

The University Interscholastic League

Number Sense Test • HS A • 2019

Contestant's Number _____

Read directions carefully
before beginning test

**DO NOT UNFOLD THIS SHEET
UNTIL TOLD TO BEGIN**

Final	_____
2nd	_____
1st	_____
Score	Initials

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!

- | | |
|---|--|
| <p>(1) $111 - 209 + 219 =$ _____</p> <p>(2) $201 + 911 - 129 =$ _____</p> <p>(3) $209 \times 11 =$ _____</p> <p>(4) $29^2 =$ _____</p> <p>(5) $15 + 24 + 33 + 42 + 51 =$ _____</p> <p>(6) $\frac{3}{8} =$ _____ % (decimal)</p> <p>(7) $45 + 67 + 89 =$ _____</p> <p>(8) $90 \div 3\frac{1}{3} =$ _____</p> <p>(9) MMXIX = _____</p> <p>*(10) $111 + 2019 + 902 + 9102 =$ _____</p> <p>(11) If 1 gram = .04 oz., 1200 grams = _____ oz.</p> <p>(12) $\frac{7}{2(5^3)} =$ _____ (decimal)</p> <p>(13) $6\frac{1}{8} - 2\frac{3}{4} =$ _____ (mixed number)</p> <p>(14) $\sqrt[3]{2197} =$ _____</p> <p>(15) $35 + 30 \div 25 \times (20 - 15) =$ _____</p> <p>(16) $56^2 - 64^2 = 8 \times$ _____</p> <p>(17) The smallest prime number greater than 47 is _____</p> | <p>(18) $11129 \div 6$ has a remainder of _____</p> <p>(19) \$1.30 is 6.5% tax on \$ _____</p> <p>*(20) $902111 \div 2019 =$ _____</p> <p>(21) $1993 \times 7 + 49 =$ _____</p> <p>(22) 15% of 60 is 25% of _____</p> <p>(23) The product of the roots of $2x^2 - 3x - 4 = 0$ is _____</p> <p>(24) $(3^3 + 6 \times 9) \div 4$ has a remainder of _____</p> <p>(25) $1600 = [2(16 + k)]^2$. Find $k \geq 0$. _____</p> <p>(26) $15 \times 52 =$ _____</p> <p>(27) If $f(x) = x^3 - 3x^2$ then $f(5) =$ _____</p> <p>(28) Two numbers have a sum of 21, a product of 98, and a positive difference of _____</p> <p>(29) $56_8 =$ _____ ₇</p> <p>*(30) $\sqrt{111209} =$ _____</p> <p>(31) If $(3x + 5)(3x - 5) = ax^2 + bx + c$ then $a + b + c =$ _____</p> <p>(32) The set {p,o,w,e,r} has _____ proper subsets</p> <p>(33) The sum of the positive integral divisors of 40 is _____</p> |
|---|--|

- (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) $1 + 3 + 5 + 7 + \dots + 19 + 21 =$ _____
- *(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) $\log_2(16) = \log_8(\text{_____})$
- (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) $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \frac{1}{81} + \dots =$ _____
- (64) If $\sin(38^\circ) = \cos(A)$ and A is in QI then $A =$ _____ $^\circ$
- (65) Let $15^5 \div 5 = (3^x)(5^y)$. Find $y - x =$ _____
- (66) $40^\circ \text{ C} =$ _____ $^\circ \text{ F}$
- (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) $\lim_{x \rightarrow \infty} \frac{7x}{x-7} =$ _____
- (76) $\int_{-2}^2 (x^4) dx =$ _____
- (77) $0.0303\dots$ 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 | (18) 5 | (34) 3,016 | (58) $\frac{16}{9}, 1\frac{7}{9}$ |
| (2) 983 | (19) \$20.00 | (35) 8 | (59) 90 |
| (3) 2,299 | *(20) 425 — 469 | (36) 9 | *(60) 1,538 — 1,698 |
| (4) 841 | (21) 14,000 | (37) 12 | (61) 120 |
| (5) 165 | (22) 36 | (38) $3\frac{1}{2}$ | (62) 30 |
| (6) 37.5 | (23) — 2 | (39) 2.5, $\frac{5}{2}, 2\frac{1}{2}$ | (63) .5, $\frac{1}{2}$ |
| (7) 201 | (24) 1 | *(40) 18,729 — 20,699 | (64) 52 |
| (8) 27 | (25) 4 | (41) 2 | (65) — 1 |
| (9) 2,019 | (26) 780 | (42) 25 | (66) 104 |
| *(10) 11,528 — 12,740 | (27) 50 | (43) 96 | (67) 25 |
| (11) 48 | (28) 7 | (44) 5 | (68) .13 |
| (12) .028 | (29) 64 | (45) 2102 | (69) .9, $\frac{9}{10}$ |
| (13) $3\frac{3}{8}$ | *(30) 317 — 350 | (46) $-\frac{2}{3}$ | *(70) 315,188 — 348,364 |
| (14) 13 | (31) — 16 | (47) — 1 | (71) 1 |
| (15) 41 | (32) 31 | (48) 35 | (72) 9 |
| (16) — 120 | (33) 90 | (49) 121 | (73) 9 |
| (17) 53 | | *(50) 273,714 — 302,526 | (74) 26 |
| | | (51) 5 | (75) 7 |
| | | (52) 21 | (76) 12.8, $\frac{64}{5}, 12\frac{4}{5}$ |
| | | (53) 4,096 | (77) $\frac{1}{13}$ |
| | | (54) 10011101 | (78) 21 |
| | | (55) $6\frac{14}{15}$ | (79) 5,552 |
| | | (56) 50 | *(80) 507 — 559 |
| | | (57) $\frac{13}{12}$ | |

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- | | |
|---|---|
| <p>(1) $215 + 316 + 19 =$ _____</p> <p>(2) $2019 - 1516 - 3 =$ _____</p> <p>(3) $15 \times 16 + 19 =$ _____</p> <p>(4) $1516201 \div 9$ has a remainder of _____</p> <p>(5) $\frac{5}{8} =$ _____ % (decimal)</p> <p>(6) $\frac{5}{14} + \frac{3}{7} - 1 =$ _____</p> <p>(7) $17 + 21 + 25 + 29 + 33 =$ _____</p> <p>(8) $3\frac{2}{9} - 1\frac{2}{3} =$ _____ (mixed number)</p> <p>(9) The multiplicative inverse of 1.7 is _____</p> <p>*(10) $2153 + 1620 + 1921 + 5316 =$ _____</p> <p>(11) The median of 2,1,5,3,1,2,0,1 and 9 is _____</p> <p>(12) $15 \times 16 + 19 \times 15 =$ _____</p> <p>(13) The largest prime divisor of 352 is _____</p> <p>(14) $53 \times 47 =$ _____</p> <p>(15) 4 gallons — 2 quarts — 1 pint = _____ pints</p> <p>(16) $15 - 16 \times 2^0 \div (1 + 9) =$ _____</p> <p>(17) MDXVI = _____ (Arabic Numeral)</p> <p>(18) The smallest prime number larger than 67 is _____</p> | <p>(19) \$2.40 is _____ % tax on \$30.00</p> <p>*(20) $316 \times 215 =$ _____</p> <p>(21) $1691 \times 9 + 81 =$ _____</p> <p>(22) $0.4666\ldots =$ _____ (proper fraction)</p> <p>(23) $151_6 =$ _____ 10</p> <p>(24) Find the simple interest on \$3200.00 at 5.25% for two years. \$ _____</p> <p>(25) $6\frac{1}{3} \times 9\frac{2}{3} =$ _____ (mixed number)</p> <p>(26) Let $n = \sqrt[3]{3375}$. Find n^2. _____</p> <p>(27) $\frac{12}{13} - \frac{13}{12} =$ _____</p> <p>(28) 12% of 24 is 48% of _____</p> <p>(29) $\frac{4}{5}$ is what percent more than $\frac{1}{2}$? _____ %</p> <p>*(30) $215316 \div 2019 =$ _____</p> <p>(31) Let $(2x + 3)(4x - 1) = ax^2 + bx + c$.
Find $a + b + c$. _____</p> <p>(32) $4^{-2} + 4^{-3} =$ _____</p> <p>(33) The smallest root of $8x^2 + 10x - 3 = 0$ is _____</p> <p>(34) Set A has 12 elements, set B has 8 elements, and
$A \cap B$ has 4 elements. $A \cup B$ has _____ elements</p> |
|---|---|

- (35) Find k , if $kx^2 - x - 12 = 0$ and the product of the roots is -2 . $k =$ _____
- (36) The angle complementary to 32° measures _____ $^\circ$
- (37) $1101_2 =$ _____ $_4$
- (38) The 4-digit number $215k$ is divisible by 8. $k =$ _____
- (39) The LCM of 12, 18 and 20 is _____
- *(40) $16^3 =$ _____
- (41) If $4^x = 24$, then $4^{(x+1)} =$ _____
- (42) If $x + y = 8$ and $x - y = 2$, then $xy =$ _____
- (43) The area of a circle is $24\pi \text{ in}^2$. The diameter of this circle is $a\sqrt{b} \text{ in.}$, where $a > 1$. Find $a + b$. _____
- (44) $74^2 - 66^2 =$ _____
- (45) The coefficient of the x^2y^2 term in the expansion of $(3x - 2y)^4$ is _____
- (46) $132 \times 111 =$ _____
- (47) $(i)^{16} = a\sqrt{b}$, where $a, b \in \{-1, 1\}$. Find b . _____
- (48) $(316_7) \div (4_7) =$ _____ $_7$
- (49) $\frac{3}{5} + \frac{3}{25} + \frac{3}{125} + \frac{3}{625} + \dots =$ _____
- *(50) $\sqrt{1516} \times \sqrt{2019} =$ _____
- (51) $\log 4 - \log 400 =$ _____
- (52) The roots of $x^3 + x^2 - 2x = 0$ are d , e , and f . Find $(d + e)(e + f)(f + d)$. _____
- (53) $\frac{4\pi}{5}$ radians = _____ degrees
- (54) The vertex of the parabola $x^2 - 6x - 12$ is (h, k) and $k =$ _____
- (55) If $3P = 4Q$ and $2Q = 5R$ then $P =$ _____ R
- (56) Given: 4, 6, 10, 14, 22, 26, 34, k , 46, $k =$ _____
- (57) $7 \times \frac{11}{13} =$ _____ (mixed number)
- (58) $\frac{1}{3} + \frac{1}{6} + \frac{1}{10} + \frac{1}{15} + \dots + \frac{1}{78} + \frac{1}{91} =$ _____
- (59) Let $(a - 5i)^2 = -9 - 40i$. Find a . _____
- *(60) $(31)^6 \div (21)^5 =$ _____
- (61) How many ways can 4 people be seated in a circle of 6 chairs? _____
- (62) $1234 \times 8 + 4 =$ _____
- (63) The odds of passing the test is $\frac{13}{15}$. The probability of failing the test is _____ (proper fraction)
- (64) $\sin(\text{Arcsin}(\frac{3}{5})) =$ _____
- (65) The first four digits of the decimal for $\frac{13}{30}$ base 7 is 0. _____ base 7
- (66) $95^\circ \text{ F} =$ _____ $^\circ \text{ C}$
- (67) If 3 workers can do a job in 18 days, how many days would it take 5 workers working at the same rate? _____ days
- (68) $50^2 - 48^2 + 46^2 - 44^2 =$ _____
- (69) The sum of the product of the roots taken 3 at a time of $2x^4 - 13x^3 + 28x^2 - 23x + 6 = 0$ is _____
- *(70) $6 \times 12 \times 18 \times 24 =$ _____
- (71) Let $g(x) = x^2 - 9$. Find $g(-3)$. _____
- (72) How many positive 3-digit numbers divisible by 5 exist? _____
- (73) If $122_b = 50$ then $221_b =$ _____
- (74) Let $f(x) = (3x + 4)^2$. Find $f'(2)$. _____
- (75) The horizontal asymptote of $y = 4^x$ is _____
- (76) $\begin{vmatrix} -1 & 6 \\ 3 & -10 \end{vmatrix} =$ _____
- (77) If $x > 0$ and $|3x + 16| = 20$ then $x =$ _____
- (78) $\frac{6 \times 5! - 5 \times 4!}{3!} =$ _____
- (79) $215 \times 101 =$ _____
- *(80) $714.285 \div 14.2857 \times 8.57142 =$ _____

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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) 550 | (19) 8 | (35) 6 | (59) 4 |
| (2) 500 | *(20) 64,543 — 71,337 | (36) 58 | *(60) 207 — 228 |
| (3) 259 | (21) 15,300 | (37) 31 | (61) 60 |
| (4) 7 | (22) $\frac{7}{15}$ | (38) 2 | (62) 9,876 |
| (5) 62.5 | (23) 67 | (39) 180 | (63) $\frac{15}{28}$ |
| (6) $-\frac{3}{14}$ | (24) \$336.00 | *(40) 3,892 — 4,300 | (64) .6, $\frac{3}{5}$ |
| (7) 125 | (25) $61\frac{2}{9}$ | (41) 96 | (65) 3222 |
| (8) $1\frac{5}{9}$ | (26) 225 | (42) 15 | (66) 35 |
| (9) $\frac{10}{17}$ | (27) $-\frac{25}{156}$ | (43) 10 | (67) 10.8, $\frac{54}{5}$, $10\frac{4}{5}$ |
| *(10) 10,460 — 11,560 | (28) 6 | (44) 1,120 | (68) 376 |
| (11) 2 | (29) 60 | (45) 216 | (69) 11.5, $\frac{23}{2}$, $11\frac{1}{2}$ |
| (12) 525 | *(30) 102 — 111 | (46) 14,652 | *(70) 29,549 — 32,659 |
| (13) 11 | (31) 15 | (47) 1 | (71) — 9 |
| (14) 2,491 | (32) .078125, $\frac{5}{64}$ | (48) 55 | (72) 180 |
| (15) 27 | (33) $-1.5, -\frac{3}{2}, -1\frac{1}{2}$ | (49) .75, $\frac{3}{4}$ | (73) 85 |
| (16) 13.4, $\frac{67}{5}$, $13\frac{2}{5}$ | (34) 16 | *(50) 1,663 — 1,836 | (74) 60 |
| (17) 1,516 | | (51) — 2 | (75) 0 |
| (18) 71 | | (52) 2 | (76) — 8 |
| | | (53) 144 | (77) $\frac{4}{3}$, $1\frac{1}{3}$ |
| | | (54) — 21 | (78) 100 |
| | | (55) $\frac{10}{3}$, $3\frac{1}{3}$ | (79) 21,715 |
| | | (56) 38 | *(80) 408 — 449 |
| | | (57) $5\frac{12}{13}$ | |
| | | (58) $\frac{6}{7}$ | |

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|--|---|
| <p>(1) $329 + 330 + 2019 =$ _____</p> <p>(2) $16 \times 75 =$ _____</p> <p>(3) $910 + 203 - 923 =$ _____</p> <p>(4) $32930 \div 9$ has a remainder of _____</p> <p>(5) $79 \div 8 - 31 \div 8 =$ _____</p> <p>(6) $\frac{4}{7} - \frac{7}{8} =$ _____ (proper fraction)</p> <p>(7) $17 + 24 + 53 + 29 + 36 =$ _____</p> <p>(8) Which is larger, 0.59 or $\frac{9}{14}$ = _____</p> <p>(9) The multiplicative inverse of 2.9 is _____</p> <p>*(10) $329 + 2019 + 9102 + 923 =$ _____</p> <p>(11) CCCXXIX = _____ (Arabic Numeral)</p> <p>(12) The LCM of 18 and 72 is _____</p> <p>(13) $4\frac{2}{3} - 1\frac{1}{12} =$ _____ (mixed number)</p> <p>(14) $62 \times 58 =$ _____</p> <p>(15) 10 is what percent of 8? _____ %</p> <p>(16) The number of prime numbers less than 100 and greater than 80 is _____</p> <p>(17) $33\frac{1}{3}\%$ of a yard = _____ inches</p> | <p>(18) $3\frac{1}{2} + 6\frac{2}{3} =$ _____</p> <p>(19) 6.5% tax on \$20.00 is \$ _____</p> <p>*(20) $329 \times 330 + 2019 =$ _____</p> <p>(21) $1793 \times 7 + 49 =$ _____</p> <p>(22) 16% of 36 is 12% of _____</p> <p>(23) 330 base 10 is _____ base 7</p> <p>(24) Find the simple interest on \$1500.00 at 4% for 18 months. \$ _____</p> <p>(25) If $f(x) = x^2 - 16x + 64$ then $f(25) =$ _____</p> <p>(26) 0.181818... = _____ (proper fraction)</p> <p>(27) If $f(x) = 3x^2 + 2x + 9$ then $f(-1) =$ _____</p> <p>(28) $\frac{3^3}{(2^4)(5^2)} =$ _____ (decimal)</p> <p>(29) The largest root of $2x^2 + 3x - 2 = 0$ is _____</p> <p>*(30) $\sqrt{329330} =$ _____</p> <p>(31) If $(2x - 9)^2 = ax^2 + bx + c$ then $a + b + c =$ _____</p> <p>(32) Given: 2, 9, 11, 20, 31, p, q, r, 215, $r =$ _____</p> <p>(33) 40% of 60 minus 80 = _____</p> <p>(34) If $x + 18 = 4x$ and $x > 0$ then $x =$ _____</p> |
|--|---|

- (35) Set A has 14 elements, set B has 11 elements and $A \cup B$ has 15 elements. $A \cap B$ has _____ elements.
- (36) $\frac{1}{8}$ is _____ % more than $\frac{1}{10}$
- (37) $10110_2 =$ _____ 4
- (38) $8\frac{1}{6} \div 3\frac{1}{2} =$ _____ (mixed number)
- (39) The smallest root of $(3x - 1)^2 = \frac{1}{9}$ is _____
- *(40) $\left(10\left(\frac{\sqrt{5}+1}{2}\right)\right)^3 =$ _____
- (41) If $2.5^x = 360$, then $2.5^{(x-1)} =$ _____
- (42) If $2x + y = 8$ and $2x - y = 4$, then $xy =$ _____
- (43) The area of a circle is 32π in². The diameter of this circle is $a\sqrt{b}$ in., where $a > 1$. Find $a + b$. _____
- (44) $34 \times 43 =$ _____
- (45) $56^2 + 55^2 =$ _____
- (46) $32 \times 1111 =$ _____
- (47) $(i)^{22} = a\sqrt{b}$, where $a, b \in \{-1, 1\}$. Find a . _____
- (48) A string 3 yards 2 feet long is cut into 3 equal pieces. How long is each piece? _____ inches
- (49) $5 + 10 + 15 + 20 \dots + 70 + 75 =$ _____
- *(50) $28 \times 21 \times 14 \times 7 =$ _____
- (51) The integral sides of a right triangle are x, y & 25, where $x < y < 25$ and $\text{GCF}(x, y) = 1$. Find xy . _____
- (52) The roots of $x^3 - 6x^2 - x + 1 = 0$ are d, e , and f . Find $(d + e)(e + f)(f + d)$. _____
- (53) $\log_4(64) = \log_3(\text{_____})$
- (54) The vertex of $3x^2 + 4x - 5$ is (h, k) . $h =$ _____
- (55) $2,442 \div 111 =$ _____
- (56) Given: 0,2,5,9,14,20,k,35,44... . $k =$ _____
- (57) The simplified coefficient of the x^3y^3 term in the expansion of $(x + 2y)^6$ is _____
- (58) $1111001_2 =$ _____ 8
- (59) $222 \times \frac{5}{37} =$ _____
- *(60) $(28)^5 \div (14)^3 =$ _____
- (61) How many ways can 3 people be seated in a row of 5 chairs? _____
- (62) $12345 \times 8 + 5 =$ _____
- (63) $4\sin\left(\frac{\pi}{3}\right)\cos\left(\frac{\pi}{6}\right) =$ _____
- (64) The first four digits of the decimal for $\frac{21}{40}$ base 5 is 0. _____ base 5
- (65) Let $18^9 \div 9 = (2^x)(9^y)$. Find $x - y =$ _____
- (66) $60^\circ \text{ C} =$ _____ $^\circ \text{ F}$
- (67) If 4 workers can do a job in 12 days, how many can do it in 8 days working at the same rate? _____
- (68) $\begin{bmatrix} 1 & 2 \\ -4 & -3 \end{bmatrix} \times \begin{bmatrix} 3 & 4 \\ -2 & -1 \end{bmatrix} = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$. $bd =$ _____
- (69) The harmonic mean of the roots of $3x^2 - 14x + 8 = 0$ is _____
- *(70) $4167 \div 0.0833 \times \frac{1}{2} =$ _____
- (71) Let $g(x) = 5x - 1$. Find $g(g(1))$. _____
- (72) Find x , $0 \leq x \leq 6$, if $x + 5 \equiv 4 \pmod{7}$. _____
- (73) If $33_b = 24$ then $42_b =$ _____
- (74) Let $f(x) = (5x - 7)^2$. Find $f'(-3)$. _____
- (75) $\lim_{x \rightarrow 5} \frac{3x^2}{x+5} =$ _____
- (76) $\begin{vmatrix} -1 & 5 \\ -12 & -22 \end{vmatrix} =$ _____
- (77) $0.262626\dots$ base 8 = _____ base 8 (fraction)
- (78) $\int_{-1}^1 (x - 1) dx =$ _____
- (79) $231 \times 101 =$ _____
- *(80) $2222 \times 333 \div 44 =$ _____

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST**University Interscholastic League - Number Sense Answer Key HS • District • 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) 2,678 | (18) $\frac{61}{6}, 10\frac{1}{6}$ | (35) 10 | (58) 171 |
| (2) 1,200 | (19) \$1.30 | (36) 25 | (59) 30 |
| (3) 190 | *(20) 105,060 — 116,118 | (37) 112 | *(60) 5,959 — 6,585 |
| (4) 8 | (21) 12,600 | (38) $2\frac{1}{3}$ | (61) 60 |
| (5) 6 | (22) 48 | (39) $\frac{2}{9}$ | (62) 98,765 |
| (6) $-\frac{17}{56}$ | (23) 651 | *(40) 4,025 — 4,447 | (63) 3 |
| (7) 159 | (24) \$90.00 | (41) 144 | (64) 2333 |
| (8) $\frac{9}{14}$ | (25) 289 | (42) 6 | (65) 1 |
| (9) $\frac{10}{29}$ | (26) $\frac{2}{11}$ | (43) 10 | (66) 140 |
| *(10) 11,755 — 12,991 | (27) 10 | (44) 1,462 | (67) 6 |
| (11) 329 | (28) .0675 | (45) 6,161 | (68) 78 |
| (12) 72 | (29) .5, $\frac{1}{2}$ | (46) 35,552 | (69) $\frac{8}{7}, 1\frac{1}{7}$ |
| (13) $3\frac{7}{12}$ | *(30) 546 — 602 | (47) — 1 | *(70) 23,762 — 26,262 |
| (14) 3,596 | (31) 49 | (48) 44 | (71) 19 |
| (15) 125 | (32) 133 | (49) 600 | (72) 6 |
| (16) 3 | (33) — 56 | *(50) 54,743 — 60,505 | (73) 30 |
| (17) 12 | (34) 6 | (51) 168 | (74) — 220 |
| | | (52) — 5 | (75) 7.5, $\frac{15}{2}, 7\frac{1}{2}$ |
| | | (53) 27 | (76) 82 |
| | | (54) $-\frac{2}{3}$ | (77) $\frac{26}{77}$ |
| | | (55) 22 | (78) — 2 |
| | | (56) 27 | (79) 23,331 |
| | | (57) 160 | *(80) 15,976 — 17,657 |

The University Interscholastic League

Number Sense Test • HS Regional • 2019

Contestant's Number _____

Read directions carefully
before beginning test

**DO NOT UNFOLD THIS SHEET
UNTIL TOLD TO BEGIN**

Final	_____
2nd	_____
1st	_____
Score	Initials

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!

- | | |
|---|---|
| <p>(1) $301 + 412 + 413 =$ _____</p> <p>(2) $3 \times 12 + 3 \times 13 =$ _____</p> <p>(3) $301 \div 4 =$ _____ (mixed number)</p> <p>(4) $2019 - 301 - 413 =$ _____</p> <p>(5) $412 + 413 + 414 + 415 + 416 =$ _____</p> <p>(6) 12 is what percent of 8? _____ %</p> <p>(7) $\frac{5}{9} - \frac{9}{10} =$ _____ (proper fraction)</p> <p>(8) $81 \div 4\frac{1}{2} =$ _____</p> <p>(9) $1,111,111 = 123456 \times 9 + k$. $k =$ _____</p> <p>*(10) $3014 + 1241 + 3201 + 9 =$ _____</p> <p>(11) $3^4 \div (12 - 3) \times 14 =$ _____</p> <p>(12) The LCM of 36 and 84 is _____</p> <p>(13) $4\frac{1}{3} + 20\frac{1}{9} =$ _____</p> <p>(14) \$2.70 is 6.75% tax on \$ _____</p> <p>(15) The multiplicative inverse of -3.1 is _____</p> <p>(16) $\sqrt[3]{2197} =$ _____</p> <p>(17) $12 \times 413 =$ _____</p> <p>(18) The mode of 3, 0, 1, 4, 1, 2, 4, 1, and 3 is _____</p> | <p>(19) The number of prime numbered calendar days in the month of April is _____</p> <p>*(20) $301412 \div 413 =$ _____</p> <p>(21) $2889 \times 11 + 121 =$ _____</p> <p>(22) The average of 17, 31, and k is 36. Find k. _____</p> <p>(23) 413 base 10 is _____ base 5</p> <p>(24) $36 \text{ inches} \times 12 \text{ feet} \times 2 \text{ yards} =$ _____ cubic yards</p> <p>(25) $(41 \times 24 - 13) \div 5$ has a remainder of _____</p> <p>(26) $(64)^{\frac{2}{3}} =$ _____</p> <p>(27) 24% of 36 is 48% of _____</p> <p>(28) Find the smallest prime number p, where $p > 13$ and $4p + 7$ is a prime number. _____</p> <p>(29) $35_7 =$ _____ $_9$</p> <p>*(30) $41 \times 12 \times 13 =$ _____</p> <p>(31) Let $(18x - 13)(18x - 13) = ax^2 + bx + c$. Find $a + b + c$. _____</p> <p>(32) If $(4x + 1)^2 = ax^2 + bx + c$, then $a - b - c =$ _____</p> <p>(33) Two numbers have a sum of 36, a product of 320, and a positive difference of _____</p> <p>(34) If $4x - 13 = 2x$ and $0 < x < 6$, then $x =$ _____</p> |
|---|---|

- (35) Set A has 13 elements, $A \cap B$ has 4 elements, and $A \cup B$ 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 $a, b \in \{-1, 1\}$. $a - b =$ _____
- (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) $210^\circ =$ _____ 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) $\frac{3}{4} + \frac{3}{16} + \frac{3}{64} + \frac{3}{256} + \dots =$ _____
- (63) $95^\circ \text{ F} =$ _____ $^\circ \text{ C}$
- (64) $\cos(\text{Arcsin}(\frac{4}{5})) =$ _____
- (65) Let $18^8 \div 36 = (2^x)(9^y)$. Find $x + y =$ _____
- (66) $\cos(112^\circ) = \sin A$, $180^\circ < A < 270^\circ$. $A =$ _____ $^\circ$
- (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) $\lim_{x \rightarrow \infty} \frac{x - \cos(x)}{x} =$ _____
- (76) $\begin{vmatrix} 4 & 13 \\ 20 & 19 \end{vmatrix} =$ _____
- (77) $0.131313\dots$ base 4 = _____ base 4 (fraction)
- (78) $\int_{-1}^3 (2x + 1) dx =$ _____
- (79) $1213 \times 14 =$ _____
- *(80) $976.666 \div 58.333 \times 41.666 =$ _____

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 | (19) 10 | (35) 11 | (59) 5 |
| (2) 75 | *(20) 694 — 766 | (36) 4 | *(60) 224,265 — 247,871 |
| (3) $75\frac{1}{4}$ | (21) 31,900 | (37) 1100111 | (61) 14 |
| (4) 1,305 | (22) 60 | (38) 9 | (62) 1 |
| (5) 2,070 | (23) 3,123 | (39) 7 | (63) 35 |
| (6) 150 | (24) 8 | *(40) 122 — 134 | (64) $.6, \frac{3}{5}$ |
| (7) $-\frac{31}{90}$ | (25) 1 | (41) $-\frac{13}{3}, -4\frac{1}{3}$ | (65) 13 |
| (8) 18 | (26) 16 | (42) 3,430 | (66) 202 |
| (9) 7 | (27) 18 | (43) 32 | (67) 60 |
| *(10) 7,092 — 7,838 | (28) 19 | (44) — 640 | (68) .14 |
| (11) 126 | (29) 28 | (45) — 1 | (69) 3 |
| (12) 252 | *(30) 6,077 — 6,715 | (46) 79,992 | *(70) 574 — 633 |
| (13) $\frac{220}{9}, 24\frac{4}{9}$ | (31) 25 | (47) 0 | (71) 11 |
| (14) \$40.00 | (32) 7 | (48) 8 | (72) 936 |
| (15) $-\frac{10}{31}$ | (33) 4 | (49) 5300 | (73) 335 |
| (16) 13 | (34) $\frac{13}{6}, 2\frac{1}{6}$ | *(50) 168 — 185 | (74) — 38 |
| (17) 4,956 | | (51) — 3 | (75) 1 |
| (18) 1 | | (52) 4 | (76) — 184 |
| | | (53) 67,196 | (77) $\frac{13}{33}$ |
| | | (54) $\frac{7}{6}, 1\frac{1}{6}$ | (78) 12 |
| | | (55) $6\frac{3}{16}$ | (79) 16,982 |
| | | (56) 19 | *(80) 663 — 732 |
| | | (57) 84 | |
| | | (58) 720 | |

The University Interscholastic League

Number Sense Test • HS State • 2019

Contestant's Number _____

Read directions carefully
before beginning test

DO NOT UNFOLD THIS SHEET
UNTIL TOLD TO BEGIN

Final	_____
2nd	_____
1st	_____
Score	Initials

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!

- | | |
|--|---|
| <p>(1) $503 + 350 + 530 =$ _____</p> <p>(2) $504 + 450 - 45 =$ _____</p> <p>(3) $15 \times 24 \div 10 =$ _____</p> <p>(4) $25 \times 7.2 =$ _____</p> <p>(5) $103 \div 7 - 54 \div 7 =$ _____</p> <p>(6) 18 is what percent of 12? _____ %</p> <p>(7) $12 + 34 + 56 + 78 =$ _____</p> <p>(8) $(48 - 24) \times 12 \div 6 =$ _____</p> <p>(9) $5.03 \times 10^2 - 53 =$ _____</p> <p>*(10) $503 + 201 + 930 + 504 =$ _____</p> <p>(11) If 1 gram = .04 oz., then 400 grams = _____ oz.</p> <p>(12) The median of 5,0,3,2,0,1,9,5,0, and 4 is _____</p> <p>(13) $29^2 =$ _____</p> <p>(14) $53 \times 47 =$ _____</p> <p>(15) The multiplicative inverse of 5.4 is _____</p> <p>(16) $4\frac{2}{3} \times 9\frac{3}{4} =$ _____ (mixed number)</p> <p>(17) $\sqrt[3]{2744} =$ _____</p> <p>(18) The number of prime numbers greater than 50 and less than 70 is _____</p> | <p>(19) \$3.00 is 7.5% tax on \$ _____</p> <p>*(20) $503 \times 305 + 2019 =$ _____</p> <p>(21) $1881 \times 19 + 361 =$ _____</p> <p>(22) $54^2 - 45^2 =$ _____</p> <p>(23) 503 base 10 is _____ base 7</p> <p>(24) 48 inches \times 6 feet \times 2 yards = _____ cubic feet</p> <p>(25) If $A = -4$, $B = -3$, and $C = 2$, then $AB^C =$ _____</p> <p>(26) Find the smallest prime number p, where $p > 7$ and $4p + 7$ is a prime number. _____</p> <p>(27) How many elements are in a set that has 63 proper subsets? _____</p> <p>(28) $(2^4 + 6 \times 8) \div 5$ has a remainder of _____</p> <p>(29) $\frac{3}{4}$ is what percent more than $\frac{3}{5}$? _____ %</p> <p>*(30) $\sqrt{503} \times 1920 =$ _____</p> <p>(31) Let $(27x - 23)^2 = ax^2 + bx + c$.
Find $a + b + c$. _____</p> <p>(32) Let $(17x - 15)(17x + 15) = ax^2 + bx + c$.
Find $a + b + c$. _____</p> <p>(33) Given: 1, 5, 12, 22, p, 51, q, 92... . $p + q =$ _____</p> <p>(34) If $f(x) = 25x^2 + 30x + 9$, then $f(4)$ is _____</p> |
|--|---|

- (35) The slope of the line $5x - 3y = 2$ is _____
- (36) How many positive integers less than 60 are relatively prime to 60? _____
- (37) $1001011_2 =$ _____ ₄
- (38) Given: 2, 7, 9, 16, 25, 41, k, 107, 173, k = _____
- (39) The smallest root of $(5x + 1)^2 = \frac{1}{16}$ is _____
- *(40) $16^5 \div 8^3 \times 4^2 =$ _____
- (41) If $7^{(x-1)} = 50$, then $7^{(x+1)} =$ _____
- (42) The sum of the roots minus the product of the roots of $15x^2 - 13x + 10 = 0$ is _____
- (43) The area of a circle is 45π in². The radius of this circle is $a\sqrt{b}$ in., where $a > 1$. Find $a + b$. _____
- (44) $(503_6)(4_6) =$ _____ ₆
- (45) The coefficient of the x^4y^2 term in the expansion of $(2x + 3y)^6$ is _____
- (46) $503 \times 1111 =$ _____
- (47) $(i)^{53} = a\sqrt{b}$, where $a, b \in \{-1, 1\}$. Find $a + b$. _____
- (48) If $5x + y = 3$ and $2x - 3y = 5$, then $x =$ _____
- (49) A container has 2 gallons 2 quarts 2 pints of water in it. How many pints are left in the container if 5 quarts 7 pints are poured out? _____ pints
- *(50) $17 \times 34 \times 51 \times 68 =$ _____
- (51) The integral sides of a right triangle are x , y & 13, where $x < y < 13$ and $\text{GCF}(x, y) = 1$. Find xy . _____
- (52) The roots of $x^3 + 2x^2 - 15x = 0$ are d , e , and f . Find $(d + e)(e + f)(f + d)$. _____
- (53) $(89)^2 - (55)(144) =$ _____
- (54) The vertex of the parabola $x^2 - 8x + 15$ is (h, k) and $h + k =$ _____
- (55) The sum of the 5th triangular number and the third pentagonal number is _____
- (56) Given: 1, 0, 2, 3, 6, 10, 17, k, 46, k = _____
- (57) The probability of winning is 76%. The odds of winning is _____ (improper fraction)
- (58) Find the sum of the reciprocals of the first nine triangular numbers. _____
- (59) $534 \times 219 =$ _____
- *(60) $\left(\pi \times e \times \frac{\sqrt{5} + 1}{2}\right)^3 =$ _____
- (61) In how many ways can 3 boys and 2 girls be seated in a row if a boy has to be in the first seat? _____
- (62) ${}_5P_3 - {}_5C_3 =$ _____
- (63) $\sin\left(\frac{\pi}{4}\right)\cos\left(\frac{3\pi}{4}\right)\tan\left(\frac{5\pi}{4}\right) =$ _____
- (64) Y varies inversely as X, and $X = 5$ when $Y = 3$. Find Y when $X = 7$. Y = _____
- (65) The first four digits of the decimal for $\frac{27}{34}$ base 8 is 0. _____ base 8
- (66) $140^\circ \text{ F} =$ _____ $^\circ \text{ C}$
- (67) $\begin{bmatrix} 5 & 0 \\ 3 & 4 \end{bmatrix} \times \begin{bmatrix} 2 & 1 \\ 0 & 9 \end{bmatrix} = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$. $ad =$ _____
- (68) Change $\frac{11}{216}$ to a base 6 decimal. _____ base 6
- (69) The harmonic mean of the roots of $x^5 - 11x^4 + 47x^3 - 97x^2 + 96x - 36 = 0$ is _____
- *(70) The volume of a cone with a radius of 9" and a height of 21" is _____ cu. in.
- (71) Let $f(x) = 3x^2 - 5x - 2$. Find $f(-f(1))$. _____
- (72) How many positive 2-digit numbers divisible by 3 exist? _____
- (73) If $113_b = 75$, then $34_b =$ _____
- (74) The remainder of $(3x^2 - 5x - 2) \div (x - 4)$ is _____
- (75) $\lim_{x \rightarrow 0} \frac{x^2 + 3x}{x} =$ _____
- (76) $\int_1^2 (3 - 4x) =$ _____
- (77) $\frac{5! \times 0! - 4! \times 1!}{3! \times 2!} =$ _____
- (78) Let $f(x) = \frac{5x-4}{3} - 2$. Find $f^{-1}(-1)$. _____
- (79) $724 \times 17 =$ _____
- *(80) $3333 \times 222 \div 66 =$ _____

DO NOT DISTRIBUTE TO STUDENTS BEFORE OR DURING THE CONTEST

University Interscholastic League - Number Sense Answer Key HS • State • 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) 1,383 | (19) \$40.00 | (35) $\frac{5}{3}, 1\frac{2}{3}$ | (58) $1.8, \frac{9}{5}, 1\frac{4}{5}$ |
| (2) 909 | *(20) 147,663 —
163,205 | (36) 16 | (59) 116,946 |
| (3) 36 | (21) 36,100 | (37) 1023 | *(60) 2,507 — 2,770 |
| (4) 180 | (22) 891 | (38) 66 | (61) 72 |
| (5) 7 | (23) 1316 | (39) — .25, — $\frac{1}{4}$ | (62) 50 |
| (6) 150 | (24) 144 | *(40) 31,130 — 34,406 | (63) — .5, — $\frac{1}{2}$ |
| (7) 180 | (25) — 36 | (41) 2,450 | (64) $\frac{15}{7}, 2\frac{1}{7}$ |
| (8) 48 | (26) 13 | (42) .2, $\frac{1}{5}$ | (65) 6444 |
| (9) 450 | (27) 6 | (43) 8 | (66) 60 |
| *(10) 2,032 — 2,244 | (28) 4 | (44) 3220 | (67) 390 |
| (11) 16 | (29) 25 | (45) 2,160 | (68) .015 |
| (12) $2.5, \frac{5}{2}, 2\frac{1}{2}$ | *(30) 40,909 — 45,214 | (46) 558,833 | (69) $1.875, \frac{15}{8}, 1\frac{7}{8}$ |
| (13) 841 | (31) 16 | (47) 0 | *(70) 1,693 — 1,870 |
| (14) 2,491 | (32) 64 | (48) $\frac{14}{17}$ | (71) 26 |
| (15) $\frac{5}{27}$ | (33) 105 | (49) 5 | (72) 30 |
| (16) $45\frac{1}{2}$ | (34) 529 | *(50) 1,904,279 —
2,104,729 | (73) 28 |
| (17) 14 | | (51) 60 | (74) 26 |
| (18) 4 | | (52) 30 | (75) 3 |
| | | (53) 1 | (76) — 3 |
| | | (54) 3 | (77) 8 |
| | | (55) 27 | (78) $1.4, \frac{7}{5}, 1\frac{2}{5}$ |
| | | (56) 28 | (79) 12,308 |
| | | (57) $\frac{19}{6}$ | *(80) 10,651 — 11,771 |