

**SECTION ONE - (3 point problems)**

1. The mean of two numbers is 2019. One of the numbers is 2021. What is the other number?

- (A) 2017
- (B) 2018
- (C) 2020
- (D) 2022
- (E) 2023

2. Which of the following has the largest value?

- (A)  $\frac{2^3}{3^2}$
- (B)  $\frac{3^2}{2^3}$
- (C)  $3^2 - 2^3$
- (D)  $2^3 - 3^2$
- (E)  $(3 - 2)(2 - 3)$

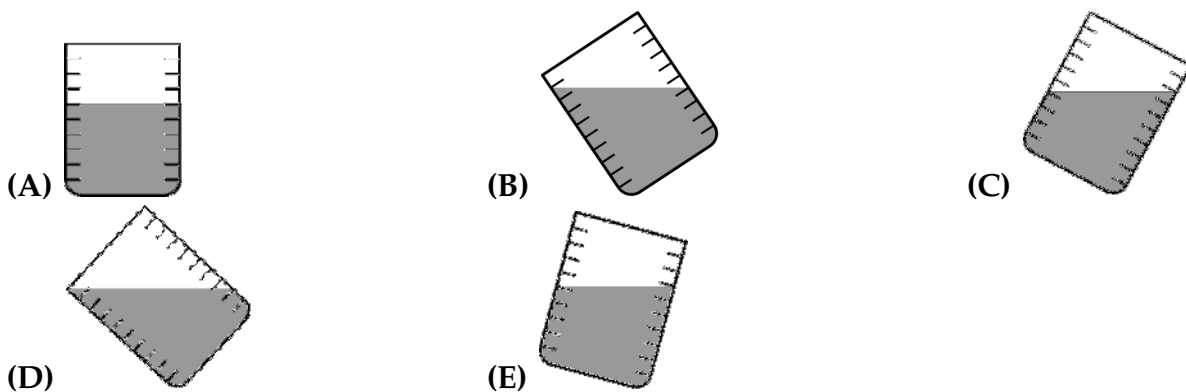
3. A barber wants to write the word SHAVE on a board in such a way that a client looking in to the mirror reads the word correctly. How should the barber write it on the board?

- (A) **SHAVE**
- (B) **SHAVƎ**
- (C) **ƎVAHS**
- (D) **ƎVAHƎ**
- (E) **ƎVAH2**

4. How many different sums of dots can you get by rolling three standard dice simultaneously?

- (A) 14
- (B) 15
- (C) 16
- (D) 17
- (E) 18

5. Five identical glasses are filled with water. Four of them contain the same amount of water. Which one contains a different amount?



6. A park has five gates. Monica wants to enter through one gate and to exit through a different one. In how many ways can she enter and exit the park?

- (A) 25
- (B) 20
- (C) 16
- (D) 15
- (E) 10





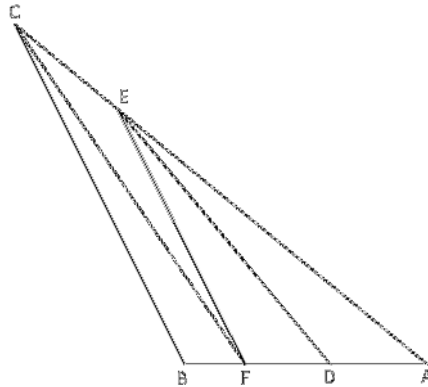
# KSF 2019 - Problems Junior (Class 9 & 10)

Time Allowed: 150 minutes

15. The triathlon consists of swimming, running, and biking. The biking is three-quarters of the total distance; the running is one-fifth; and the swimming is 2 km. What is the total distance of this triathlon, in km?

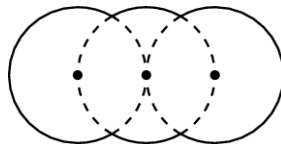
- (A) 10 (B) 20 (C) 38  
(D) 40 (E) 60

16. The triangle  $ABC$  is divided by segments  $DE$ ,  $EF$  and  $CF$  into four triangles whose areas are equal. Determine the ratio of  $AF:BD$ .



- (A) 1 (B) 9:8 (C) 8:7  
(D) 7:6 (E) 6:5

17. The given shape is made of parts of three equal circles of radius  $R$  that have their centres on a straight line. The middle circle passes through the centres of the other two, as shown. What is the perimeter of the shape?



- (A)  $\frac{10\pi R}{3}$  (B)  $\frac{5\pi R}{3}$  (C)  $\frac{2\pi R\sqrt{3}}{3}$   
(D)  $2\pi R\sqrt{3}$  (E)  $4\pi R$

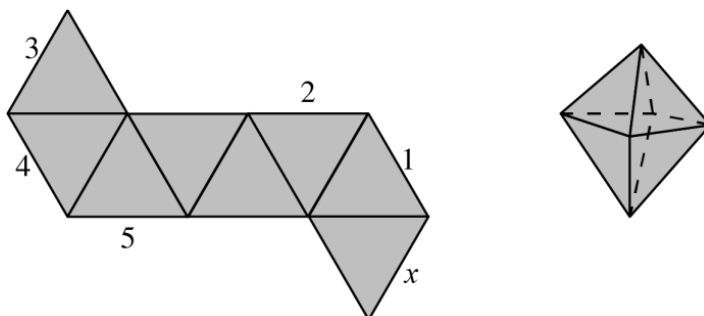
18. The seven digits of the telephone number  $\overline{aaabbbb}$  add up to the two digit number  $\overline{ab}$ . What is the sum  $a + b$ ?

- (A) 8 (B) 9 (C) 10  
(D) 11 (E) 12

19. 60 apples and 60 pears are packed into boxes so that each box contains the same number of apples, and no two boxes contain the same number of pears. What is the largest possible number of boxes that can be packed in this way?

- (A) 20 (B) 15 (C) 12  
(D) 10 (E) 6

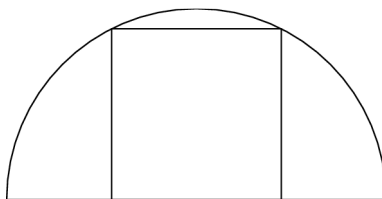
20. The diagram shows a net of an octahedron. When this is folded to form the octahedron, which of the labelled line segments will coincide with the line segment marked with the  $x$ ?



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

**SECTION THREE - (5 point problems)**

21. A square has two of its vertices on a semicircle and the other two on the diameter of the semicircle as shown.



The radius of the circle is 1 cm. What is the area of the square?

- (A)  $\frac{4}{5} cm^2$                                       (B)  $\frac{\pi}{4} cm^2$                                       (C)  $1 cm^2$   
 (D)  $\frac{4}{3} cm^2$                                       (E)  $\frac{2}{\sqrt{3}} cm^2$

22. Two dots are marked in a disc that is rotating around its centre. One of them is 3 cm further than the other to the centre of the disc and moves at a constant speed that is 2.5 times as fast as the other. What is the distance from the centre of the disc to this far point?

- (A) 10 cm                                      (B) 9 cm                                      (C) 8 cm  
 (D) 6 cm                                      (E) 5 cm

23. 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)

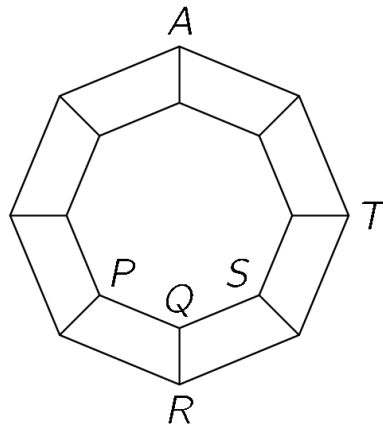
# KSF 2019 - Problems Junior (Class 9 & 10)

Time Allowed: 150 minutes

24. How many planes pass through exactly three vertices of a given cube?

- (A) 1                                      (B) 2                                      (C) 4  
(D) 8                                      (E) 12

25. A graph consists of 16 vertices and some edges that connect them, as in the picture. An ant is now at the vertex labelled  $A$ . At each move, it can walk from one vertex to any neighbouring vertex crawling along a connecting edge. At which of the vertices labelled  $P$ ,  $Q$ ,  $R$ ,  $S$ ,  $T$  can the ant be after 2019 moves?



- (A) only  $P$ ,  $R$  or  $S$ , not  $Q$  and  $T$                                       (B) only  $P$ ,  $R$ ,  $S$  or  $T$ , not  $Q$   
(C) only  $Q$                                       (D) only  $T$   
(E) all of these are possible

26. The positive integers  $a$ ,  $b$ , and  $c$  each have three digits, and for each integer the first digit is the same as its last digit. Also  $b = 2a + 1$  and  $c = 2b + 1$ . How many possibilities are there for the integer  $a$ ?

- (A) 0                                      (B) 1                                      (C) 2  
(D) 3                                      (E) more than 3

27. On each vertex of a square, one positive integer is placed. For any two numbers joined by an edge of the square, one is a multiple of the other. However, for any two diagonally opposite numbers, neither is a multiple of the other. What is the smallest possible sum of the four numbers?

- (A) 12                                      (B) 24                                      (C) 30  
(D) 35                                      (E) 60

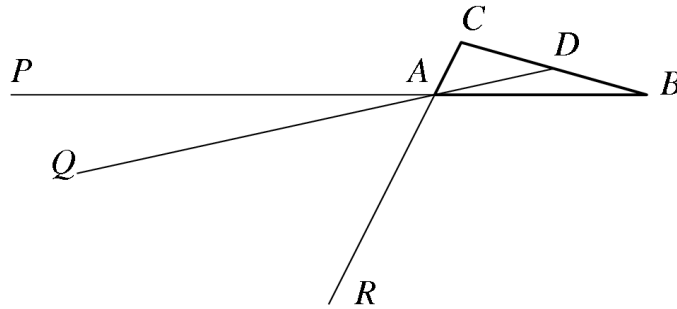
28. What is the least number of elements we have to delete from the set  $\{10, 20, 30, 40, 50, 60, 70, 80, 90\}$  so that the product of the elements remaining in the set is a perfect square?

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

## KSF 2019 - Problems Junior (Class 9 & 10)

Time Allowed: 150 minutes

29. 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).

30. If any digit of a given 4-digit number is deleted, the resulting 3-digit number is a divisor of the original number. How many 4-digit numbers have this property?

- (A) 5 (B) 9 (C) 14  
(D) 19 (E) 23

-- Good Luck --