

## CIPHERING

1. Find the sum of the roots of  $x^3 - 3x^2 + 2x = 0$

Correct Answer: 3

2. Evaluate:  $1_2 + 2_3 + 3_4 + 4_5 + 5_6$  Write your answer in base 7.

Correct Answer:  $21_7$

3. Evaluate:  $\log_8 4 + \log_{10} 100 + \log_{125} 625$

Correct Answer: 4

4. Evaluate:  $i^{5!-4!+3!-2!+1!}$

Correct Answer:  $i$

5. If each edge of a cube is increased by 50%, what is the percentage increase by of the surface area of the cube?

Correct Answer: 125%

6. Solve for  $x$ :  $3^x - 3^{x-1} = 162$

Correct Answer: 5

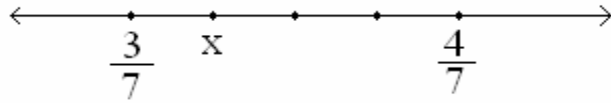
7. How many integers that are greater than 4 million and less than 9 million are perfect squares?

Correct Answer: 999

8.  $y^{-1} = x^2$  and  $x = 2$  then  $y = ?$

Correct Answer:  $1/4$

9. Find the exact value of  $x$  on the number line, given that the points are evenly spaced.



Correct Answer:  $\frac{13}{28}$

10. Who am I?



Hint: I am famous for my work about trigonometry series.

Correct Answer: Fourier

11. Jennifer has \$2.46 in pennies, nickels, dimes, and quarters. If she has equal numbers of each coin, how many coins does she have?

Correct Answer: 24

12. If  $5^{-x} = 3$ , what does  $5^{3x} = ?$

Correct Answer:  $\frac{1}{27}$

13. If the matrix  $\begin{bmatrix} 3 & x \\ 2 & 8 \end{bmatrix}$  does not have an inverse, then  $x = ?$

Correct Answer: 12

14. If  $A = 9^{9999} + 9^{-9999}$  and  $B = 9^{9999} - 9^{-9999}$  find the value of  $A^2 - B^2 + 1$

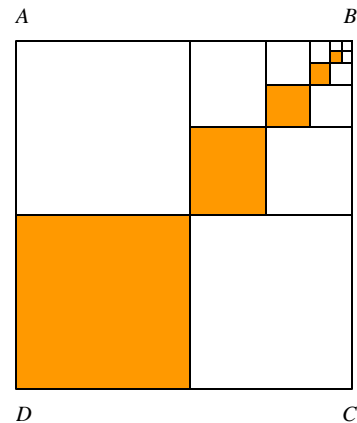
Correct Answer: 5

15. The average of 9 numbers is 7, and the average of 7 other numbers is 9. What is the average of all 16 numbers?

Correct Answer:  $7\frac{7}{8}$

16. The area of square  $ABCD$  is 1. It is divided into four congruent squares and one of them is shaded as shown in the figure. One of the other three is divided into four congruent squares again and one of them is shaded too. If the pattern continued forever and ever, what is the exact value of the area shaded?

Correct Answer:  $\frac{1}{3}$



17. How many zeros will be at the end of the product  $(35)^8(44)^7(55)^9$ ?

Correct Answer: 14

18. You are standing in line to see a movie. There are 5 more people ahead of you in line than are behind you. Four times as many people are in line as the number of people who are behind you. How many people are ahead of you in line?

Correct Answer: 8

19. 
$$\frac{\frac{2}{3} - \frac{1}{2}}{\frac{1}{6} + \frac{1}{4} + \frac{2}{3}} = ?$$

Correct Answer:  $\frac{2}{13}$

20. Who are we?



Hint: Swiss Family \_\_\_\_\_

Correct Answer: Bernoulli