

⑧ let speed of train = x km/h
 distance travelled = 360 km
 time = $\frac{d}{s} = \frac{360}{x}$ hr

Increased speed of train = $(x+5)$ hr
 time = $\frac{d}{s} = \frac{360}{x+5}$ hr

acc to condition

$$\frac{360}{x} - \frac{360}{x+5} = 1$$

$$\Rightarrow 360 \left(\frac{1}{x} - \frac{1}{x+5} \right) = 1$$

$$\Rightarrow 360 \left(\frac{x+5-x}{x^2+5x} \right) = 1$$

$$\Rightarrow x^2+5x = 360 \times 5$$

$$\Rightarrow x^2+5x-1800=0$$

$$\Rightarrow x^2+45x-40x-1800=0$$

$$\Rightarrow x(x+45)-40(x+45)=0$$

$$\Rightarrow (x+45)(x-40)=0$$

$$\Rightarrow x+45=0, \quad x-40=0$$

$$\Rightarrow x=-45, \quad x=40$$

rejected

$$\therefore \text{Speed of train} = 40 \text{ km/h}$$

⑨ Time taken by pipe of smaller diam. to fill tank = x hr

Time taken by pipe of larger diam = $(x-10)$ hr

acc to condition

$$\frac{1}{x} + \frac{1}{x-10} = \frac{1}{75/8}$$

$$\Rightarrow \frac{x-10+x}{x(x-10)} = \frac{8}{75}$$

$$\Rightarrow \frac{2x-10}{x^2-10x} = \frac{8}{75}$$

$$\Rightarrow \frac{2(x-5)}{x^2-10x} = \frac{8}{75}$$

$$\Rightarrow 4x^2-40x = 75x-375$$

$$\Rightarrow 4x^2-115x+375=0$$

$$\Rightarrow 4x^2-15x-100x+375=0$$

$$\Rightarrow x(4x-15)-25(4x-15)=0$$

$$\Rightarrow (4x-15)(x-25)=0$$

$$\Rightarrow 4x-15=0, \quad x-25=0$$

$$\Rightarrow x = 15/4, \quad x = 25$$

rejected

$$\therefore x-10 < 0$$

$$\therefore \text{Time taken } 25 \text{ h, } 15 \text{ h}$$