

---

# 2022 UH MATHEMATICS CONTEST

## NUMBER SENSE EXAM

---

**Directions:** Read the instructions carefully before you begin this exam. You will have 30 minutes to complete this exam. Solve accurately as many problems as you can in the order in which they appear and enter your answers using the panel on your screen. ALL PROBLEMS ARE TO BE SOLVED MENTALLY. Make NO calculations on paper. Enter the answer correctly for each question. You cannot erase anything once the numbers are entered. Five points will be awarded for correct answers and four points will be deducted for each problem not solved correctly and for each problem skipped. No deduction is taken for problems after the last problem attempted. All answers should be either (simplified) fractions, or decimals, or just integers. Mixed numbers are not allowed. Answers should be written in the most efficient form possible.

---

- (1)  $11 \times 65 =$  \_\_\_\_\_
- (2)  $\frac{6}{13} \times \frac{26}{15} \times \frac{5}{12} =$  \_\_\_\_\_ (fraction)
- (3)  $31.5 \div .09 =$  \_\_\_\_\_
- (4) MDCXLIV = \_\_\_\_\_
- (5)  $3 + 6 \div 9 \times 12 - 15 =$  \_\_\_\_\_
- (6) Which is smaller:  $\frac{7}{12}$  or  $\frac{6}{11}$ ? \_\_\_\_\_
- (7)  $20 \times 80 + 20 \times 90 =$  \_\_\_\_\_
- (8) The negative reciprocal of 3.5 is \_\_\_\_\_ (fraction)
- (9)  $5 + 2 - 3 \times 5 \div (2 - 4) - 2 \div (-2) + 1 \times 6$   
 $=$  \_\_\_\_\_ (decimal)
- (10) 1516201  $\div$  9 has a remainder of \_\_\_\_\_
- (11)  $637 + 642 + 647 =$  \_\_\_\_\_
- (12)  $\frac{5}{9} - \frac{9}{10} =$  \_\_\_\_\_ (fraction)
- (13)  $\frac{2}{7} + 2\frac{1}{8} =$  \_\_\_\_\_ (fraction)
- (14) The LCM of 16, 20, and 32 is \_\_\_\_\_
- (15) The arithmetic mean of 17, 28, 31, and 36 is \_\_\_\_\_
- (16)  $\frac{5}{6} - \frac{5}{12} - \frac{5}{24} =$  \_\_\_\_\_ (fraction)
- (17) 48 has \_\_\_\_\_ positive integral divisors.
- (18) If 11 pens cost \$1.43, then a dozen pens  
cost \$ \_\_\_\_\_ (decimal)
- (19)  $9' \times 6' \times 3' =$  \_\_\_\_\_ cubic yards
- (20) 12.7 is \_\_\_\_\_ % (decimal) of 25.
- (21) The largest prime divisor of 253 is \_\_\_\_\_
- (22)  $(44 + 55 \times 66) \div 7$  has a remainder of \_\_\_\_\_
- (23) 22 is what % less than 88? \_\_\_\_\_ %
- (24) The sum of the first 4 odd prime numbers is \_\_\_\_\_
- (25) The GCD of 78 and 26 is \_\_\_\_\_
- (26)  $MMVII \div IX =$  \_\_\_\_\_ (Arabic Numeral)
- (27)  $4^{-1} + 4^{-2} =$  \_\_\_\_\_ (fraction)
- (28)  $2 + |1 - 2| - |3 - 1| + 2 =$  \_\_\_\_\_
- (29) If  $3 - 4x = 5$  then  $6x - 7 =$  \_\_\_\_\_
- (30) If  $(2x - 5)^2 = ax^2 + bx + c$ , then  $a + b - c =$  \_\_\_\_\_
- (31) A pentagon has \_\_\_\_\_ distinct diagonals
- (32) Let  $P = 5$ ,  $Q = 3$ , and  $R = 2$ . Find  $PQ^R$ . \_\_\_\_\_
- (33) The simple interest of \$600.00 at 5% for 4 years is \$ \_\_\_\_\_
- (34) Find the area of the rhombus whose diagonals are 22  
and 18. \_\_\_\_\_ sq. units.
- (35) Given the set of  $\{1, 3, 6, 10, 15, p, 28, 36, q, \dots\}$ , then  
 $q - p =$  \_\_\_\_\_
- (36)  $11 \times 24 \times 25 =$  \_\_\_\_\_
- (37)  $54^2 - 45^2 =$  \_\_\_\_\_
- (38)  $121 \times 103 =$  \_\_\_\_\_
- (39) 24% of 25 is 20% of \_\_\_\_\_
- (40) A cube has sides equal to 4 in. The surface area of the  
cube is \_\_\_\_\_ sq. in.
- (41)  $3(3!) \times \frac{1}{2}(4!) =$  \_\_\_\_\_

- (42) Find the slope of the line perpendicular to the line  $6x - 2y = 4$ . \_\_\_\_\_ (fraction)
- (43) If  $\sqrt{4 + \sqrt{4 + 4\sqrt{x}}} = 4$ , then  $x =$  \_\_\_\_\_
- (44) A number times three gives the same result as that number added to 9. What is the number? \_\_\_\_\_ (fraction)
- (45)  $|-(-2 - 4) - |6 - 8|| =$  \_\_\_\_\_
- (46) The cube root of 681472 is \_\_\_\_\_
- (47)  $.3222\dots =$  \_\_\_\_\_ (fraction)
- (48) The tax on a \$36 book is \$2.70. The tax rate is \_\_\_\_\_ percent (decimal)
- (49) The discriminant of  $x^2 - 13x + 20 = 0$  is \_\_\_\_\_
- (50)  $1011101_2 =$  \_\_\_\_\_ 8
- (51) If  $7x^3 - 2x^2 - x - 3 = 0$ , then the product of the roots is \_\_\_\_\_ (fraction)
- (52)  $1^2 + 1^2 + 2^2 + 3^2 + 5^2 + 8^2 =$  \_\_\_\_\_
- (53)  $991^2 =$  \_\_\_\_\_
- (54) If  $x - y = 5$  and  $xy = 2$ , then  $x^3 - y^3 =$  \_\_\_\_\_
- (55) The next term of 1, 1, 2, 4, 3, 9, 4, ... is \_\_\_\_\_
- (56) The smallest root of  $(x + 3)^2 = \frac{1}{4}$  is \_\_\_\_\_ (fraction)
- (57) The vertex of  $y = 2x^2 - 3x + 8$  is  $(h, k)$ .  $h =$  (fraction)
- (58) In a  $45^\circ - 45^\circ$  right triangle, one leg is 5 cm. The other leg is \_\_\_\_\_ cm.
- (59) The units digit of  $9^6$  is \_\_\_\_\_
- (60)  $18 \times \frac{19}{20} =$  \_\_\_\_\_ (decimal)
- (61)  $17_8 + 35_8 - 62_8 =$  \_\_\_\_\_ 8
- (62) The perimeter of a right triangle with a base of 7 and a hypotenuse of 25 is \_\_\_\_\_
- (63) The tenth term of 8, 11, 14, 17, ... is \_\_\_\_\_
- (64) Let  $3x - y = 1$  and  $x - 2y = 2$ . Find  $y$ . \_\_\_\_\_
- (65) The area of a square increased from 49 to 81 sq. units. The increase in perimeter was \_\_\_\_\_ units.
- (66) The sum of the coefficients of the  $x^3y$  term and the  $xy^3$  term of  $(x + y)^4$  is \_\_\_\_\_
- (67) Two numbers are in the ratio 3:5. Their sum is 40. Find the larger number. \_\_\_\_\_
- (68)  $76^2 + 53^2 =$  \_\_\_\_\_
- (69) The foci of  $25x^2 + 9y^2 = 225$  are  $(a, k)$  and  $(a, -k)$ . Find  $k$ . \_\_\_\_\_
- (70) If  $\log_{16}(4x) = \frac{3}{4}$ , then  $x =$  \_\_\_\_\_
- (71) How many 3-digit positive integers are multiples of 11?
- (72) An equilateral triangle has an area of  $27\sqrt{3}$  sq. cm. Its height is \_\_\_\_\_ cm.
- (73)  $28^2 \div 14^2 \times 7^2 =$  \_\_\_\_\_
- (74)  $\frac{(x^2 + 6x + 9)}{(x + 3)} \times \frac{(x^2 - 6x + 9)}{(x^2 - 9)} = x -$  \_\_\_\_\_
- (75) The line of symmetry of the parabola  $y = x^2 + 6x + 13$  is  $x =$  \_\_\_\_\_
- (76) The conjugate of  $3 + 4i$  is  $a + bi$ . Find  $a + b$ . \_\_\_\_\_
- (77) If  $x$  and  $y$  vary inversely and  $x = 3$  when  $y = 20$ , find  $x$  when  $y = 5$ . \_\_\_\_\_
- (78)  $271 \times 314 =$  \_\_\_\_\_
- (79) Let  $f(x) = 3x^2 - x - 1$ . Find  $f(f(1))$ . \_\_\_\_\_
- (80) If  $\begin{bmatrix} 5 & 1 \\ 3 & 2 \end{bmatrix} \times \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ , then  $c =$  \_\_\_\_\_
- (81) If  $\cos(\theta) = -.25$ , then  $\sec(\theta) =$  \_\_\_\_\_
- (82) If  $\log_b 4 = .5$  and  $\log_b x = 2$ , then  $x =$  \_\_\_\_\_
- (83) Change 0.123 base-4 to a base-10 fraction \_\_\_\_\_
- (84) The shortest distance between  $(0, -2)$  and  $5x + 12y = 11$  is \_\_\_\_\_ (fraction)
- (85) The determinant of  $\begin{bmatrix} 3a & a \\ 2 & 3 \end{bmatrix} = 42$ . Find  $a$ . \_\_\_\_\_
- (86) The volume of a right cylinder that is 9 in. high with a base radius 2 in. is \_\_\_\_\_  $\pi$  cu. in.
- (87)  $\cos^2(45^\circ) - \sin^2(45^\circ) =$  \_\_\_\_\_
- (88)  $44^2 - 47^2 + 50^2 - 53^2 =$  \_\_\_\_\_
- (89)  $\frac{1}{15} + \frac{1}{21} + \frac{1}{28} =$  \_\_\_\_\_ (fraction)
- (90) How many 3 digit numbers are even? \_\_\_\_\_
- (91) If the range of  $f(x) = a \sin(bx) + c$  is  $-3 \leq y \leq 11$ , and  $a > 0$ , then  $a =$  \_\_\_\_\_
- (92) If  $f(x) = \frac{3x - 4}{5}$ , then  $f^{-1}(3) =$  \_\_\_\_\_ (fraction)
- (93) The range of the function  $y = |2x| - 3$  is  $y \geq$  \_\_\_\_\_
- (94) The graph of  $f(x) = \frac{(x^2 - 5x + 6)}{(x^2 - 4)}$  has a hole at  $x =$  \_\_\_\_\_

- (95) A number is randomly drawn from the set  $\{1, 2, 3, 4, 5\}$ . What is the probability that the number drawn is a prime number? \_\_\_\_\_ %
- (96)  $\int_{-1}^2 3x^2 dx =$  \_\_\_\_\_
- (97)  $25^\circ\text{C} =$  \_\_\_\_\_  $^\circ\text{F}$
- (98)  $(x^3 + 4x^2 + 6) \div (x + 5)$  has remainder of \_\_\_\_\_.
- (99) If  $f(x) = 3x^2 - 1$  and  $g(x) = 2x - 3$ , then find  $f(g(4))$ .
- (100) The minimum value of  $y = x^2 + 4x$  is at  $y =$  \_\_\_\_\_
- (101)  $\left(8, \frac{2\pi}{3}\right)$  are polar coordinates for the Cartesian coordinates  $(x, y)$ .  $x =$  \_\_\_\_\_
- (102) If  $f'(x) = 2$  and  $f(3) = 11$ , find  $f(18)$ . \_\_\_\_\_
- (103) The slope of the line tangent to  $y = 2x^3 - x + 1$  at the point  $(2, 15)$  is \_\_\_\_\_
- (104) If  $f(x) = x^4 - x^3 + x^2 - x + 1$ , then  $f''(1) =$  \_\_\_\_\_