

Grade 9 Mathematics Worksheet

Functional relationship and equations

Questions:

- Sheldon lives 15 km from school and cycles to school every day. The equation that gives us this distance (D) from the school, in km, as a function of the travelling time (t), in minutes, is $D = 15 - 0,75t$. At what time will Sheldon arrive at school if he leaves home at 7:45 am?
 - At 8:00 am
 - At 7:56 am
 - At 8:05 am
 - At 7:55 am
- The population of a city is currently 2 800 000 people and this figure is growing by approximately 2 500 per week with the sudden influx of refugees from a neighbouring country. How many weeks until the population reaches 3000 000?
 - 75 weeks
 - 85 weeks
 - 90 weeks
 - 80 weeks
- When ploughing a field in preparation for the planting season, a farmer takes 8 hours with his older John Deere tractor to plough the field. If he only uses the newer model, he can do the job three hours faster. He decides to use both tractors, and asks his foreman to help with the ploughing.



- Write down an equation that shows the rate at which they will be ploughing the field in one hour.
 - Use this equation to find how long it will take them to plough the field.
- Two aeroplanes take off at the same time from two airports 1 869 km apart. Plane A flies at 120 km/h faster than Plane B. Each of the planes are flying to the airports from which the other plane is taking off.

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- a) Find an equation for distance in terms of the time (t) and the speed (s) of each of the planes
- b) Write the time in terms of the speed.
- c) Use a table of value to find the value of t . Interpret your answer correct to two decimals.

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Solution:

1. When he reaches school, the distance (D) away from the school is zero. So $D = 0$. Then we find the value of t :

$$0 = 15 - 0,75t$$

$$\therefore 15 = \frac{3}{4}t$$

$$\therefore t = \frac{15 \times 4}{3}$$

$$\therefore t = 20 \text{ min}$$

So the time will be $7:45 + 0:20 = 8:05 \text{ am}$.

The solution is thus (C).

2. Population = $2\,800\,000 + 2\,500w$ where w is the numbers of weeks that lapsed.

Now:

$$P = 2800000 + 2500w$$

$$\therefore 3000000 = 2800000 + 2500w$$

$$\therefore 200000 = 2500w$$

$$\therefore w = 80.$$

3. a) $\frac{1}{5} + \frac{1}{8} = \frac{1}{x}$

$$\frac{1}{5} + \frac{1}{8} = \frac{1}{x}$$

$$\therefore 40x \times \left(\frac{1}{5} + \frac{1}{8}\right) = \left(\frac{1}{x}\right) \times 40x$$

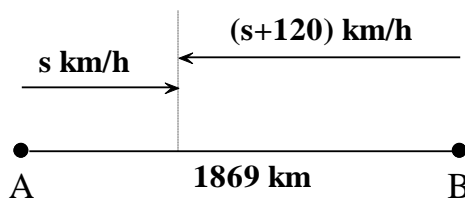
b) $\therefore 8x + 5x = 40$

$$\therefore 13x = 40$$

$$\therefore x = 3,0769$$

$$x = 3 \text{ hours and } 5 \text{ min}$$

4. a)



Assume this happens t hours after takeoff: (they have both flown for t hours)

Then:

$$\text{Distance}_{\text{slow}} + \text{Distance}_{\text{fast}} = 1869 \text{ km}$$

$$\therefore st + (s + 120)t = 1869$$

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$$st + (s + 120)t = 1869$$

b) $\therefore 2st + 120t = 1869$

$$\therefore t = \frac{1869}{2(s + 120)} = \frac{934.5}{s + 120}$$

c)

| s | t=1 869/s | t=1 869/(s+120) | Δt |
|-------|-------------|-----------------|-------------|
| 120 | 15.575 | 7.7875 | 7.7875 |
| 130 | 14.37692308 | 7.476 | 6.900923077 |
| 140 | 13.35 | 7.188461538 | 6.161538462 |
| 150 | 12.46 | 6.922222222 | 5.537777778 |
| 160 | 11.68125 | 6.675 | 5.00625 |
| 170 | 10.99411765 | 6.444827586 | 4.549290061 |
| 180 | 10.38333333 | 6.23 | 4.153333333 |
| 190 | 9.836842105 | 6.029032258 | 3.807809847 |
| 200 | 9.345 | 5.840625 | 3.504375 |
| 210 | 8.9 | 5.663636364 | 3.236363636 |
| 220 | 8.495454545 | 5.497058824 | 2.998395722 |
| 230 | 8.126086957 | 5.34 | 2.786086957 |
| 240 | 7.7875 | 5.191666667 | 2.595833333 |
| 300 | 6.23 | 4.45 | 1.78 |
| 350 | 5.34 | 3.976595745 | 1.363404255 |
| 400 | 4.6725 | 3.594230769 | 1.078269231 |
| 500 | 3.738 | 3.014516129 | 0.723483871 |
| 600 | 3.115 | 2.595833333 | 0.519166667 |
| 700 | 2.67 | 2.279268293 | 0.390731707 |
| 800 | 2.33625 | 2.031521739 | 0.304728261 |
| 1000 | 1.869 | 1.66875 | 0.20025 |
| 3000 | 0.623 | 0.599038462 | 0.023961538 |
| 4000 | 0.46725 | 0.453640777 | 0.013609223 |
| 10000 | 0.1869 | 0.184683794 | 0.002216206 |
| 20000 | 0.09345 | 0.092892644 | 0.000557356 |

It will take the planes roughly 11 minutes to cross paths and the lower plane will fly at a speed of 10 000 km/h

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It is very important to help learners understand what a function is and how functional relationships are formed.

The input is not given here, and learners have to understand what the function represents before they can continue.

Here the output for an unknown function is given, and the learner has to find the function and use it to answer the question with.

This can also be asked from grade 7 onwards. Make sure the variable is clearly defined when feedback is given.

Rate of work done in one hour.

The meaning of what 0,0769... means in terms of minutes (part of an hour) is important to understand.

At which point will the two aeroplanes cross above each other on their respective journeys?

There are two variables here. The time since take off and the speed at which the planes are flying.