

Q1

ABC is an equilateral triangle. A circle with radius 1 is tangent to the line AB at the point B and to the line AC at point C. What is the side length of ABC?

- A. $\frac{\sqrt{3}}{2} + 1$
- B. $\sqrt{3}$
- C. $\frac{\sqrt{3}}{2}$
- D. $2\sqrt{3}$
- E. 2

Q2

If $m = 2(3)(4)(5) \dots (31)(32)$, which statement about m is true?

- A. $m < 2^{40}$
- B. $2^{40} < m < 2^{70}$
- C. $2^{70} < m < 2^{100}$
- D. $2^{100} < m < 2^{130}$
- E. $2^{130} < m$

Q3

Real numbers a and b satisfy the equations $3^a = 81^{b+2}$ and $125^b = 5^{a-3}$. What is ab ?

- A. -60
- B. -17
- C. 9
- D. 12
- E. 60

Q4

What are the last two digits of 2017^{2017} ?

- A. 77
- B. 81
- C. 93
- D. 37
- E. 57

Q5

Points A, B, C, D, and E are on a line such that $AB = 3$, $BC = 6$, $CD = 8$, and $DE = 4$. What is the smallest possible value of AE ?

- A. 0
- B. 1
- C. 2
- D. 3
- E. 5

Q6

Arne has a box with 100 chips of colours red, white, blue, and black. Each chip has only one colour. Arne told Berit that she (Berit) must pick at least 81 chips from the box to be sure of getting at least one of each colour, if she picks them without looking. After some thought, Berit concluded correctly that the box contains at least N chips of each colour, but at most M of each. What is the smallest possible value of $M - N$?

- A. 0
- B. 5
- C. 20
- D. 40
- E. 60

Q7

Emmy is playing with a calculator. She enters an integer, and takes its square root. Then she repeats the process with the integer part (round down) of the answer. After the third process, the integer part equals 1 for the first time. What is the difference between the largest and the smallest number Emmy could have started with?

- A. 229
- B. 231
- C. 239
- D. 241
- E. 254

Q8

There are eight positive integers in a row. Starting from the third, each is the sum of the two numbers before it. If the eighth number is 2017, what is the largest possible value of the first one?

Q9

Given that $5r + 4s + 3t + 6u = 100$, where $r \geq s \geq t \geq u \geq 0$ are real numbers, find the sum of the maximum and minimum possible values of $r + s + t + u$.

Q10

Let a, b, x, y be real number such that:

$$a + b = 23; ax + by = 79; ax^2 + by^2 = 217; ax^3 + by^3 = 691$$

What is the value of $ax^4 + by^4$?