2022 P4 Exploration Class Selection Test

(Time: 90 min; Full marks: 120 points)

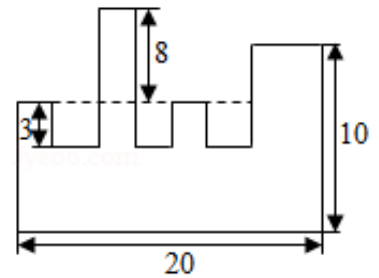Name: _____ .   Score: _____ .

Part I. Fill in the blanks (4'×8=32')

1. Given the 9 by 9 grid below, the sum of the three numbers in every row, column and diagonal must be equal. Then the "☆" corresponds to _____ .

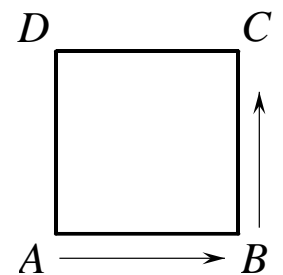2. The perimeter of the following shape is _____ .

3. $\overline{a42b}$ is a multiple of 18. The maximum value of $\overline{a42b}$ is _____ .

4. A car is travelling from point A to B with speed 30km/h. 4 hours after its departure, a train begins travelling from point A to B with triple the speed of the car. The train catches up with the car at the mid-point of A and B, the distance between A and B is _____ km.

5. A class had 58 participants who registered for extracurricular activities. A total of 32 of them joined the literature society, 24 the art society, and 30 the music society. Thirteen students are members of both the literature society and the art society, twelve are members of both the music society and the art society, and eleven are members of both the literature society and the music society. _____ people joined all three societies.

6. In the square with a side of 90 meters shown below, Alex and Bob leave points A and B, respectively, at the same moment and move anticlockwise. Given that Alex moves at a speed of 63 m/min and Bob at a speed of 72 m/min, when Bob finally catches up to Alex, it will be at point _____ (fill in "A", "B", "C" or "D").
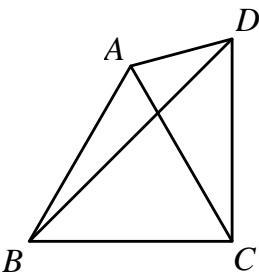

7. A boat can travel 60 km downstream and 80 km upstream in 3.2 hours. The boat then travels 80 km downstream and 40 km upstream in another 2.6 hours, the speed of the boat in still water is _____ km/h.

8. By utilizing each of the digits 2, 3, 4, 5, and 6 once, fill in the corresponding blanks to multiply a 3-digit number by a 2-digit number. When the product is the largest, the sum of the two numbers is _____ .

Part II. Fill in the blanks (6'×8=48')

9. To complete the work, 80 automobiles had to travel through a 120-meter tunnel. If each car is 10 meters long and there must be a 20-meter space between them, it would take the convoy _____ minutes to travel through the tunnel at 500 meters per minute.

10. The figure depicts an equilateral triangle ABC and an isosceles right triangle BCD, if BC=18, the area of the triangle ACD is _____ .
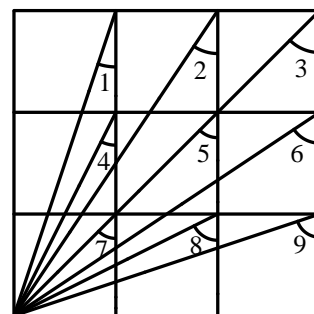
11. A teacher gives out fruits to some pupils; if everyone gets 10 apples, there will be 8 left; if everyone gets 11 peaches, 4 more peaches will be needed. It is known that there are 5 more apples than peaches, there are _____ apples and peaches in total.

12. In the vertical algorithm below, different Kanji corresponds to different digits from 0 to 9, and the same Kanji to the same number. The 4-digit number that "方了个田" corresponds to is _____ .
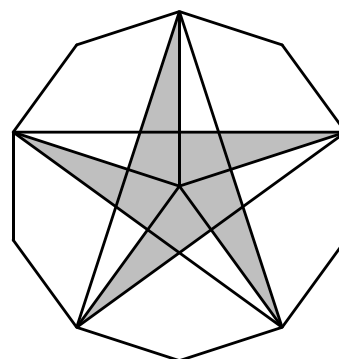
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              个  田
×             田  个
─────────────────────
          田  了  田
      有  个  田
─────────────────────
      方  了  个  田
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13. As indicated by the figure, a 3 by 3 square grid contains a total of 9 angles, their sum is _____ digress.

14. Adam, Berry, and Conner each have one, two, or three candies. Berry says: "Adam has the most candies", Adam responds, "I have two," and Conner responds, "I have two more candies than Berry." If one of them lied, Conner has _____ candies.
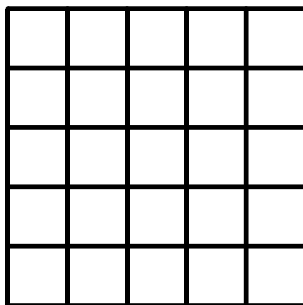
15. As depicted in the picture, the decagon's area is 2020. The shaded region's area is _____ .
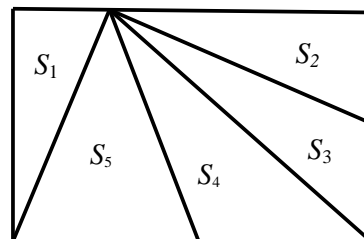
16. Dividing the natural numbers 1 through 8 into two groups so that the difference between the sums of the two groups is 16, there are _____ possible ways.

Part III. Answer questions (10'×4=40', write the necessary steps, or no points will be given)

17. As shown in the figure, 3 pieces of identical chess need to be placed in the 5 by 5 grid. If each row and column hold no more than 1 piece of chess, how many possible arrangements are there?

18. As shown in the figure below, a rectangle with an area of 420 is divided into 5 triangles. the triangles' area S_1, S_2, S_3, S_4, S_5 form an arithmetic sequence, find S_5.

19. The natural numbers 1 through 20 are divided into two groups A and B so that the product of group A can be divided by the product of group B. What is the minimum value of $A \div B$?

20. The following arrangement of natural numbers beginning with 5 is depicted in the figure below. The notation $distance(k)$ is defined to be the minimum number of steps needed to get from "5" to the number k, with each step required to be either horizontal or vertical. For example, $distance(19)=2$ and $distance(29)=4$, find $distance(2023)$.

	...	...	...	...	...	...	...
...	21	20	19	18	17	...	
...	22	9	8	7	16	...	
...	23	10	5	6	15	...	
...	24	11	12	13	14	...	
...	25	26	27	28	29	...	
...	...	...	...	...	...	...	...