

Category IV (Grades 9&10)

- For how many integer values of x the expression $(x - \sqrt{8})(\sqrt{73} - x)$ is positive?
A) 4 B) 5 C) 6 D) 7
- There are twenty people working in an office. The first group of five works between 8.00 A.M. and 2.00 P.M. The second group of ten works between 10.00 A.M. and 4.00 P.M. And the third group of five works between 12 noon and 6.00 P.M. There are three computers in the office which all the employees frequently use. During which of the following hours are the computers likely to be used most?
A) 10.00 A.M. - 12 noon B) 12 noon - 2.00 P.M.
C) 1.00 P.M. - 3.00 P.M. D) 2.00 P.M. - 4.00 P.M.
- If L denotes /, M denotes \times , P denotes + and Q denotes -, then which of the following statements is true?
A) $32 \text{ P } 8 \text{ L } 16 \text{ Q } 4 = -3/2$ B) $6 \text{ M } 18 \text{ Q } 26 \text{ L } 13 \text{ P } 7 = 173/13$
C) $11 \text{ M } 34 \text{ L } 17 \text{ Q } 8 \text{ L } 3 = 38/3$ D) $9 \text{ P } 9 \text{ L } 9 \text{ Q } 9 \text{ M } 9 = -71$
- A student got twice as many sums wrong as he got right. If he attempted 48 sums in all, how many did he solve correctly?
A) 12 B) 16 C) 24 D) 18
- Choose the correct alternative that will continue the given pattern 0.5, 0.55, 0.65, 0.8, ?
A) 0.9 B) 0.82 C) 1 D) 0.95
- Find the area of the triangle whose two median lengths are 6 and 5 and these two medians are perpendiculars.
A) 12 B) 15 C) 20 D) 24
- Which of the followings is the natural summation of the binomial expansion of $(\sqrt[7]{7} + \sqrt[5]{5})^{36}$?
A) $C_{36}^{15} * 7^3 * 5^3$ B) $C_{36}^1 * 7^5 * 5^2$
C) $C_{36}^{25} * 7^2 * 5^5$ D) $C_{36}^8 * 7^4 * 5^2$

8. Find the greatest value of the image $\sin^6 t + \cos^6 t$

- A) 1 B) $\sqrt{2}$ C) 2 D) π

9. How many integer solutions does the inequality $\sqrt{6x - x^2} > x$ have?

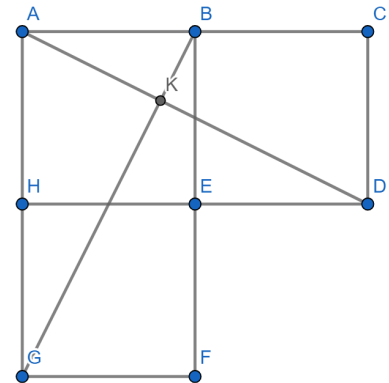
- A) 0 B) 1 C) 2 D) 3

10. If $x^3 - 3\sqrt{3}x^2 + 9x - 64 - 3\sqrt{3} = 0$. Find the value of $x^6 - 8x^5 + 13x^4 - 5x^3 + 49x^2 - 137x + 2022$.

- A) 2022 B) 1905 C) 1976 D) 0

11. The figure shows three squares of unit length. Find the area of triangle ABK:

- A) 1/5
 B) 1/4
 C) $\sqrt{2}/4$
 D) $\sqrt{2}/5$



12. Find a from the equation $(4a^2 + 3)^2 + (7 - 4a^2)^2 - 2(4a^2 + 3)(4a^2 - 7) = a + 96$

- A) $a = 3.5$ B) $a = 4$ C) $a = 4.5$ D) $a = 5$

13. The President of Dollarstan is deciding between two income tax plans. According to one of the plans, all residents would pay tax equal to 10% of their yearly income (if this income is positive). According to the other plan, the first 150,000 D-dollars of a resident's yearly income would not be taxed, and the tax (if any) would equal 16% of any yearly income over 150,000 D-dollars. The President cannot decide which tax plan to propose because his own tax under either plan is the same. What is the yearly income (in D-dollars) of the President of Dollarstan? Note that this income is a positive number.

- A) 400 000 B) 240 000 C) 320 000 D) 480 000

14. Write the simplest form of $\sqrt[6]{3^8 4^5} \sqrt[3]{3^5 4}$.

- A) 24 B) 36 C) 56 D) $108\sqrt[3]{2}$

20. Write the expression $\frac{a^3-8b^3}{a^2-4b^2} : \frac{a^3+4ab^2+2ba^2}{a^3+2ba^2}$ in the simplest form.

- A) $2a$ B) a C) $-a$ D) $-2a$

21. Find $f'(1)$, if $f(x) = \frac{\ln(x)}{e^x}$

- A) $1/e$ B) $e-1$ C) $2e$ D) $\sqrt{2}$

22. Let $c = \frac{2\pi}{11}$. Find the value of

$$\frac{\sin 3c * \sin 6c * \sin 9c * \sin 12c * \sin 15c}{\sin c * \sin 2c * \sin 3c * \sin 4c * \sin 5c}$$

- A) -1 B) $10/11$ C) $\frac{\sqrt{11}}{5}$ D) 1

23. Find the limit $\lim_{x \rightarrow +\infty} \frac{\sqrt{x^2+2x+5} + \sqrt{x^2-2x+5}}{2x+1}$

- A) 0 B) -1 C) 1 D) 2

24. 10 students in the class walk in the circle of mathematics, 14 - in physics, 13 - in informatics, 10 students walk in at least two circles at once, and 2 students - in all three circles. How many students do not walk in any circle if there are 27 students in a class?

- A) None B) 4 C) 3 D) 2

25. Find the sum of the solutions of the equation $(x^2 - 1) \cdot \log_{12}(1 - x) = 0$

- A) 4 B) 0 C) -1 D) 1