

MK Team Level 9-10 Sample

Multiple-choice Questions

1. The big wheel of this bicycle has perimeter 4.2 meters. The small wheel has perimeter 0.9 meters. At a certain moment, the valve of both wheels are at their lowest point. The bicycle rolls to the left. After how many meters will both valves first be at their lowest point together again?



- (A) 4.2 (B) 6.3 (C) 12.6 (D) 25.2 (E) 37.8

2. How many positive integers A possess the property that exactly one of the numbers A and $A + 20$ has four digits?

- (A) 19 (B) 20 (C) 38 (D) 39 (E) 40

3. A square has vertices A, B, C, D labelled clockwise. An equilateral triangle is constructed with labels A, E, C labelled clockwise. What is the size of angle CBE in degrees?

- (A) 30 (B) 45 (C) 135 (D) 145 (E) 150

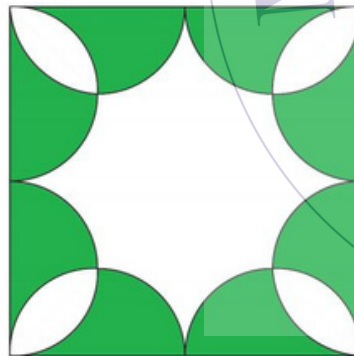
4. Every inhabitant of the Winger planet has at least two ears. Three inhabitants named Imi, Dimi and Trimi met in a crater. Imi said: "I can see 8 ears." Dimi: "I can see 7 ears." Trimi: "That's strange, I can see only five ears." None of them could see his own ears. How many ears does Trimi have?

- (A) 2 (B) 4 (C) 5 (D) 6 (E) 7

5. The integers a , b , c and d satisfy $ab = 2cd$. Which of the following numbers could not be the value of the product $abcd$?

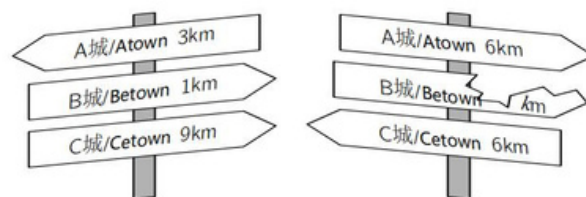
- (A) 50 (B) 100 (C) 200 (D) 450 (E) 800

6. Eight congruent semicircles are drawn inside a square of side length 4 cm. What is the area of the non-shaded part of the square?



- (A) 2π cm (B) 8 cm (C) $(6 + \pi)$ cm (D) $(3\pi - 2)$ cm (E) 3π cm

7. The shortest path from Atown to Cetown runs through Betown. Walking on this path from Atown to Cetown, we would first find the signpost shown on the left. Later we would find the signpost shown on the right. What distance was written on the broken sign?



- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

8. Jill is making a magic multiplication square using the numbers 1, 2, 4, 5, 10, 20, 25, 50 and 100. The products of the numbers in each row, in each column and in each of the two diagonals must all be the same. In the figure you can see how she has started. Which number should Jill place in the cell with the question mark?

20	1	
		?

- (A) 2 (B) 4 (C) 5 (D) 10 (E) 25

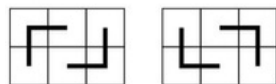
9. A container with the form of a rectangular prism and whose basis is a square of side 10 cm, is filled with water up to a height of h cm. A solid cube of 2 cm of edge is put in it. The minimal value of h such that the cube keep full submerged in the water is:

- (A) 1.92 (B) 1.93 (C) 1.90 (D) 1.91 (E) 1.94

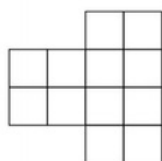
10. At the University of Humanities you can study languages, history and philosophy. 35% of students that study languages, choose to study English. 13% of the university students study a language other than English. No student studies more than one language. What percentage of the university students study languages?

- (A) 13% (B) 20% (C) 22% (D) 48% (E) 65%

11. A 3×2 rectangle can be exactly covered by two of the L-shape figures in two different ways as shown below.



In how many different ways can the figure below be covered by the L-shape figures?

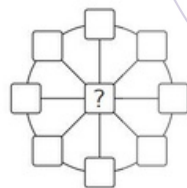


- (A) 1 (B) 2 (C) 3 (D) 4 (E) 48

12. How many 3-digit numbers are there with the property that the 2-digit number obtained by deleting the middle digit is equal to one-ninth of the original 3-digit number?

- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

13. Tom wants to write a number in each of the nine boxes in the figure shown. He wants the sum of the three numbers on each diameter to be 13 and the sum of the eight numbers on the circumference to be 40. What is the number that Tom has to write in the central cell?

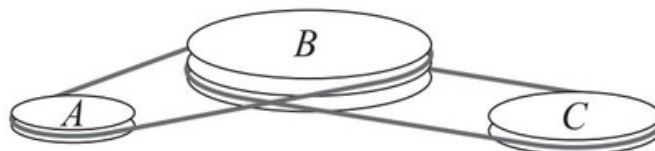


- (A) 3 (B) 5 (C) 8 (D) 10 (E) 12

14. Some diluted juice is to be made out of concentrate and water in the ratio 1:7 by volume. Juice concentrate is in a 1-litre flask, and the flask is half full. What fraction of this concentrate should be used to produce 2 litres of diluted juice?

- (A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{2}{7}$ (D) $\frac{4}{7}$ (E) All of the concentrate.

15. A belt drive system consists of the wheels A, B and C, which rotate smoothly. Wheel B turns 4 full rounds when wheel A turns 5 full rounds. Wheel B turns 6 full rounds when wheel C turns 7 full rounds. Find the perimeter of wheel A if the perimeter of wheel C is 30 cm.



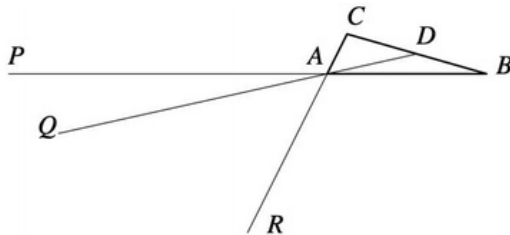
- (A) 27 cm (B) 28 cm (C) 29 cm (D) 30 cm (E) 31 cm

16. Jenny decided to enter numbers into the cells of the 3×3 table in order that the sums of the numbers in all four 2×2 squares be the same. Three numbers in the corner cells have already been written. What number should she write in the cell with the question mark?

3		1
2		?

- (A) 5 (B) 4 (C) 1 (D) 0 (E) impossible to determine

17. Given triangle ABC of area S , let D be the midpoint of BC . Take points P, Q, R on lines AB, AD, AC , respectively, as shown in the picture, and such that $AP = 2 \cdot AB$, $AQ = 3 \cdot AD$ and $AR = 4 \cdot AC$.



What is the area of triangle PQR ?

- (A) S (B) $2S$ (C) $3S$ (D) $\frac{1}{2}S$ (E) 0 (i.e. P, Q, R are collinear)

18. Petra has three different dictionaries, and two different novels on a shelf. How many ways are there to arrange the books if she wants to keep the dictionaries together and the novels together?

- (A) 12 (B) 24 (C) 30 (D) 60 (E) 120

19. The integers from 1 to 99 are written in ascending order without gaps. The sequence of digits is then divided into triplets of digits:

$$123456789101112 \dots 979899 \rightarrow (123)(456)(789)(101)(112) \dots (979)(899)$$

Which of the following is not one of the triplets?

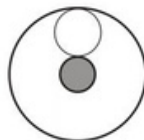
- (A) (222) (B) (444) (C) (464) (D) (646) (E) (888)

20. Let p, q, r be positive integers and $p + \frac{1}{q+\frac{1}{r}} = \frac{25}{19}$. Which of the following is equal to pqr ?

- (A) 6 (B) 10 (C) 18 (D) 36 (E) 42

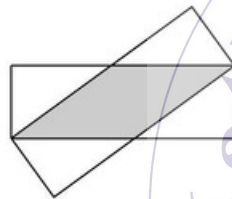
Fill-in-the-blank Questions

21. Two concentric circles of radii 1 cm and 9 cm make a ring. In this ring, n circles are drawn without overlapping, each being tangent to both of the circles of the ring. What is the largest possible value for n ?

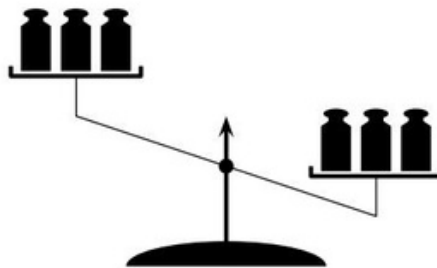


22. All numbers in the set $\{1, 2, 3, 4, 5, 6\}$ are written into the cells of a 2×3 table. How many different ways can this be done such that in each row and in each column the sum of the numbers is divisible by 3?

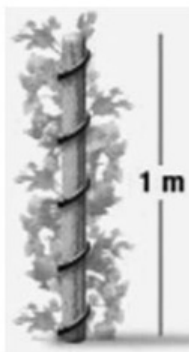
23. Two identical rectangles with side lengths 3 cm and 9 cm overlap, as shown in the diagram. What is the area of the overlap of the two rectangles?



24. On a balance scale 3 different bottles are put at random on each pan. The right pan is heavier. The bottles have weights of 101, 102, 103, 104, 105 and 106 grams. What is the probability that the 106 gram bottle stands on the heavier pan?



25. A plant wound itself exactly 5 times around a pole with height 1 m and circumference 15 cm as shown in the picture. As it climbed, its height increased at a constant rate. What is the length of the plant?



26. Jakob wrote down four consecutive positive integers. He then calculated the four possible totals made by taking three of the integers at a time. None of these totals was a prime. What is the smallest integer Jakob could have written?

27. On an island, frogs are always either green or blue. The number of blue frogs increased by 60% while the number of green frogs decreased by 60%. It turns out that the new ratio of blue frogs to green frogs is the same as the previous ratio in the opposite order (green frogs to blue frogs). By what percentage did the overall number of frogs change?

28. Anna wants to write a number in each square of the grid so that the sum of the four numbers in each row and in each column are the same. She has already written some numbers, as shown. What number does she write in the shaded square?

1		6	3
	2	2	8
	7		4
		7	

29. Several points are marked on a line, and all possible line segments are constructed between pairs of these points (a segment does not include the endpoints). One of the points lies on 80 of these segments; another point lies on 90 segments. How many points were marked on the line?

30. Points A and B are on the circle with centre M. PB is tangent to the circle at B. The distances PA and MB are integers. We know that $PB = PA + 6$. How many possible values are there for the length of MB?

