2 Section B

B1
My sister was 2 when I was born. I turned 10 today. How old is my sister now?

Solution. My sister must be 2 years older than me if she was 2 when I was born. Therefore, she is $10 + 2 = \boxed{12}$ years old.

Answer to B1: 12

B2
A duck weighs 1 kg and a horse weighs 1000 kg. How much more (in kg) do 5000 ducks weigh than 3 horses?

Solution. We must calculate $5000 \times 1 - 1000 \times 3 = 2000$. Therefore, the ducks weigh 2000 kg more in total.

Answer to B2: 2000

B3
I had 20 candies. Then I ate half of them. Then I bought 3 more. How many candies do I have now?

Solution. We start with 20. After I eat half, we are left with $20 \div 2 = 10$. After I buy 3 more, we now have $10 + 3 = \boxed{13}$.

Answer to B3: 13

B4
What is the smallest whole number, such that, when you add its digits together, you get 19?

Solution. Clearly we need at least three digits, since the maximum sum of digits of a two digit numbers is $9 + 9 = 18$. The smallest way to make 19 is to use a 1 and two 9s; any other way would be at least 200. So $\boxed{199}$ is our answer.

Answer to B4: 199

B5
The symbol $<$ means "less than"; that is, the number on the left is smaller than the number on the right. For example, $5 < 10$ is true.

True or false: $100 < 98$. (Write `true` or `false` on the answer line.)

Solution. $100 < 98$ is false. When we compare numbers, we first check the number of digits. Since 100 has more digits, it's actually a bigger number.

Answer to B5: false

B6
A fast-food restaurant only sells chicken nuggets in quantities of 6, 12, and 18. Below are the prices:

Quantity	Price
6 chicken nuggets	)3.00
12 chicken nuggets	(5.00
18 chicken nuggets	)7.00

What is the lowest price you could possibly pay to buy 30 chicken nuggets?

Solution. One way to approach these problems is to come up with a possible solution first, and then improve it until we can no longer make it any better. Since all quantities of chicken nuggets we can buy are divisible by 6, let's start by considering buying 30 nuggets using only the 6-nugget boxes. We will need $30 \div 6 = 5$ such boxes. The total cost will be

(15.

Next, let's observe that it is cheaper to buy 12 chicken nuggets than to buy two boxes of 6 chicken nuggets. So we can improve our solution by buying $12+6+6+6$ instead of $6+6+6+6+6$. In fact, we can improve it even more by buying $12+12+6$ instead of $12+6+6+6$. The total cost now will be
(5 × 2 +
)3 =
)13.

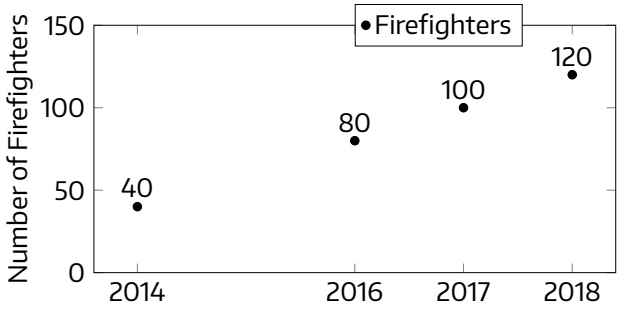
Finally, let's observe that it is cheaper to buy 18 chicken nuggets than to buy a box of 6 chicken nuggets and a box of 12 chicken nuggets (
(7 vs.
)8). Thus we can improve our solution even further by buying $18+12$ instead of $12+12+6$. The cost is now
(12.

Now we cannot improve the solution further, so $\boxed{)12}$ is in fact the best we can do.

Answer to B6:

(12.00

B7
The number of firefighters in the city of Fireloo is plotted on the following chart:

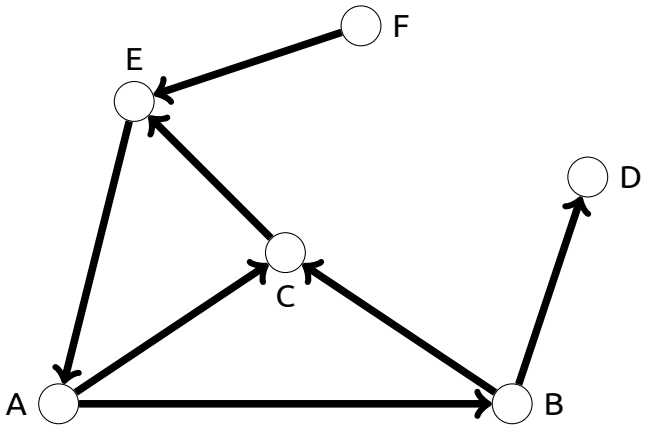


The data for 2015 is missing from the chart. Based on the trend, how many firefighters would you expect the city to have had in 2015?

Solution. From the years 2016 to 2018, we can see that the number of firefighters grows by 20 each year. Indeed, if we put $40+20=\boxed{60}$ in for 2015, that will continue the trend.

Answer to B7: 60

B8
The picture below shows a map of several cities and the one-way roads connecting them.



Currently, some trips are impossible. For example, it is not possible to get from city A to city F. The government would like to build a new one-way road so that it is possible to reach any city from any other city. From which city would you build this new road, and where would it go? (Write your answer as X $\to$ Y, but replace X and Y with your choice of cities.)

Solution. We must consider what cities are the most problematic with the current layout. The cities A, B, C, and E are generally OK: we can get from any of those cities to any other of those cities (for example, by following the loop A $\to$ B $\to$ C $\to$ E $\to$ A).

But the cities D and F are problematic, because there is no way to leave city D, and there is no way to get to city F. So we should construct a road to fix these problems. The road $\boxed{\text{D}\to\text{F}}$ makes the most sense. We then can see that all cities are connected, because now there is a new loop B $\to$ D $\to$ F $\to$ E $\to$ A $\to$ B which intersects with the old loop.

Answer to B8: D, F