1. Suppose that $\dfrac{1}{\sqrt[8]{128}+\sqrt[8]{8}+\sqrt{2}+1}=\dfrac{\sqrt{a}-1}{\sqrt[b]{b}+1}$, Find $\sqrt{ab}$.

2. Let f be a function defined on the set of all positive integers such that $f(xy)=f(x)+f(y)$ for all positive integers x and y. If $f(15)=30$ and $f(135)=80$, find $f(1125)$.

3. Let $\log_x\left(x+y\right)=5$, where x and y are positive real number. Find the value of $\log_x\left(\dfrac{1}{\sqrt{x+y}+\sqrt{y}}+\dfrac{\sqrt{y}}{x}\right)$.

4. Suppose that $4\cos\dfrac{\pi}{12}=\sqrt{a}+\sqrt{b}$, where $0\le a\le b$. Find the value of $\left(a+b\right)^2$.

5. Given that $\tan^2\left(\arccos\left(\frac{12}{13}\right)-2\arccos\left(\frac{4}{5}\right)\right)=\frac{a}{b}$, where a and b are integers and $\gcd(a,b)=1$. Find a sum of all digits of number $a-b$.

6. Let z be a complex number, where $\mathrm{Im}(z)\neq 0$, satisfying the equation $2\left(|z|-1\right)+\bar{z}\left(i\right)=4+3i$. Find a value of $z\cdot\bar{z}$.

7. Let f be the function defined by $f(x)=ax^2-\frac{1}{\sqrt{3}}$ for some positive real number a. If $f(f(\sqrt{3}))=-\frac{1}{\sqrt{3}}$, find the value of $6a\tan\frac{\pi}{3}$.

8. POP MART shop wants to donate Molly dolls to 5 schools. The first, second, third, and fourth schools get $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, and $\frac{1}{8}$ of the total Molly dolls, respectively. If the fifth school gets 93 Molly dolls, then how many Molly dolls does the second school get?

9. Tom and Jerry raced 3 kilometers, in which both maintained constant speed. If Jerry reached the finish line, then Jerry was 750 meters in front of Tom. After that Jerry immediately turned around and ran back toward the start line. How far from the finish line did Tom and Jerry meet? (Give your answer to the nearest meter)

10. The price of gold bars increased rapidly in the past twelve years. In the first 5 years, the price of the gold bars increased by 2040 baths per year. Seven years later, the price of the gold bars increased by 2400 baths per year. If the price of the gold bar in 2012 cost 13,500 baths, what is the percent increase of the gold bars in 2024 from 2012?

11. Justin's 14-day running practice schedule is as follows:
    Day 1 to day 3, the total distance running is 12 kilometers
    Day 2 to day 4, the total distance running is 18 kilometers
    Day 3 to day 5, the total distance running is 24 kilometers
    Day 4 to day 6, the total distance running is 30 kilometers and so on.
    For the last three days, the total distance running is 78 kilometers. He runs 24 kilometers on Day 12. On the Day 2 and Day 13, he runs 30 kilometers. What is the total distance, he is running on the first and last days?

12. The temperature of Miso soup in the pot is modeled by the formula $T = 5e^{k-t} + 22$, where T is the temperature (Celsius), t is time (minutes) and k is a positive constant, respectively. After 7 minutes the temperature of the Miso soup will be $87^{\circ}C$. How long will it take for the Miso soup to reach a temperature of $27^{\circ}C$? $\left(\ln 13 = 2.56\right)$

13. 100 students are going to the gym on Sunday. It is found that:
34 students who like running,
33 students who like cycling,
38 students who like swimming,
13% of students like only running, and
30% of students do not like any activities.
How many students, who like both swimming and cycling, are there?

14. Suppose that the straight line $y = \sqrt{3}x$ is tangent to a circle at $x = \frac{3\sqrt{3}}{2}$.
The center of a circle is on the y-axis. If an equation of a circle is $(x-h)^2 + (y-k)^2 = r^2$, then find the value of $h + k + r$.

15. Let ABC be an acute triangle such that $\left|\overrightarrow{AB}\right| = c, \left|\overrightarrow{AC}\right| = b,$ and $\left|\overrightarrow{BC}\right| = a$, where a, b, c are positive real numbers. If $a^2 + b^2 + c^2 = 256$, then what is the value of $\overrightarrow{AB} \cdot \overrightarrow{BC} + \overrightarrow{BC} \cdot \overrightarrow{CA} + \overrightarrow{CA} \cdot \overrightarrow{AB}$?

16. There are nine cards numbered with the digits 1-9. Three cards are randomly drawn, one at a time without replacement. Let m, n and p be the numbers on the cards drawn the first, second, and third time, respectively. Let $\frac{a}{b}$ be the probability that $m + n + p$ is an even number, where $\gcd(a, b) = 1$. Find the value of ab.

17. Let x^{-2} and x^4 be terms in the distribution $\left(x^4 - \frac{1}{2x^2}\right)^{10}$. Let a and b be coefficients of x^{-2} and x^4, respectively. Find the value of $\left|\frac{7a}{b}\right|$.

18. The numbers arranged in ascending order are shown below.

$$8, a, 12, 17, 22, 24, b$$

If the average and first quartile of the given data set are 17 and 10, respectively, find the mean deviation of the data set.

19. 50 students take the test. The teacher randomly selects the scores of 9 students and displays the scores in ascending order as shown in the data set below.

$$8, 11, 15, 18, x, 28, 30, 31, 33$$

If the median of the data set is 24, find the variance of the scores of the 9 students.

20. Taylor finds the sum of the series $2+4+6+...+2n$. Lisa finds the sum of the series $(2n+2)+(2n+4)+(2n+6)+...+40$. If both series have the same sum, find the mean of numbers in the set $\{2, 4, 6, ..., 2n\}$.

21. Find a, if $\log_{81} 9a^{34} = 6\sin\frac{\pi}{3}\tan\frac{\pi}{3}$.

22. Let $f(x)$ be a fourth-degree polynomial, the coefficient of whose highest power is 1. Let $f(x)$ have a double zero at $x = 2$, $f(0) = 16$, and $f(1) = 5$, respectively. What is the sum of the roots of this polynomial equation?

23. A church has a parabolic window. The equation of parabola shape is $y = \frac{7 + 2x - x^2}{4}$. The base of the window is on the latus rectum of this parabola. What is the height of the window?

24. How many four-letter words can be formed by using the letters of the word "ASMOPSS"?

25. How many four-digit numbers can be formed whose all digits in a number are different and in ascending order?

GRADE 11 ANSWER KEY

No.	Answer	No.	Answer
1	4.00	14	9.00
2	65.00	15	128.00
3	1.50	16	231.00
4	64.00	17	2.00
5	19.00	18	6.00
6	25.00	19	86.00
7	2.00	20	15.00
8	72.00	21	3.00
9	15.00	22	4.00
10	200.00	23	1.00
11	30.00	24	208.00
12	9.56	25	126.00
13	14.00		