

# Number Sense

## Multiple-Choice Questions

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1. Jeremy's bedroom has two doors leading into the hallway. His house has four doors leading to the outside. Using the doorways, in how many different ways can Jeremy leave his room and go outside?
- (1) 8
  - (2) 6
  - (3) 5
  - (4) 4

**Correct Answer:** (1) 8. To answer this question, use the Counting Principle. In this problem, multiply the number of doors leading to the hall by the number of doors leading to the outside, and that is  $2 \times 4 = 8$ . (*Operations*)

2. Which expression is equivalent to  $x^{-4}$ ?
- (1)  $\frac{1}{x^4}$
  - (2)  $x^4$
  - (3)  $-4x$
  - (4) 0

**Correct Answer:** (1)  $\frac{1}{x^4}$ . Change the base to its reciprocal and then rewrite the exponent as a positive. Do not move the coefficient. (*Operations*)

3. Which number is irrational?
- (1)  $\sqrt{9}$
  - (2)  $\sqrt{8}$
  - (3) 0.3333
  - (4)  $\frac{2}{3}$

**Correct Answer:** (2)  $\sqrt{8}$ . This number is irrational because its value is a non-repeating, non-terminating decimal. (*Number Systems*)

4. The amount of time,  $t$ , in seconds, it takes an object to fall a distance,  $d$ , in meters, is expressed by the formula  $t = \sqrt{\frac{d}{4.9}}$ . Approximately how long will it take an object to fall 75 meters?
- (1) 0.26 sec
  - (2) 2.34 sec
  - (3) 3.9 sec
  - (4) 7.7 sec

**Correct Answer:** (3) 3.9 sec. Since  $d$  represents the distance an object falls and it's given that the object falls 75 meters, plug 75 in for  $d$  and solve for  $t$ . Use a calculator. (*Operations*)

5. At the beginning of her mathematics class, Mrs. Reno gives a warm-up problem. She says, "I am thinking of a number such that 6 less than the product of 7 and this number is 85." Which number is she thinking of?
- (1) 11
  - (2) 13
  - (3) 84
  - (4) 637

**Correct Answer:** (2) 13. Try each choice.  $7(13) - 6 = 85$ . So choice (2) works.

**Incorrect Choices:**  $7(11) - 6 \neq 85$ , so choice (1) does not work.  $7(84) - 6 \neq 85$ , so choice (3) does not work.  $7(637) - 6 \neq 85$ , so choice (4) does not work. (*Operations*)

6. If  $x^3 < x < \frac{1}{x}$ , then  $x$  could be equal to
- (1) 1
  - (2) 5
  - (3)  $\frac{6}{5}$
  - (4)  $\frac{1}{5}$

**Correct Answer:** (4)  $\frac{1}{5}$ . For 1 over  $x$  to be larger than  $x$ ,  $x$  would have to be less than 1, but not equal to zero. (*Operations*)

7. Which equation illustrates the distributive property?

- (1)  $5(a + b) = 5a + 5b$
- (2)  $a + b = b + a$
- (3)  $a + (b + c) = (a + b) + c$
- (4)  $a + 0 = a$

**Correct Answer:** (1)  $5(a + b) = 5a + 5b$ . Using the distributive property means to take an expression, in this case, 5, that is being multiplied by a quantity in a set of parentheses ( $a + b$ ), and multiply it by each expression in the parentheses. (*Number Systems*)

8. If  $M$  and  $A$  represent integers,  $M + A = A + M$  is an example of which property?

- (1) commutative
- (2) associative
- (3) distributive
- (4) closure

**Correct Answer:** (1) commutative. The commutative property of addition states that you can change the order in which numbers are added without affecting the sum. The associative property says that you can group three numbers differently without affecting their sum, such as  $A + (B + C) = (A + B) + C$ . The distributive property combines the operations of multiplication and addition such as  $a(b + c) = ab + ac$ . Closure says that within a set of numbers and for a certain operation, an answer remains in that particular set of numbers. For example, when you add two integers, your answer will always be another integer. (*Number Systems*)

9. The number  $1.56 \times 10^{-2}$  is equivalent to

- (1) 156
- (2) 0.156
- (3) 0.0156
- (4) 0.00156

**Correct Answer:** (3) 0.0156. The  $-2$  power tells us to move the decimal point 2 units left. (*Operations*)

10. The mass of an orchid seed is approximately 0.0000035 gram. Written in scientific notation, that mass is equivalent to  $3.5 \times 10^n$ . What is the value of  $n$ ?

- (1)  $-8$
- (2)  $-7$
- (3)  $-6$
- (4)  $-5$

**Correct Answer:** (3)  $-6$ . To get from 3.5 to 0.0000035, you have to move the decimal to the left 6 places so  $n$  is the number of places you move the decimal, and if you move to the left, then  $n$  is negative. (*Operations*)

- 11.** Which statement is logically equivalent to the statement “If you are an elephant, then you do not forget”?
- (1) If you do not forget, then you are an elephant.
  - (2) If you do not forget, then you are not an elephant.
  - (3) If you are an elephant, then you forget.
  - (4) If you forget, then you are not an elephant.

**Correct Answer: (4)** If you forget, then you are not an elephant. The phrase logically equivalent indicates the answer should be the contrapositive. The contrapositive switches and negates the two parts of the statement. (*Operations*)

- 12.** Which property of real numbers is illustrated by the equation  $-\sqrt{3} + \sqrt{3} = 0$ ?
- (1) additive identity
  - (2) commutative property of addition
  - (3) associative property of addition
  - (4) additive inverse

**Correct Answer: (4)** additive inverse. The additive inverse of a given number is the number that when added to the given number yields the additive identity, 0. (*Number Systems*)

- 13.** A cake recipe calls for 1.5 cups of milk and 3 cups of flour. Seth made a mistake and used 5 cups of flour. How many cups of milk should he use to keep the proportions correct?
- (1) 1.75
  - (2) 2
  - (3) 2.25
  - (4) 2.5

**Correct Answer: (4)** 2.5. Set up a proportion to solve this such as  $\frac{1.5}{3} = \frac{n}{5}$ , where  $n$  = cups of milk. Set the product of one diagonal ( $1.5 \times 5$ ) equal to the product of the other diagonal ( $3 \times n$ ) and solve to get  $n = 2.5$ . (*Operations*)

**14.** Cole's Ice Cream Stand serves sixteen different flavors of ice cream, three types of syrup, and seven types of sprinkles. If an ice cream sundae consists of one flavor of ice cream, one type of syrup, and one type of sprinkles, how many different ice cream sundaes can Cole serve?

- (1) 10,836
- (2) 336
- (3) 3
- (4) 26

**Correct Answer: (2)** 336. Using the Counting Principle, multiply the number of flavors, number of syrups, and number of sprinkles together ( $16 \cdot 3 \cdot 7$ ) to get 336, the number of different ice cream sundaes that can be made. (*Operations*)

**15.** What is the multiplicative inverse of  $\frac{3}{4}$ ?

- (1) -1
- (2)  $\frac{4}{3}$
- (3)  $-\frac{4}{3}$
- (4)  $-\frac{3}{4}$

**Correct Answer: (2)**  $\frac{4}{3}$ . The multiplicative inverse is the reciprocal of the number, and  $\frac{4}{3}$  is the reciprocal of  $\frac{3}{4}$ . (*Number Theory*)

**16.** The expression  $\sqrt{50} + \sqrt{32}$  is equivalent to

- (1)  $9\sqrt{2}$
- (2)  $\sqrt{82}$
- (3) 6
- (4) 18

**Correct Answer: (1)**  $9\sqrt{2}$ . First simplify each radical,  $\sqrt{50} = 5\sqrt{2}$  and  $\sqrt{32} = 4\sqrt{2}$ . Now add the radicals together because they're like radicals and get  $9\sqrt{2}$ . (*Operations*)

17. What is the value of  $3^0 + 3^{-2}$ ?

- (1) 0
- (2)  $\frac{1}{9}$
- (3)  $1\frac{1}{9}$
- (4) 6

**Correct Answer: (3)**  $1\frac{1}{9}$ . You can enter this entire expression into your calculator to get the correct answer. Otherwise, recall that anything to the zero power equals one. Negative powers ask us to take the reciprocal of the same positive power. So,  $3^{-2} = \frac{1}{3^2}$  or  $\frac{1}{9}$ .  $1 + \frac{1}{9}$  is choice (3). (*Operations*)

18. The statement “ $x$  is *not* the square of an integer, and  $x$  is a multiple of 3” is true when  $x$  is equal to

- (1) 9
- (2) 18
- (3) 32
- (4) 36

**Correct Answer: (2)** 18. The numbers in choices (2) and (3) are not squares of an integer. The number in choice 2 is a multiple of 3 since  $6(3) = 18$ . (*Number Theory*)

19. If  $r = 2$  and  $s = -7$ , what is the value of  $|r| - |s|$ ?

- (1) 5
- (2)  $-5$
- (3) 9
- (4)  $-9$

**Correct Answer: (2)**  $-5$ . Evaluate the absolute value of  $r$ , which equals 2 and the absolute value of  $s$ , which equals 7 and subtract  $2 - 7$  to get  $-5$ . (*Operations*)

20. The expression  $-|-7|$  is equivalent to

- (1) 1
- (2) 0
- (3) 7
- (4)  $-7$

**Correct Answer: (4)**  $-7$ . The first step is to take the absolute value of  $-7$ , which is 7, and then multiply it by the negative outside the absolute value and obtain  $-7$ . (*Operations*)

**21.** Which equation illustrates the associative property of addition?

- (1)  $x + y = y + x$
- (2)  $3(x + 2) = 3x + 6$
- (3)  $(3 + x) + y = 3 + (x + y)$
- (4)  $3 + x = 0$

**Correct Answer: (3)**  $(3 + x) + y = 3 + (x + y)$ . The associative property of addition states that if more than two numbers are added, the order in which they are added does not matter. (*Operations*)

**22.** On a scale drawing of a new school playground, a triangular area has sides with lengths of 8 centimeters, 15 centimeters, and 17 centimeters. If the triangular area located on the playground has a perimeter of 120 meters, what is the length of its longest side?

- (1) 24 m
- (2) 40 m
- (3) 45 m
- (4) 51 m

**Correct Answer: (4)** 51 m. First, find the perimeter of the triangle in the scale drawing and then set up a proportion comparing the longest side and perimeter of the scale drawing to the longest side and perimeter of the actual triangle, such as  $\frac{17}{40} = \frac{n}{120}$  and solve for  $n$ . (*Operations*)

**23.** Rashawn bought a CD that cost \$18.99 and paid \$20.51, including sales tax. What was the rate of the sales tax?

- (1) 5%
- (2) 2%
- (3) 3%
- (4) 8%

**Correct Answer: (4)** 8%.  $\$20.51 - \$18.99 = \$1.52$ , the amount of money spent on tax. Sales tax is  $\frac{1.52}{18.99} = 0.08 = 8\%$ . (*Operations*)

**24.** Which expression has the *smallest* value?

- (1)  $-\pi$
- (2)  $-\sqrt{10}$
- (3)  $\frac{-16}{5}$
- (4)  $-3.02$

**Correct Answer: (3)**  $\frac{-16}{5}$ . Using a calculator, convert each choice into a decimal equivalent, and since all the choices are negative, the correct answer would be one with the largest absolute value. That is choice 3. (*Number Theory*)

**25.** If  $a$  and  $b$  are both odd integers, which expression must always equal an odd integer?

- (1)  $a + b$
- (2)  $a - b$
- (3)  $a \cdot b$
- (4)  $\frac{a}{b}$

**Correct Answer:** (3)  $a \cdot b$ . If you can't remember the rule that the product of two odd integers is an odd integer, then an effective way to answer this question is to plug in odd integers for  $a$  and  $b$  into the choices. If you pick  $a = 3$  and  $b = 5$ , then choices 1 and 2 result in an even integer, choice 3 is not an integer, and choice 3 results in an odd integer. (*Number Theory*)

**26.** The multiplicative inverse of  $-\frac{1}{3}$  is

- (1)  $\frac{1}{3}$
- (2)  $-\frac{1}{3}$
- (3) 3
- (4) -3

**Correct Answer:** (4) -3. When a number and its multiplicative inverse are multiplied, the result is the multiplicative identity of one. A number multiplied by its reciprocal equals one. The reciprocal of  $-\frac{1}{3}$  is -3. In equation form,  $-\frac{1}{3}x = 1$ . Choice (4), -3, satisfies this equation. (*Number Systems*)

**27.** The value of  $\frac{7!}{3!}$  is

- (1) 840
- (2) 24
- (3) 7
- (4) 4

**Correct Answer:** (1) 840. Plug this expression into a calculator or do  $\frac{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3 \cdot 2 \cdot 1}$  to get 840. (*Operations*)

**28.** When  $\sqrt{72}$  is expressed in simplest  $a\sqrt{b}$  form, what is the value of  $a$ ?

- (1) 6
- (2) 2
- (3) 3
- (4) 8

**Correct Answer:** (1) 6. To simplify radicals, find the largest perfect square factor. In this case, the largest perfect square factor is 36, so  $\sqrt{72} = \sqrt{36} \cdot \sqrt{2} = 6\sqrt{2}$ . Since  $a$  is the number outside the radical,  $a$  is 6. (*Operations*)

**29.** Which expression is an example of the associative property?

- (1)  $(x + y) + z = x + (y + z)$
- (2)  $x + y + z = z + y + x$
- (3)  $x(y + z) = xy + xz$
- (4)  $x \cdot 1 = x$

**Correct Answer: (1)**  $(x + y) + z = x + (y + z)$ . Associativity states that when more than two numbers are added, they can be added in pairs regardless of order. (*Number Theory*)

**30.** The equation  $\clubsuit(\Delta + \heartsuit) = \clubsuit\Delta + \clubsuit\heartsuit$  is an example of the

- (1) associative law
- (2) commutative law
- (3) distributive law
- (4) transitive law

**Correct Answer: (3)** distributive law. The distributive law means to take an expression that is being multiplied by a set of parentheses (the left of the equation) and that expression is multiplied by every term inside the parentheses to get the right side of the equation. (*Number Theory*)

**31.** If the mass of a proton is  $1.67 \times 10^{-24}$  gram, what is the mass of 1,000 protons?

- (1)  $1.67 \times 10^{-24}$ g
- (2)  $1.67 \times 10^{-23}$ g
- (3)  $1.67 \times 10^{-22}$ g
- (4)  $1.67 \times 10^{-21}$ g

**Correct Answer: (4)**  $1.67 \times 10^{-21}$ g.  $1.67 \times 10^{-24} \times 1000 = 1.67 \times 10^{-24} \times 10^3 = 1.67 \times 10^{-21}$ . (*Operations*)

**32.** The height of a golf ball hit into the air is modeled by the equation  $h = -16t^2 + 48t$ , where  $h$  represents the height, in feet, and  $t$  represents the number of seconds that have passed since the ball was hit. What is the height of the ball after 2 seconds?

- (1) 16 ft.
- (2) 32 ft.
- (3) 64 ft.
- (4) 80 ft.

**Correct Answer: (2)** 32 ft. Since  $t$  represents time and 2 is given for time, plug 2 in for  $t$  ( $-16(2)^2 + 48(2)$ ) and solve for  $h$ , which equals 32 feet. (*Operations*)

**33.** The expression  $0.62 \times 10^3$  is equivalent to

- (1) 0.062
- (2) 62,000
- (3)  $6.2 \times 10^4$
- (4)  $6.2 \times 10^2$

**Correct Answer: (4)**  $6.2 \times 10^2$ . In numeric form, the problem is 620, which is not choice 1 or choice 2. Choice 3 written out is 62,000, and choice 4 is 620, so it must be choice 4. (*Operations*)

**34.** What is the identity element for  $\clubsuit$  in the accompanying table?

$\clubsuit$	r	s	t	u
r	t	r	u	s
s	r	s	t	u
t	u	t	s	r
u	s	u	r	t

- (1)  $r$
- (2)  $s$
- (3)  $t$
- (4)  $u$

**Correct Answer: (2)**  $s$ . Notice the heading is  $r,s,t,u$  in that order. Look in the table in which those letters are in that same order down a column and across a row. In column  $s$  and row  $s$ , the letters are in the same order as the heading. The identity element doesn't change what is given. (*Number Theory*)

**35.** Which equation illustrates the multiplicative inverse property?

- (1)  $1 \cdot x = x$
- (2)  $x \cdot \frac{1}{x} = 1$
- (3)  $1 \cdot 0 = 0$
- (4)  $-1 \cdot x = -x$

**Correct Answer: (2)**  $x \cdot \frac{1}{x} = 1$ . The multiplicative inverse property states that a number multiplied by its reciprocal equals 1. (*Number Theory*)

**36.** Which numbers are arranged from smallest to largest?

- (1)  $3.14, \frac{22}{7}, \pi, \sqrt{9.1}$
- (2)  $\sqrt{9.1}, \pi, 3.14, \frac{22}{7}$
- (3)  $\sqrt{9.1}, 3.14, \frac{22}{7}, \pi$
- (4)  $\sqrt{9.1}, 3.14, \pi, \frac{22}{7}$

**Correct Answer:** (4)  $\sqrt{9.1}, 3.14, \pi, \frac{22}{7}$ . Convert the non-decimal numbers to decimals and put the numbers in order.  $\sqrt{9.1} = 3.0166, \pi = 3.14159, \frac{22}{7} = 3.14285$ . The correct choice is (4). (*Number Theory*)

**37.** What is the first step in simplifying the expression  $(2 - 3 \times 4 + 5)^2$ ?

- (1) square 5
- (2) add 4 and 5
- (3) subtract 3 from 2
- (4) multiply 3 by 4

**Correct Answer:** (4) multiply 3 by 4. The order of operations states that the operations in the parentheses are performed first. Out of these, multiplication is performed before addition/subtraction. (*Operations*)

**38.** What is the value of  $2^{-3}$ ?

- (1)  $\frac{1}{6}$
- (2)  $\frac{1}{8}$
- (3)  $-6$
- (4)  $-8$

**Correct Answer:** (2)  $\frac{1}{8}$ . In this exponent problem, the base is 2 and the exponent is  $-3$ . To change an exponent to a positive number, take the reciprocal of the base and your exponent will then be positive. The reciprocal of the base 2 is  $\frac{1}{2}$ , so the new problem becomes  $\left(\frac{1}{2}\right)^3$  and  $1^3 = 1$  and  $2^3 = 8$  so the answer is choice (2). (*Operations*)

**39.** Which list shows the numbers  $|-0.12|$ ,  $\sqrt{\frac{1}{82}}$ ,  $\frac{1}{8}$ ,  $\frac{1}{9}$  in order from smallest to largest?

- (1)  $|-0.12|$ ,  $\frac{1}{8}$ ,  $\frac{1}{9}$ ,  $\sqrt{\frac{1}{82}}$   
 (2)  $\sqrt{\frac{1}{82}}$ ,  $|-0.12|$ ,  $\frac{1}{9}$ ,  $\frac{1}{8}$   
 (3)  $\frac{1}{8}$ ,  $\frac{1}{9}$ ,  $\sqrt{\frac{1}{82}}$ ,  $|-0.12|$   
 (4)  $\sqrt{\frac{1}{82}}$ ,  $\frac{1}{9}$ ,  $|-0.12|$ ,  $\frac{1}{8}$

**Correct Answer:** (4)  $\sqrt{\frac{1}{82}}$ ,  $\frac{1}{9}$ ,  $|-0.12|$ ,  $\frac{1}{8}$

$$|-0.12| = 0.12, \sqrt{\frac{1}{82}} = 0.1104315261, \frac{1}{8} = 0.125, \frac{1}{9} = 0.11111111.$$

The order from smallest to largest is: 0.1104315261, 0.11111111, 0.12, 0.125. (*Operations*)

**40.** What is an irrational number?

- (1)  $0.\bar{3}$   
 (2)  $\frac{3}{8}$   
 (3)  $\sqrt{49}$   
 (4)  $\pi$

**Correct Answer:** (4)  $\pi$ . An irrational number is a number that is a non-terminating and non-repeating decimal.  $\pi$  is a decimal that does not end or repeat. (*Number Theory*)

**41.** What is the sum of  $6 \times 10^3$  and  $3 \times 10^2$ ?

- (1)  $6.3 \times 10^3$   
 (2)  $9 \times 10^5$   
 (3)  $9 \times 10^6$   
 (4)  $18 \times 10^5$

**Correct Answer:** (1)  $6.3 \times 10^3$ .  $6 \times 10^3 = 6,000$  and  $3 \times 10^2 = 300$  so  $6,000 + 300 = 6,300 = 6 \times 10^3$ . (*Operations*)

**42.** What is the sum of  $5\sqrt{7}$  and  $3\sqrt{28}$ ?

- (1)  $9\sqrt{7}$
- (2)  $11\sqrt{7}$
- (3)  $60\sqrt{7}$
- (4)  $8\sqrt{35}$

**Correct Answer: (2)**  $11\sqrt{7}$ . In order to add radicals, the radicands must be like. You need to simplify  $3\sqrt{28}$ , which is  $6\sqrt{7}$ . Now add the numbers outside the radical and carry over the radical to the answer. So  $5\sqrt{7} + 6\sqrt{7} = 11\sqrt{7}$ . (*Operations*)

**43.** Expressed in simplest radical form, the product of  $\sqrt{6} \cdot \sqrt{15}$  is

- (1)  $\sqrt{90}$
- (2)  $3\sqrt{10}$
- (3)  $9\sqrt{10}$
- (4)  $3\sqrt{15}$

**Correct Answer: (2)**  $3\sqrt{10}$ .  $\sqrt{6} \cdot \sqrt{15} = \sqrt{90} = \sqrt{9} \cdot \sqrt{10} = 3\sqrt{10}$ . (*Operations*)

**44.** What is the sum of  $\sqrt{50}$  and  $\sqrt{32}$ ?

- (1)  $\sqrt{82}$
- (2)  $20\sqrt{20}$
- (3)  $9\sqrt{2}$
- (4)  $\sqrt{2}$

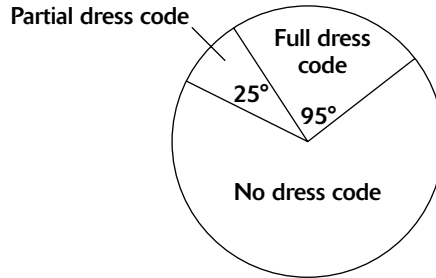
**Correct Answer: (3)**  $9\sqrt{2}$ .  $\sqrt{50} = \sqrt{25}\sqrt{2} = 5\sqrt{2}$ ;  $\sqrt{32} = \sqrt{16}\sqrt{2} = 4\sqrt{2}$ ;  $\sqrt{50} + \sqrt{32} = 5\sqrt{2} + 4\sqrt{2} = 9\sqrt{2}$ . (*Operations*)

**45.** Which statement best illustrates the additive identity property?

- (1)  $6 + 2 = 2 + 6$
- (2)  $6(2) = 2(6)$
- (3)  $6 + (-6) = 0$
- (4)  $6 + 0 = 6$

**Correct Answer: (4)**  $6 + 0 = 6$ . The additive identity is 0, and it implies that a number plus 0 remains unchanged. (*Number Theory*)

- 46.** Nine hundred students were asked whether they thought their school should have a dress code. A circle graph was constructed to show the results. The central angles for two of the three sectors are shown in the accompanying diagram. What is the number of students who felt that the school should have *no* dress code?



- (1) 600
- (2) 180
- (3) 300
- (4) 360

**Correct Answer: (1)** 600. First find the central angle representing the no dress code. All the central angles in a circle add to  $360^\circ$  and the no dress code is  $(360 - 95 - 25)$ , which equals  $240^\circ$ . Now set up a proportion to solve for the number of students that you'll let equal  $n$ . The proportion is  $\frac{240}{360} = \frac{n}{900}$ . Solve for  $n$  to get 600 students. (*Operations*)

- 47.** If  $x = 3$ , which statement is *false*?

- (1)  $x$  is prime, and  $x$  is odd.
- (2)  $x$  is odd, or  $x$  is even.
- (3)  $x$  is not prime, and  $x$  is odd.
- (4)  $x$  is odd, and  $2x$  is even.

**Correct Answer: (3)**  $x$  is not prime, and  $x$  is odd. The statement " $x$  is not prime" is false because  $x = 3$  is a prime number since it only divides itself and 1. (*Number Theory*)

- 48.** The size of a certain type of molecule is 0.00009078 inch. If this number is expressed as  $9.078 \times 10^n$ , what is the value of  $n$ ?

- (1)  $-5$
- (2)  $5$
- (3)  $-8$
- (4)  $8$

**Correct Answer: (1)**  $-5$ . To rewrite 9.078 as 0.00009078 you need to move the decimal point 5 places to the left, thus the value of  $n$  is  $-5$ . (*Operations*)

**49.** Given the statement: “If  $x$  is a rational number, then  $\sqrt{x}$  is irrational.” Which value of  $x$  makes the statement *false*?

- (1)  $\frac{3}{2}$
- (2) 2
- (3) 3
- (4) 4

**Correct Answer: (4)** 4. 4 is a rational number, and 2, its square root, is also a rational number. (*Number Systems*)

**50.** While solving the equation  $4(x + 2) = 28$ , Becca wrote  $4x + 8 = 28$ . Which property did she use?

- (1) distributive
- (2) associative
- (3) commutative
- (4) identity

**Correct Answer: (1)** distributive. Becca distributed the 4 on the left side of the equation. (*Number Theory*)

**51.** Which list is in order from smallest value to largest value?

- (1)  $\sqrt{10}$ ,  $\frac{22}{7}$ ,  $\pi$ , 3.1
- (2) 3.1,  $\frac{22}{7}$ ,  $\pi$ ,  $\sqrt{10}$
- (3)  $\pi$ ,  $\frac{22}{7}$ , 3.1,  $\sqrt{10}$
- (4) 3.1,  $\pi$ ,  $\frac{22}{7}$ ,  $\sqrt{10}$

**Correct Answer: (4)** 3.1,  $\pi$ ,  $\frac{22}{7}$ ,  $\sqrt{10}$ .  $\pi = 3.1415$ ,  $\frac{22}{7} = 3.1429$ ,  $\sqrt{10} = 3.1622$ ;  $3.1 < 3.1415 < 3.1429 < 3.1622$ . (*Number Systems*)

**52.** A micron is a unit used to measure specimens viewed with a microscope. One micron is equivalent to 0.00003937 inch. How is this number expressed in scientific notation?

- (1)  $3.937 \times 10^{-5}$
- (2)  $3.937 \times 10^5$
- (3)  $3.937 \times 10^{-8}$
- (4)  $3.937 \times 10^8$

**Correct Answer: (1)**  $3.937 \times 10^{-5}$ . The  $-5$  power tells you to move the decimal point to the left 5 places. (*Operations*)

**53.** Leo purchased five shirts, three pairs of pants, and four pairs of shoes. Which expression represents how many different outfits consisting of one shirt, one pair of pants, and one pair of shoes Leo can make?

- (1)  $5 \cdot 3 \cdot 4$
- (2)  $5 + 3 + 4$
- (3)  ${}_{12}C_3$
- (4)  ${}_{12}P_3$

**Correct Answer:** (1)  $5 \cdot 3 \cdot 4$ . By the counting principle, multiply the number of shirts by the number of pairs of pants by the number of pairs of shoes. (*Number Theory*)

**54.** On February 18, from 9 A.M. until 2 P.M., the temperature rose from  $-14^{\circ}\text{F}$  to  $36^{\circ}\text{F}$ . What was the total increase in temperature during this time period?

- (1)  $50^{\circ}$
- (2)  $36^{\circ}$
- (3)  $32^{\circ}$
- (4)  $22^{\circ}$

**Correct Answer:** (1)  $50^{\circ}$ . The difference between 36 and  $-14$  is  $36 - (-14) = 36 + 14 = 50$ . (*Operations*)

**55.** What is the value of  $\frac{8!}{4!}$ ?

- (1) 1,680
- (2) 2
- (3)  $2!$
- (4)  $4!$

**Correct Answer:** (1) 1,680.  $\frac{8!}{4!} = \frac{8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{4 \times 3 \times 2 \times 1} = 8 \times 7 \times 6 \times 5 = 1,680$ . Alternately, use the calculator to evaluate  $\frac{8!}{4!}$ . (*Number Theory*)

## Open-Ended Questions

**56.** A recent survey shows that the average man will spend 141,288 hours sleeping, 85,725 hours working, 81,681 hours watching television, 9,945 hours commuting, 1,662 hours kissing, and 363,447 hours on other tasks during his lifetime. What percent of his life, to the *nearest tenth of a percent*, does he spend sleeping?

**Correct Answer:** A man spends 20.7% of his life sleeping. The total number of hours a man lives is  $141,288 + 85,725 + 81,681 + 9,945 + 1,662 + 363,447 = 683,748$ . The number of hours a man spends sleeping is 141,288, so the percentage of hours he spends sleeping is  $\frac{141,288}{683,748} \cdot 100\% \approx 20.7\%$ .  
(Operations)

**57.** Kyoko's mathematics teacher gave her the accompanying cards and asked her to arrange the cards in order from least to greatest. In what order should Kyoko arrange the cards?

$\pi$	$\sqrt{8}$	$3.\bar{1}$	$2\sqrt{3}$	$2\frac{4}{5}$
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**Correct Answer:**  $2\frac{4}{5}$ ,  $\sqrt{8}$ ,  $3.\bar{1}$ ,  $\pi$ ,  $2\sqrt{3}$ .  $\pi \approx 3.1415$ ,  $\sqrt{8} \approx 2.8284$ ,  $3.\bar{1} \approx 3.1111$ ,  $2\sqrt{3} \approx 3.4641$ ,  $2\frac{4}{5} = 2.8$ . (Number Systems)

**58.** Five friends met for lunch, and they all shook hands. Each person shook the other person's right hand only once. What was the total number of handshakes?

**Correct Answer:**  ${}_5C_2 = 10$  handshakes. (Number Theory)

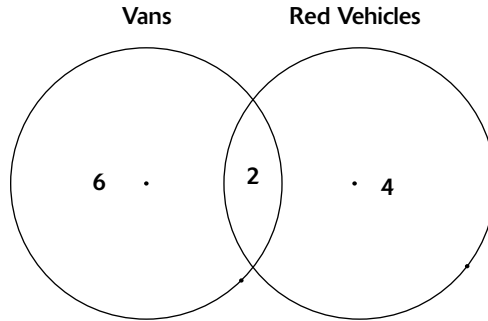
**59.** Given:  $\frac{\sqrt{99}}{11}$ ,  $\sqrt{164}$ ,  $\sqrt{196}$

Identify the expression that is a rational number and explain why it is rational.

**Correct Answer:**  $\sqrt{196}$  is rational. All whole numbers are rational, and  $\sqrt{196} = 14$ , which is a whole number. (Number Systems)

**60.** A car dealer has 22 vehicles on his lot. If 8 of the vehicles are vans and 6 of the vehicles are red, and 10 vehicles are neither vans nor red, how many red vans does he have on his lot?

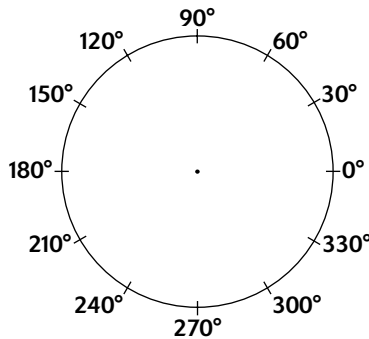
**Correct Answer:** There are 2 red vans on the lot.



**10 Vehicles That Are Neither Vans nor Red**

Since 10 vehicles are neither vans nor red, 12 must be red or vans or both. After constructing the Venn diagram, you notice that there are 2 red vans on the lot. (*Number Theory*)

**61.** In a class of 24 students, 10 have brown hair, 8 have black hair, 4 have blond hair, and 2 have red hair. On the accompanying diagram, construct a circle graph to show the students' hair color.



**Correct Answer:** On the diagram, the brown hair = 150° angle, black hair = 120° angle, blond hair = 60° angle, and red hair = 30°. For each color of hair a proportion could be solved to find out the measure of the angle each color represents, such as (for brown hair,  $\frac{10}{24} = \frac{n}{360}$ ,  $n = 150^\circ$ ). An alternate way would be to look at the diagram and realize that there are 12 equal intervals of 30° each and that each interval represents 2 out of the 24 students, so for brown hair, you would need to draw an angle containing 5 of the intervals. (*Operations*)

**62.** A 14-gram serving of mayonnaise contains 11 grams of fat. What percent of the mayonnaise, to the *nearest tenth of a percent*, is fat?

**Correct Answer:** 78.6%. 11 out of 14 grams are fat.  $11/14 = .7857142857$ . You must multiply by 100 or move the decimal to the right two spaces to change your answer to the correct rounded percent of 78.6. (*Operations*)

