

2. A person rows down a stream in 20 minutes, but without the aid of the stream it would have taken him half an hour. What is the rate of the stream per hour, and how long would it take him to row against it?

1st. Moving with stream:

$$\begin{aligned} \text{In } 20', \text{ distance rowed} &= 1\frac{1}{2} \text{ miles;} \\ \therefore \text{ in } 1', & \quad \quad \quad = \frac{3}{40} \text{ miles.} \end{aligned}$$

2nd. Moving in still water.

$$\begin{aligned} \text{In } 30', \text{ distance rowed} &= 1\frac{1}{2} \text{ miles;} \\ \therefore \text{ in } 1', & \quad \quad \quad = \frac{3}{60} \text{ miles;} \\ \therefore \text{ rate of stream} &= \frac{3}{40} - \frac{1}{20} = \frac{1}{40} \text{ miles;} \\ \therefore \text{ rate of stream per hour, } & \frac{1}{40} \times 60 = 1\frac{1}{2} \text{ miles.} \end{aligned}$$

$$\begin{aligned} \text{Rate of stream in } 1' &= \frac{1}{40} \text{ miles,} \\ \text{in still water, distance rowed} &= \frac{1}{20} \text{ miles;} \\ \therefore \text{ distance rowed against stream} &= \left(\frac{1}{20} - \frac{1}{40}\right) \text{ miles} \\ &= \frac{1}{40} \text{ miles;} \end{aligned}$$

$$\therefore \text{ time required to row } 1\frac{1}{2} \text{ miles} = \frac{3}{2} \div \frac{1}{40} = \frac{3 \times 40}{2} =$$

$$60' = 1 \text{ hour.}$$

3. At what time between 1 and 2 are the hands of a clock opposite to each other?

Let OC be the position of the hr. hand.

Let OD be the position of the min. hand.

At 1 o'clock OC overlapped OB , and OD overlapped OA .

Then BC space passed over by hr. hand, and AD space passed over by min. hand.

$$12 \text{ times } BC = AD \quad (1).$$

$$\begin{aligned} \text{But } AD &= AB + BC + CD. \\ &= 5 \text{ min.} + BC + 30 \text{ min.} \end{aligned}$$

