Task. Four pipes can fill a reservoir in 15, 20, 30 and 60 hours respectively. The first one was opened at 6 AM, second at 7 AM, third at 8 AM and the fourth at 9 AM. When will the reservoir be filled?

Solution. The first pipe can fill reservoir in 15 hours. This means that it fills $\frac{1}{15}$ of reservoir in one hour.

Similarly, the second, third and fourth pipes fill $\frac{1}{20}$, $\frac{1}{30}$ and $\frac{1}{60}$ of reservoir in one hour respectively.

Let t be the number of hours spent by first pipe. The second pipe opened at 7 AM, i.e. one hour later, therefore it worked $t - 1$ hours.

Similarly, the third and fourth pipes worked $t - 2$ and $t - 3$ hours respectively.

Together all pipes fill the whole reservoir, so we obtain the following equation:

$$\frac{1}{15}\, t + \frac{1}{20}\,(t-1) + \frac{1}{30}\,(t-2) + \frac{1}{60}\,(t-3) = 1$$

Let us solve it.

$$\frac{t}{15} + \frac{t-1}{20} + \frac{t-2}{30} + \frac{t-3}{60} = 1,$$
$$\frac{4t}{60} + \frac{3(t-1)}{60} + \frac{2(t-2)}{60} + \frac{t-3}{60} = 1$$
$$\frac{4t + 3(t-1) + 2(t-2) + t - 3}{60} = 1$$
$$4t + 3t - 3 + 2t - 4 + t - 3 = 60$$
$$10t - 10 = 60$$
$$10t = 60 + 10 = 70$$
$$t = \frac{70}{10} = 7 \text{ hours}$$

Answer. 7 hours