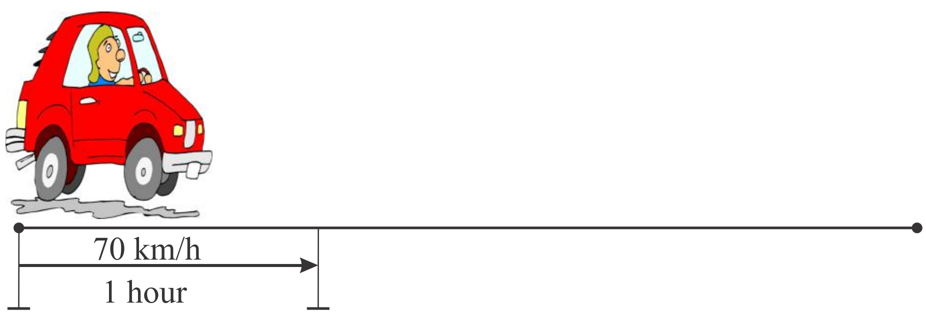
Math 4e. Classwork 10.

**Speed, time, and distance.**

Car was moving for 3 hours with the speed of 70 km/h. How far did it travel? In this kind of problems in math we always assume that the car (or any other moving object) is moving with the constant speed along the straight line. Of course, this is seldom case in the actual reality, and in physics you will be studying the laws of motion in a more profound way.

Let's denote the speed of the car *v*, the time during which the car was moving *t*, and the distance it travelled, *S*. These letters are usually used for speed, time and distance, but you can use any other letters as well.




$$S = v \times t = vt$$

If $v = 70km/h$ and $t = 3h$, then $S = 70\frac{km}{h} \times 3h = 70km$. ($70\frac{km}{h}$ means $\frac{70\ km}{1\ hour}$, kilometers per hour, also can be written as kmph).

This is simple. If we know two out of three parameters, we always can find the third one.

$$S = vt;$$

$$v = \frac{S}{t};$$

$$t = \frac{S}{v};$$

Examples:

a. Train is moving at the speed of 50 m/h. How far will it travel in 120 minutes?

Solution:

$120\ minutes = 2\ hours$

$50\ {}^{m}/_{h} \cdot 2h = 100\ m.$

b. Mary needs 25 minutes to walk from home to school. The distance between her home and school is 1.5 miles. What is the speed at which she is walking?

Solution:

$$1.5\ miles: 25\ minutes = 0.06\frac{mile}{minute} = 0.06\frac{mile}{min} \cdot 60 = 3.6\ mile/hour.$$

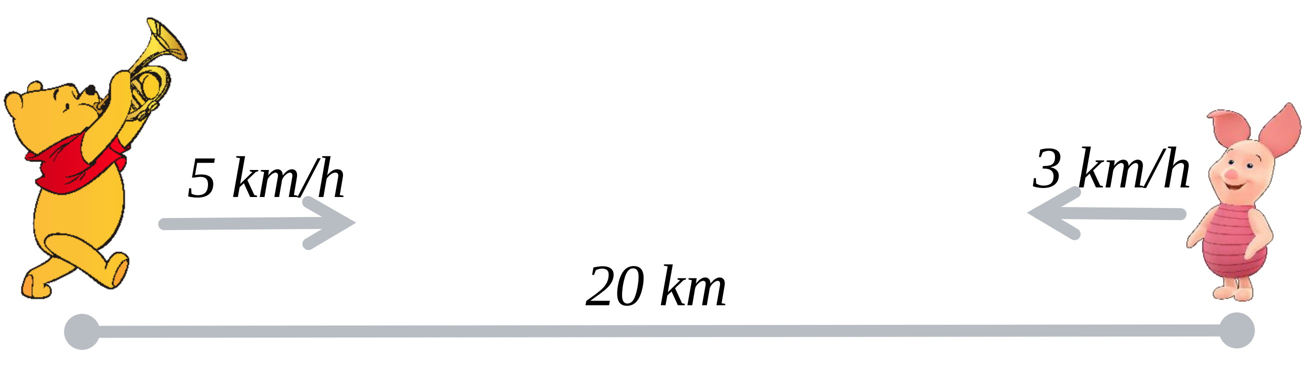
c. Cyclist is traveling from Stony Brook to Port Jefferson. Distance between these two towns is 8 kilometers. The speed of the cyclist is 16 km/h. How much time does he need to go from S.B. to P.J?

Solution:

$$8km: 16\frac{km}{h} = 0.5\ hour\ (or\ 30\ minutes)$$

Now let's take a look at the following problem:

*Winnie-the-Pooh and Piglet start walking toward each other at the same time from their houses along the straight street. The Winnie's speed is 4 km/h, and Piglet is walking at the speed of 5 km/h. Distance between there houses is 20km. When and where they will meet?*




How fast the distance between them will be shrinking? In one hour Winnie will walk 5 km and Piglet will walk 4 km, so distance between them will be

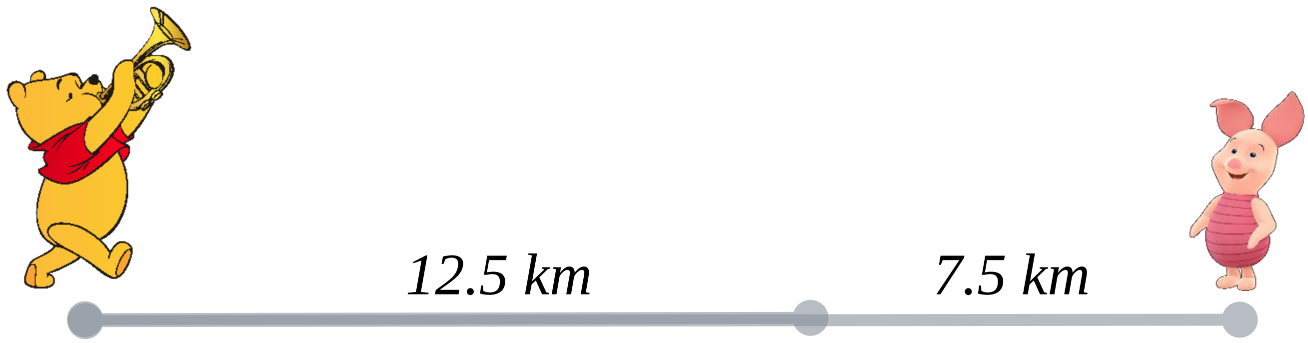
$$20km - 5km - 3km = 20 - (5 + 3) = 20 - 8 = 12km$$

Speed of this shrinking is 8 km/h, and they will meet exactly when the distance will shrink to zero.

$$20km\colon 8\frac{km}{h} = 2.5\ hour.$$

They will meet in 2.5 hours. By this time Winnie will walk

$$2.5h \cdot 5\frac{km}{h} = 12.5km, and\ Piglet\ will\ walk\ 20 - 12.5 = 7.5km$$




Another problem:
A boat is going down the river. The speed of the river flow is 6 km/h. Speed of the boat in the still water, like lake, is 10 km/h. How much time does the boat need to go 30 km down the river? 30 km up the river?

**Exercises**:

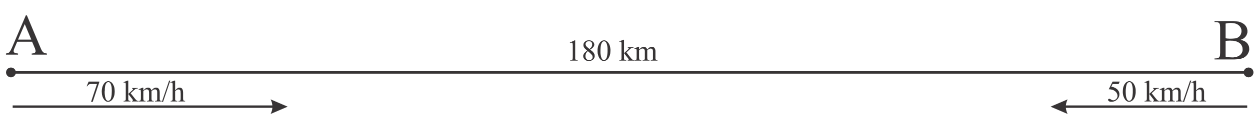
1. Peter was walking for 15 minutes with the speed of 5km/h. How far did he go?
2. The distance between the Earth and Mars is 55,757,930 km. How fast the space ship should go to reach the red planet in 250 days? Represent the answer in the units of kilometers per hour.

3. The speed of the boat in a still water on a lake is 12 km/h. The speed of the river flow is 3 km/h. How many hours does the boat need to go from the city A to the city B if the distance between the two cities is 45 km and the city A is up on the river, i.e. the river flows from A to B?

   How many hours does this boat need to go back from the city B to the city A?

4. The speed of the boat going downstream the river is 19 km/h, and the speed of the same boat going upstream this river is 15 km/h. What is the speed of the river stream and what is the speed of the boat in a still water on a lake?

5. Two cars start moving towards each other at the same time from the two cities, A and B. The distance between the cities is 180 km. The speed of the car that departed from the city A is 50 km/h, the speed of the car that left from the city B is 70 km/h. In how many hours will they meet?




How far from the city A they will meet?

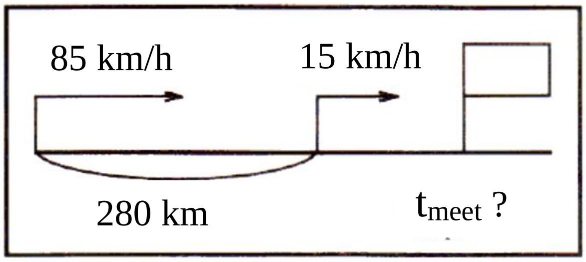
6. Two cars start moving at the same time in the same direction from cities A and B, as shown in the picture below.


How many hours will it take for the faster car to catch up with the slower car? How far from the city A will they meet?

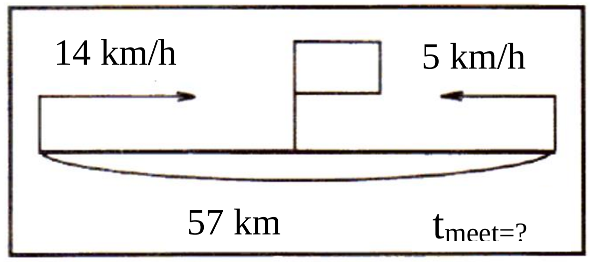
7. Find the value of the expressions with given values of variables:
   - $a.\ \ 90 - b:9,\qquad if\ b = 0;\ 9;\ 810.$
   - $b.\ \ a + 52,\qquad if\ \ a = 0; 18; 49.$
   - $c.\ \ s(15 - s),\qquad if\ s = 5; 16; 25.$
   - $d.\ \ 240: d - 4(m + n),\quad if\ d = 1, m = 15, n = 5$

8. For the four pictures below, come up with the problem and solve it.

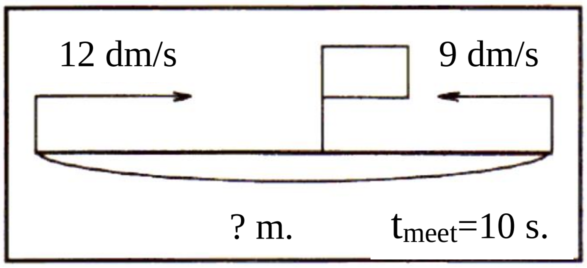
a)



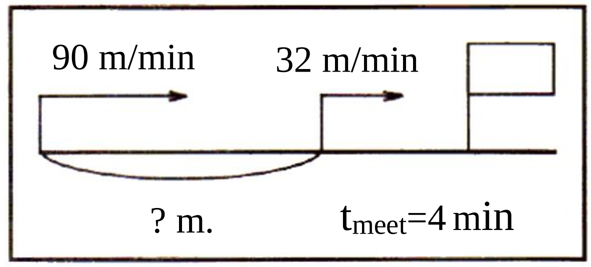

c)




b)




d)




9. Fill the tables:

| $\boldsymbol{c}$ | $\boldsymbol{b}$ | $\boldsymbol{b \cdot c}$ |
|---|---|---|
| $\frac{3}{8}$ | $\frac{3}{4}$ | |
| $\frac{3}{4}$ | | $\frac{9}{21}$ |
| | $\frac{2}{3}$ | $\frac{16}{21}$ |

| $\boldsymbol{c}$ | $\boldsymbol{b}$ | $\boldsymbol{b : c}$ |
|---|---|---|
| $\frac{5}{6}$ | $\frac{4}{9}$ | |
| $\frac{7}{10}$ | | $\frac{1}{2}$ |
| | $\frac{5}{4}$ | $\frac{2}{5}$ |

10. Each floor of a residential building has $f$ two-bedroom apartments and $g$ three-bedroom apartments. The building has 5 floors. How many apartments are there in the building? Write the expression, then solve the problem for $f = 3$ and $g = 4$

11. Write the number in parenthasis so the equality holds:

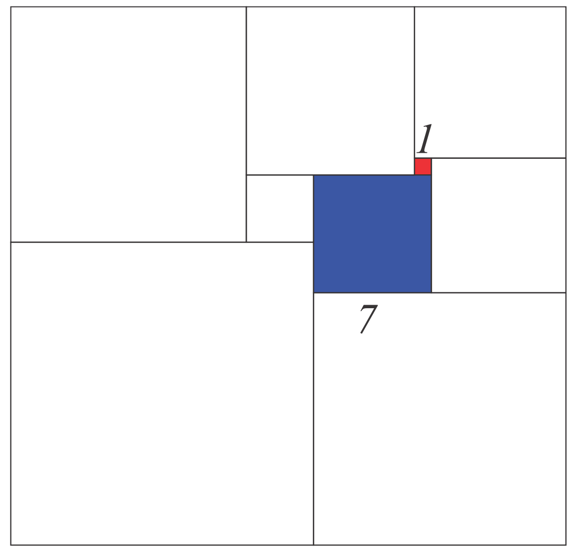
$a.\ -(\dots) = -11;$ $\quad b.\ -(\dots) = 11;$

$c.\ -(\dots) = 86;$ $\quad d.\ -(\dots) = -71$

12. If $b$ is positive number, $-b$ is ________________

13. If $b$ is negative number, $-b$ is _______________

14. Big rectangle contains 9 squares. The side of red square is 1 unit; the side of blue square is 7 units. Find sides of all other squares.




15. A store is giving rewards to its customers at the register. Every 15th receives a free lollipop, every 24th receives a free chocolate bar. During that day 1000 customers visited the store. How many of them have received …

a) a free lollipop?
b) a free chocolate bar?
c) both?

16. Create a word problem, that can be solved with the following numeric expression:

$a.\ \ 40:5\cdot 7;$ $b. (12+24):3;$ $c.\ \ 3\cdot 4+2\cdot 7;$