Answer on Question #64302 – Math – Algebra

Question

Two towns P and Q are 144km apart by rail and 150km by road. A car takes t hours for the journey from P and Q and a train takes 24 minutes longer.

(a) Write down, in terms of t, expressions for the average speed of the car and the train

(b) If a train average is 15kmh^-1 less than the car for the journey, write down an equation in t.

(c) By solving your equation in (b), find the average speed of the car and of the train.

Solution

$$24\ min = \frac{24}{60}\ h = \frac{2 \cdot 12}{5 \cdot 12} h = \frac{2}{5} h = 0.4\ h.$$

(a) The average speed of the car is

$$v_{car} = \frac{d_1}{t_1} = \frac{150}{t}.$$

The average speed of the train is

$$v_{train} = \frac{d_2}{t_2} = \frac{144}{t+0.4}.$$

(b)

$$v_{train} = v_{car} - 15,$$

$$v_{car} = v_{train} + 15,$$

$$\frac{150}{t} = \frac{144}{t+0.4} + 15.$$

(c)

$$\frac{150}{t} = \frac{144+15(t+0.4)}{t+0.4},$$

$$\frac{150}{t} = \frac{144+15t+6}{t+0.4},$$

$$\frac{150}{t} = \frac{15t+150}{t+0.4},$$

$$150(t + 0.4) = t(15t + 150),$$

$$150t + 60 = 15t^2 + 150t,$$

$$60 = 15t^2,$$

$$t^2 = \frac{60}{15} = 4 = 2^2.$$

Therefore,

$$t = 2.$$

The average speed of the car is

$$v_{car} = \frac{150}{2} = 75\frac{km}{h}.$$

The average speed of the train is

$$v_{train} = \frac{144}{2 + 0.4} = \frac{144}{2.4} = 60\frac{km}{h}.$$

Answer:

(a) $v_{car} = \frac{150}{t}$; $v_{train} = \frac{144}{t+0.4}$; **(b)** $\frac{150}{t} = \frac{144}{t+0.4} + 15$;

(c) $v_{car} = 75\frac{km}{h}$, $v_{train} = 60\frac{km}{h}$.