FEDERAL BOARD OF INTERMEDIATE AND SECONDARY EDUCATION

PAKISTAN MATHEMATICS OLYMPIAD – 2024

SAMPLE

Name: _____

Roll Number: _____

Exam Hall & Seat Number: _____

Time Allowed: 3 hours   **Total Marks:** 100

DO NOT OPEN THIS EXAM UNTIL TOLD TO DO SO.

Instructions:

- Only your Student Answer Sheet is marked. All your answers and your identity must be recorded there. You can write in this booklet if you wish, but it has no value for marking.

- Make sure your pencil marks are dark enough and your writing is neat.

- Please fill in the circles completely on your answer sheet for the choice you make for each question.

- **Length:** You get a total of 3 hours to complete this **twenty-question** exam.

- **Scores:**

  - Questions you get correct get 3.5, 5 or 7 points for sections A, B, and C, respectively.

  - Questions you answer wrong get zero points.

  - Questions you leave blank get one point. So don't guess if you are really unsure.

Section A

Q1. Which of the following is a correct factorization of $2x^2 + x - 6$?
(a) $\left(x - \frac{3}{2}\right)(x + 2)$
(b) $(2x - 3)(x + 2)$
(c) $(2x + 1)(x - 6)$
(d) $(2x - 3)\left(x - \frac{3}{2}\right)$

Q2. Which of the following points lies on the graphs of each of the following equations: $y = 2x + 1 - x^2$, $y = x^2 - 4x + 1$ and $y = 2x^2 - 8x + 1$?
(a) $(1, 0)$
(b) $(4, 1)$
(c) $\left(\frac{1}{2}, 0\right)$
(d) $(0, 1)$

Q3. Fatima bakes 6 cupcakes and eats 40% of them in 30 minutes. How many hours will it take in total (including the 30 minutes) for her to finish her meal? Assume that she eats at a constant rate.

Figure 1: The six cupcakes that Fatima baked.

(a) 1.25
(b) 1.5
(c) 2
(d) 2.5

Q4. Abdullah writes the following numbers on a sheet of paper:

$$9876543212345678987654321 \ldots$$

Continuing the pattern, what was the 2024th digit that Abdullah wrote?
(a) 1
(b) 2
(c) 4
(d) 8

Q5. How many hours are there in half of a third of a quarter of a day?
(a) $\frac{1}{3}$
(b) $\frac{1}{2}$
(c) 1
(d) 2


Q6. What is the biggest difference between two 3-digit numbers provided that no digit is used more than once?
(a) 899
(b) 885
(c) 864
(d) 987

Q7. A palindromic number reads the same backwards as it is forwards e.g. 24542. What is the sum of the largest 6-digit palindromic number and the smallest 5-digit palindromic number?
(a) 989998
(b) 1010000
(c) 1011110
(d) 1012320

Q8. What is the area of the shape given below?
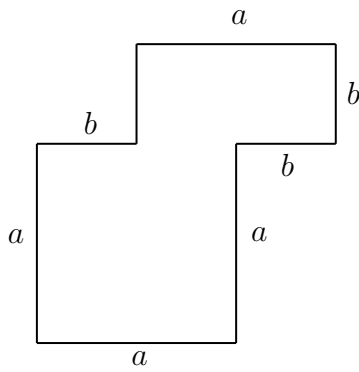
(a) $a(a+b)$
(b) $ab(a+b)$
(c) $b(a+b)$
(d) $a(a-b)$

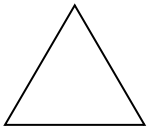**Section B**

Q9. Ali wrote a polynomial on a piece of paper but accidentally spilled some water on part of it. It now reads $x^7 + 2x^6 +$ ██████████ $+6$. Which of the following could not have been an integer root of the polynomial?
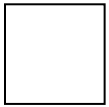(a) 6
(b) 2
(c) 4
(d) -3
(e) -2
(f) -1

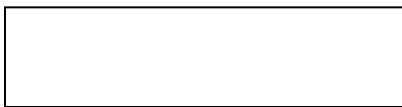Q10. In which of the following shapes is it impossible to create two trapeziums by drawing a single straight line?
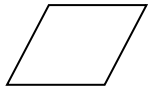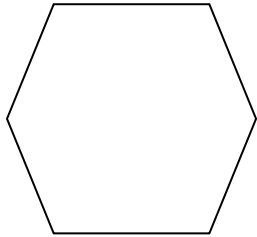(a)

(b)

(c)

(d)

(e)

(f)

Q11. Ahmad calculated the mean of a sequence of ten distinct positive numbers to be 10. However, he lost the page on which the numbers were written. What is the highest possible number that was written on the page?
(a) 10
(b) 14
(c) 25
(d) 55
(e) 60
(f) 91

Q12. On an island, there are only rabbits and foxes. A rabbit always tells the truth while a fox always lies. In the Grand Feast on 14 March, all the animals on the island sit on a circular table. Each animal says, "The animal on my right is a fox." What can you say about the number of animals on the island?

Figure 2: A rabbit and a fox.

(a) The number of animals on the island is a multiple of 2.

(b) The number of animals on the island is a multiple of 3.
(c) The number of animals on the island is a multiple of 4.
(d) The number of animals on the island is a multiple of 5.
(e) The number of animals on the island is a multiple of 7.
(f) We cannot say anything about the number of animals on the island.

Q13. 3 cats catch 3 rats in 3 minutes. How many cats are needed to catch 100 rats in 100 minutes? Assume that the rate of catching a rat depends on the number of cats chasing it.

Figure 3: A cat chasing a rat.

(a) 1
(b) 3
(c) 50
(d) 99
(e) 100
(f) 300

Q14. Rehan and Malaik, initially 20 km apart, race towards each other on bicycles at a constant speed of 10 kph. As soon as they started, a fly on Rehan's bicycle started flying at a constant speed of 15 kph to and fro between Rehan's bicycle and Malaik's bicycle until the two met each other. What distance is covered by the fly in total?

(a) 1 km
(b) 2 km
(c) 5 km
(d) 10 km
(e) 15 km
(f) 20 km

Figure 4: The fly flies between the two bicycles.

Section C

Q15. Hassan rolls a die 20 times and gets a 6 each time. He also tosses a coin n times and gets a tail each time. Given that the second event is less likely than the first, which of the following can be a value of n?

Figure 5: Dice and a coin.

(a) 10
(b) 20
(c) 30
(d) 35
(e) 40
(f) 45
(g) 50
(h) 60

Q16. The rectangle below has sides of length 14 cm and 2 cm. The circles are all identical and tangent to each other and the rectangle. Given that P, Q and R are points of tangency on the circles, what is the area of triangle PQR?
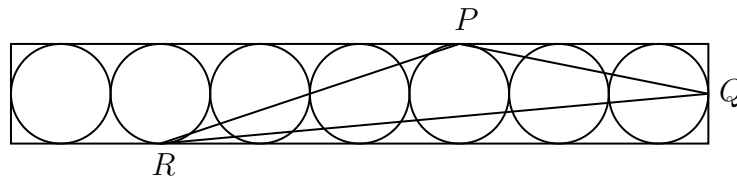
(a) 16 cm^2
(b) 13.5 cm^2
(c) 8 cm^2
(d) 5.5 cm^2

10

(e) 2.5π cm^2

(f) $5\sqrt{2}$ cm^2

(g) $\frac{25}{\pi}$ cm^2

(h) $10\sqrt{2}$ cm^2

Q17. 6 playing cards are placed upside down on a table. You are told that only 2 of these cards are kings. You are asked to select any two cards at random and turn them over. What is the probability that they are both kings?
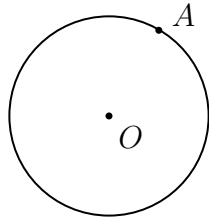

Figure 6: 6 upside down playing cards.

(a) $\frac{1}{2}$

(b) $\frac{1}{3}$

(c) $\frac{1}{4}$

(d) $\frac{2}{13}$

(e) $\frac{1}{13}$

(f) $\frac{1}{15}$

(g) $\frac{1}{26}$

(h) $\frac{1}{52}$

Q18. Let a, b, c and d be four distinct whole numbers. Given that $ab + bc + cd + ad$ is odd, how many of the original numbers could be even?

(a) 0

(b) 1

(c) 2

(d) 3

(e) 4

(f) 0 & 1

(g) 0 & 2

(h) 3 & 4

Q19. Point A lies on the edge of a circle with centre O. What proportion of the circle contains points closer to A than O?

(a) $\frac{1}{3} - \frac{\sqrt{3}}{4\pi}$

(b) $\frac{1}{3} - \frac{1}{4\pi}$

(c) $\frac{\pi}{4} - \frac{1}{3}$

(d) $\frac{\sqrt{3}\pi}{4} - \frac{1}{3}$

(e) $\frac{\sqrt{3}}{4\pi}$

(f) $\frac{1}{4\pi}$

(g) $\frac{\sqrt{3}\pi}{4}$

(h) $\frac{\pi}{3} - \frac{\sqrt{3}}{4}$

Q20. Five whole numbers are written in a circle such that no two or three consecutive numbers have a sum divisible by 3. How many of the written numbers can be divisible by 3?

(a) 0

(b) 1

(c) 2

(d) 3

(e) 4

(f) 5

(g) 0 & 2

(h) 3 & 4