

Let N be the greatest 5-digit number whose digits have a product of 120. What is the sum of the digits of N ?

Let us consider the factors of 120 to decide which digits can be in N :

#	Factor?
1	yes
2	yes
3	yes
4	yes
5	yes
6	yes
7	no
8	yes
9	no

Note that 0 cannot be included since any product involving it must be 0.

We want N to be as large as possible, so its first digit should be 8.

Now, $\frac{120}{8} = 15$ so the remaining

digits should multiply to 15. The only possible set is $\{1, 1, 3, 5\}$, hence

$$N = 85311$$

The sum of the digits is

$$8 + 5 + 3 + 1 + 1 = \boxed{18}$$

Let N be the greatest 5-digit number whose digits have a product of 120.

What is sum of digits of N ?

Factors of 120

#	Yes/No
①	Yes

85311

$$8 \times 15 = 120$$

2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	No
8	Yes
9	No

$$8 \times 3 \times 5 \times 1 \times 1$$
$$\text{sum} = 10 + 8 = 18$$

$$\frac{120}{2} = 60$$

$$\frac{60}{2} = 30$$

$$\frac{30}{2} = 15$$