

1. a. Check the following equalities:

$$\frac{1}{2} - \frac{1}{3} = \frac{1}{2 \cdot 3}; \quad \frac{1}{3} - \frac{1}{4} = \frac{1}{3 \cdot 4}; \quad \frac{1}{4} - \frac{1}{5} = \frac{1}{4 \cdot 5}; \quad \frac{1}{5} - \frac{1}{6} = \frac{1}{5 \cdot 6};$$

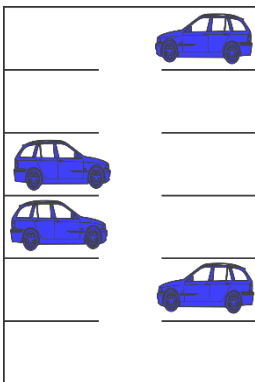
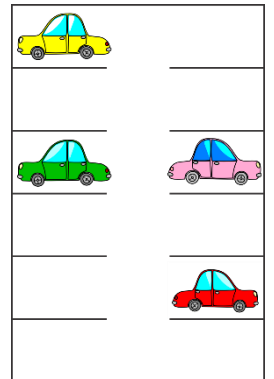
b. Continue the chain of similar equalities. Write the algebraic expression for the pattern.

c. Use the previous conclusion to simplify the following expressions:

$$\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} + \cdots + \frac{1}{n(n+1)};$$

$$\frac{1}{x(x+1)} + \frac{1}{(x+1)(x+2)} + \frac{1}{(x+2)(x+3)} + \cdots + \frac{1}{(x+99)(x+100)};$$

2. $p, p+2, p+4$ are all prime numbers. Find all possible p and prove that there are no other numbers such that the condition holds.
3. Prove that
 a. $\sqrt{8} = 2\sqrt{2}$; b. $\sqrt{45} = 3\sqrt{5}$; c. $\sqrt{12} = 2\sqrt{3}$
4. Apartment building has 12 apartments and a parking for 12 cars (each family has different car). How many different way are there to park these 12 cars?
5. Today there were only 4 cars at the parking lot. How many different ways are there to park 4 cars on a 12-place parking lot?



6. There is a 12-place parking lot at the dealership. 4 identical cars are parked there. How many different way are there to park these 4 cars?
7. Check that $A \Rightarrow B$ is equivalent to $(\text{NOT } A) \text{ OR } B$ (thus, "if you do not clean up your room, you will be punished" and "clean up your room, or you will be punished" are the same).
8. A mom tells the son "If you do not do the dishes, you will not go to the movie". Is it the same as "If you do the dishes, you go to the movie?"