Sample questions for KAUST Mathematics Competition Category A

1. Find the value of the following expression:

$$\sqrt{\left(\frac{3}{2}-\sqrt{3}\right)^2}+\sqrt{\left(\sqrt{3}-\frac{1}{2}\right)^2}.$$

(A) 1

(B) $2-2\sqrt{3}$

(C) 2

(D) $2\sqrt{3}$

(E) $2\sqrt{3}-2$

2. Ahmad needs 4 hours to plant a field. On the other hand, Khalid needs 6 hours to plant the same field. How much time (in minutes) do they need if they work together?

(A) 128 minutes

(B) 135 minutes

(C) 144 minutes

(D) 150 minutes

(E) 166 minutes

3. If the value of the algebraic expression $a^2+2ab+4b^2+2^{10}$ is equal to 2^m for $a=2^5$ and $b=2^4$, what is the value of m?

(A) 9

(B) 10

(C) 11

(D) 12

(E) 13

4. The sum of six distinct positive integers is 22. What is their product?

(A) 120

(B) 480

(C) 720

(D) 840

(E) 1120

5. A machine takes an integer number k and, in one step, replaces it by the remainder of $11 \cdot k$ divided by 7. For example, $(2 \cdot 11 = 22 \to 22 \div 7 \to 1 \implies 2 \to 1)$.
After it prints the new number, you can return it to print another number. Starting with the number 6 after how many steps will the machine print 6 again?

(A) 1

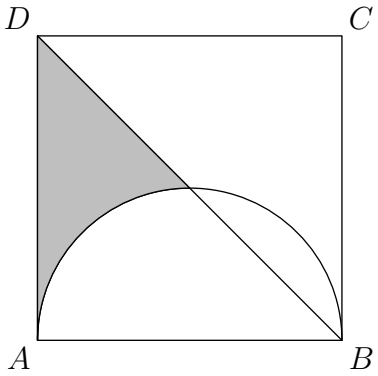
(B) 2

(C) 3

(D) 4

(E) 5

6. In the square $ABCD$, a semi-circle is drawn with diameter AB. Given that $AB = 12$, find the area of the shaded region.



(A) 12π

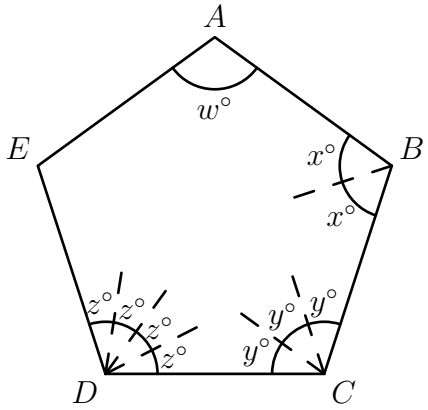
(B) $12 + 12\pi$

(C) $36 - 9\pi$

(D) $54 - 9\pi$

(E) None of the above

7. In the regular pentagon shown below, several angles are divided by rays as indicated. The labeled measures are $w^\circ, x^\circ, y^\circ$, and z°. Find the value of $w + x + y + z$.



(A) 180

(B) 198

(C) 216

(D) 225

(E) 240

8. A home library contains 7 books, 3 magazines, 5 pens, and 3 pencils. Ahmad wants to study, so he will pick exactly one book or one magazine. Moreover, he will choose exactly one pen or one pencil to write his notes. In how many ways can he choose?

(A) 18

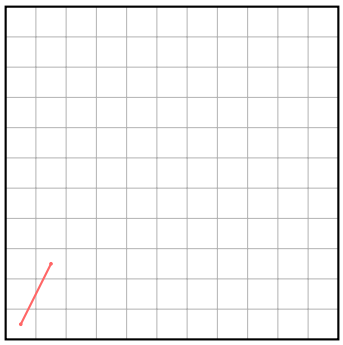
(B) 36

(C) 44

(D) 80

(E) 315

9. What is the number of all segments of length $\sqrt{5}$ connecting centers of two cells in a 11×11 grid of unit squares (the red line drawn below is one of those segments)?



(A) 200

(B) 240

(C) 280

(D) 320

(E) 360

10. A group of 12 friends planned a dinner costing 20 riyals per person. If 2 friends cancel, how much more does each remaining friend need to pay to cover the total cost?

(A) 2

(B) 4

(C) 10

(D) 12

(E) 20