frac{15}{4}$, $3\frac{3}{4}$

(77) 8.5625, $\frac{137}{16}$, $8\frac{9}{16}$

(78) 3

(79) 1,156

***(80) 17,324 — 19,146**

The University Interscholastic League
Number Sense Test • HS State • 2021

Final _____ _____

Contestant's Number _____ 2nd _____ _____

1st _____ _____

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The person conducting this contest should explain these directions to the contestants.

STOP -- WAIT FOR SIGNAL!

(1) $3394 + 902 =$ _____

(2) $34194 - 8542 =$ _____

(3) $\frac{9}{16} \times \frac{8}{15} =$ _____

(4) $794 \div 7 =$ _____ **(mixed number)**

(5) **The LCM of 78 and 24 is** _____

(6) $36 \times 22 - 14 \times 22 =$ _____

(7) $\frac{3}{16} =$ _____ **(decimal)**

(8) $MCCLV \times II =$ _____ **(Arabic Numeral)**

(9) $(4 + 8) \times 12 \div 16 - (20 - 24) =$ _____

***(10)** $868 - 9708 + 8817 - 183 =$ _____

(11) **If 3 packs cost $2.28 then 5 packs cost $** _____

(12) **Which is smaller** $-\frac{3}{7}$ **or** $-\frac{4}{9}$**?** _____

(13) **The GCD of 24, 78, and 72 is** _____

(14) **21 is what percent of 105?** _____**%**

(15) **140 less 14% of 140 is** _____ **(decimal)**

(16) $3\frac{5}{7} \times 1\frac{3}{5} =$ _____**(mixed number)**

(17) $44^2 - 42^2 =$ _____

(18) $(11 \times 7 - 5) \div 6$ **has a remainder of** _____

(19) $15^3 =$ _____

***(20)** $781 \times 8007 \div 460 =$ _____

(21) $|1 - 3| + 6 - |10 - 15| + 21 =$ _____

(22) **24% of 2.375 =** _____ **(proper fraction)**

(23) $1B8_{12} =$ _____ **10**

(24) $42 \times 47 =$ _____

(25) **How many subsets containing 3 elements or less does the set {r,e,g,i,o,n} have?** _____

(26) $\sqrt{289} + \sqrt{324} =$ _____

(27) **Let** $\frac{5}{6} = \frac{x}{15}$**. Find** $\frac{12}{x}$**.** _____ **(proper fraction)**

(28) **Find the value of k so that the slope of the line** $kx + 2y = 5$ **is** -3**. k =** _____

(29) **If** $7^{(x+1)} = 86.1$**, then** $7^{(x)} =$ _____ **(decimal)**

***(30)** $26 \times 34 \times 42 =$ _____

(31) $(4)(13)(111)(k) = 40{,}404$**. k =** _____

(32) $321 =$ _____ **6**

(33) **If** $3.08333... \times k = 1$**, then k =** _____

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

(35) Given: 3, p, 12, 21, q, r, 87, ... $p + q + r$ = _____

(36) If $f(x) = x^2 - 14x + 49$, then $f(21)$ = _____

(37) $1797 \times 3 + 18$ = _____

(38) $4\frac{1}{6}$ is _____ % less than 5

(39) If $x - y = 13$ and $x + y = 9$, then x = _____

***(40)** $\sqrt{700} \times \sqrt{600}$ = _____

(41) $(202)^3$ = _____

(42) A 7-digit number 502202k is divisible by 11. k = __

(43) Let $x + y = 17$ and $x - y = 18$. Find $x^2 - y^2$. _____

(44) $(i)^{18} \times (i)^{17} \div (i)^{20} = a\sqrt{b}$, where $a,b \in \{-1,1\}$. Find b − a. _____

(45) The median on the hypotenuse of a 9-40-41 cm triangle is _____ cm

(46) The fourth pentagonal number is _____

(47) Round $(\sqrt{2} + \sqrt{3} - \sqrt{5})$ to the tenths place. ___

(48) $31^{11} \div 11$ has a remainder of _____

(49) $52_6 + 13_6 + 4_6$ = _____ 6

***(50)** $\sqrt[3]{5032021}$ = _____

(51) $(5 - i)(20 - 21i) = a + bi$. $a + b$ = _____

(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) $16 \times \frac{20}{23}$ = _____ (mixed number)

(55) If $\log_8(x) = 2$, then $\log_4(x)$ = _____

(56) 512×251 = _____

(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)** $8333 \div 666.6 \times 44.44$ = _____

(61) 5121×13 = _____

(62) $(5_7 \times 10_7 - 21_7) \div 6_7$ has a remainder of _____

(63) The odds of winning the game is 3 to 5. The probability of losing the game is _____ %

(64) How many days are there from the end of 05/01/21 to the beginning of 09/20/21? _____ days

(65) $\sin(\frac{5\pi}{3}) \times \sin(\frac{7\pi}{3})$ = _____

(66) $18 + 15 + 12.5 + 10\frac{5}{12} + ...$ = _____

(67) Find the sum of all negative integers x such that $3x + 5 \geq -8$. _____

(68) If $A^{5k} \times A^{-1} \div A^{-2} = A$ and $A > 1$, then k = ___

(69) How many triangles can be formed using any three vertices of a regular septagon? _____

***(70)** 55 miles per hour = _____ feet per minute

(71) The first four digits of the decimal for $\frac{5}{11}$ base 7 is 0._____ base 7

(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) Find the sum of the squares of the roots of $5x^2 + 2x - 3 = 0$. _____

(75) Find k, if $\begin{vmatrix} 2 & 2k \\ 4 & 6 \end{vmatrix} = 8$. _____

(76) $\int_1^3 (2x - 3)\,dx$ = _____

(77) If $f(x) = \frac{5-4x}{3} - 2$, then $f[f^{-1}(1)]$ = _____

(78) $\prod_{k=1}^{3} (2 - k^2)$ = _____

(79) ${}_{10}P_3$ = _____

***(80)** $1875 \div 0.3125 \times \frac{7}{16}$ = _____

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University Interscholastic League - Number Sense Answer Key HS ● State ● 2021
***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) 4,296

(2) 25,652

(3) .3, $\frac{3}{10}$

(4) $113\frac{3}{7}$

(5) 312

(6) 484

(7) .1875

(8) 2,510

(9) 13

***(10) — 216 — — 196**

(11) $3.80

(12) $-\frac{4}{9}$

(13) 6

(14) 20

(15) 120.4

(16) $5\frac{33}{35}$

(17) 172

(18) 0

(19) 3,375

***(20) 12,915 — 14,274**

(21) 24

(22) $\frac{57}{100}$

(23) 284

(24) 1,974

(25) 42

(26) 35

(27) $\frac{24}{25}$

(28) 6

(29) 12.3

***(30) 35,272 — 38,984**

(31) 7

(32) 1253

(33) $\frac{12}{37}$

(34) 9

(35) 96

(36) 196

(37) 5,409

(38) $\frac{50}{3}$, $16\frac{2}{3}$

(39) 11

***(40) 616 — 680**

(41) 8,242,408

(42) 8

(43) 306

(44) 0

(45) 20.5, $\frac{41}{2}$, $20\frac{1}{2}$

(46) 22

(47) .9

(48) 9

(49) 113

***(50) 163 — 179**

(51) — 46

(52) 21

(53) — 40

(54) $13\frac{21}{23}$

(55) 3

(56) 128,512

(57) 18

(58) $\frac{360}{41}$, $8\frac{32}{41}$

(59) 96

***(60) 528 — 583**

(61) 66,573

(62) 2

(63) 62.5, $\frac{125}{2}$, $62\frac{1}{2}$

(64) 141

(65) — .75, $-\frac{3}{4}$

(66) 108

(67) — 10

(68) 0

(69) 35

***(70) 4,598 — 5,082**

(71) 4242

(72) 29.5, $\frac{59}{2}$, $29\frac{1}{2}$

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

(74) 1.36, $\frac{34}{25}$, $1\frac{9}{25}$

(75) .5, $\frac{1}{2}$

(76) 2

(77) 1

(78) 14

(79) 720

***(80) 2,494 — 2,756**

NUMBER SENSE (updated 5/10/21)

Larry White - Number Sense Contest Director - texasmath@centex.net

This will be the last update of my 'Number Sense Test Corrections and Comments' page for this 20-21 season. This has been a most unusual season. I encourage everyone to let the UIL staff know how thankful you are for all of the work it took them to put together a season amongst all of the surrounding difficulties. Finding ways to hold district, regional, and state competitions was not an easy task, to say the least. It would have been easier to cancel the season again as they had to last year, but that is not how UIL reacts to hardships. Kudos to all the UIL staff and all the coaches and hub workers for all their hard and tireless work to provide for our most valuable assets; our students and their competive spirit.
I would like to congratulate all of the students for working through all of the issues facing us this year and continuing to grow academically through UIL competitions. The knowledge and skills gained through the UIL experience is everlasting and can never be taken away from you.
I would like to congratulate all 128 of the number sense students who made to state and a special congratulations to those state championship individuals and those state championship teams. I missed not getting to see you all and I sure missed not getting to put your medals around your necks. Please don't forget to thank your parents, thank your coaches, thank your schools, and, most importantly, thank HIM. I hope you all continue to find a few minutes each day in your life to walk with, talk with, and give thanks to your creator. Without HIM the path is lonely and bleak. I am looking forward to seeing you all in the Fall.

UIL Test Comments — 2020-21

***** NOTE:** See **Off on a Tangent** below for information on workshops, Student Activity Conferences, and test discussions *******

SAC - - - > No errors, corrections, or comments reported at this time. (Release dates: 10/1/20)

A - - - > No errors, corrections, or comments reported at this time. (Release dates: 1/8/21 - 2/6/21)

B - - - > No errors, corrections, or comments reported at this time. (Release dates: 2/12/21 - 3/13/21)

District - - - > #36 … 0 and 3 are acceptable … see discussion below (Release dates: 3/22/21 - 3/27/21)
#37 … 48 is the correct answer, but … see discussion below

Regional - - - > No errors, corrections, or comments reported at this time. (Release dates: 4/16/21 - 4/17/21)

State - - - > No errors, corrections, or comments reported at this time. (Release date: 4/29/21 - 5/1/21)

TMSCA Test Comments — 2020-21 (tests I write for TMSCA)

 # 6 - - - > No errors, corrections, or comments reported at this time. (Release date: 12/07/19)

 # 13 - - - > No errors, corrections, or comments reported at this time. (Release date: 3/07/20)

State - - - > No errors, corrections, or comments reported at this time. (Release date: 3/21/20)

Off on a Tangent

Workshops and/or Presentations I will be doing:

1. UIL Capitol Conference, Austin - ~~June 23-24, 2020~~. Cancelled --- Virtual
   See the UIL Academic website for two recorded Zoom sessions and multiple downloads
   Keep an eye out on the UIL Academic Website for information of the upcoming 2021 virtual Capitol Conference.

2. *What's Your 11th Problem* - Math Camp at Texas Tech University, Lubbock on ~~July 13-18, 2020~~.
   Cancelled --- future camps have not been addressed at this time ---
   For more information contact Jack Barton at jack.barton@ttu.edu or 806-742-2350.

3. Student Activity Conferences: **The 2020 conferences will be virtual.**
   --- This Year in Number Sense and Mathematics: News -Updates- Hot Topics
   (prerecorded session to be posted on the UIL Academic website on Oct. 1)
   --- Number Sense Problem Solving
   (prerecorded session to be posted on the UIL Academic website on Oct. 29)
   --- Mathematics Problem Solving
   (prerecorded session to be posted on the UIL Academic website on Oct. 29)
   --- Number Sense and Math - Coaches Chat
   (live zoom session at 4:00 pm Wednesday, Nov. 4 --- register in advance)

History of Number Sense Project:

I had hoped to have my data compiled and ready to be seen. Unfortunately, the issues facing us today has not permitted me to complete my research. I hope to finish the research later this year and have a report next year.

Resources Update

I recently received an update on "the little red book" -- Mental Mathematics for Number Sense by Frances Walzel -- is available again. The new contact email for this book is mentalmathbook@gmail.com .

Test Discussions

I have been writing 12 number sense practice tests for HEXCO since 2012 and will be writing them again this year. Contact Linda at HEXCO.com if you are interested in ordering some of these tests.

The district, regional, and state tests will be created based on the problems from these 6 tests: 2020SAC, TMSCA 6, UIL A, UIL B, TMSCA 13, & TMSCA STATE.

District #36: The intent of this problem was for 3 to be the correct answer. We have done these types of problems in the past. I did not consider zero. However, 7 x 0 + 4 = 4 and 4 is a perfect square. The answer 0 is the correct answer for the problem as it is stated. I should have said "positive integers, k" or "0 < k < 11 ".

District #37: The actual linear term of this cubic is "48x", however number sense rules do not allow for letters or symbols or extraneous marks of any kind in the answers. So, 48x cannot be accepted. In the future I will try to put the word "coefficient" in the problem.