# Sample Problems

1. We traveled for nine hours. Then we increased our velocity by 10 miles per hour and traveled an additional five hours. What was our original velocity if all together we have traveled 750 miles?

2. A bicycle leaves Chicago, heading East at $10\frac{\text{mi}}{\text{h}}$. Three hours later, a second bicycle leaves Chicago, heading East at $12\frac{\text{mi}}{\text{h}}$. How long will to take for the second bicycle to overtake the first bicycle?

3. Town $A$ and town $B$ are located 55 miles apart. A jogger starts in town $A$ and jogs toward town $B$. At the same time, a bicycle starts in town $B$ and travels toward town $A$. The difference between the speed of the jogger and that of the bicycle is 3 miles per hour. Find the speeds if the jogger and the bicycle meet exactly 5 hours after the start.

4. Ann headed south at 35 miles per hour. Two hours later Sue followed her, at 45 miles per hour. How long until Sue catches up with Ann?

5. The cop was chasing the crook who had a 100 ft head start. The velocity of the cop was 15 feet per second while that of the crook was 11 feet per second. How long until the cop catches up with him?

6. A plane leaves an airport and flies south at 300 miles per hours. Later, a second plane leaves the same airport and flies south at 450 miles per hour. If the second plane overtakes the first one in 1 hour, how much earlier did the first plane leave?

7. Chicago, IL and Montpelier, VT are about 1000 miles apart. A car leaves Chicago to Montpelier at the same time as a train leaves Montpelier for Chicago. The train is $50\frac{\text{mi}}{\text{h}}$ faster than the car. Find the speed of the car if it takes 5 hours until the train and car meet.

8. A bicycle leaves Chicago, heading East at $14\frac{\text{mi}}{\text{h}}$. Three hours later, a second bicycle leaves Chicago, heading East at $17\frac{\text{mi}}{\text{h}}$. How long will to take for the second bicycle to overtake the first bicycle?

9. Milwaukee, WI and Albuquerque, NM are about 1500 miles apart. A plane leaves Milwaukee to Albuquerque at the same time as a train leaves Albuquerque for Milwaukee. The plane is $330\frac{\text{mi}}{\text{h}}$ faster than the train. Find the speed of the plane if it takes 3 hours until the plane and train meet.

# Practice Problems

1. We traveled for nine hours. Then we increased our velocity by 7 miles per hour and traveled an additional six hours. What was our original velocity if all together we have traveled 582 miles?

2. A bicycle leaves Chicago, heading East at $12\frac{\text{mi}}{\text{h}}$. Two hours later, a second bicycle leaves Chicago, heading East at $15\frac{\text{mi}}{\text{h}}$. How long will to take for the second bicycle to overtake the first bicycle?

3. Town $A$ and town $B$ are located 68 miles apart. A jogger starts in town $A$ and jogs toward town $B$. At the same time, a bicycle starts in town $B$ and travels toward town $A$. The difference between the speed of the jogger and that of the bicycle is 5 miles per hour. Find the speeds if the jogger and the bicycle meet exactly 4 hours after the start.

4. Ann headed south at 45 miles per hour. Two hours later Sue followed her, at 55 miles per hour. How long until Sue catches up with Ann?

5. The cop was chasing the crook who had a 60 ft head start. The velocity of the cop was 14 feet per second while that of the crook was 9 feet per second. How long until the cop catches up with him?

6. A plane leaves an airport and flies south at 400 miles per hours. Later, a second plane leaves the same airport and flies south at 480 miles per hour. If the second plane overtakes the first one in 1 hour, how much earlier did the first plane leave?

7. Chicago, IL and Montpelier, VT are about 1000 miles apart. A car leaves Chicago to Montpelier at the same time as a train leaves Montpelier for Chicago. The train is $40\frac{\text{mi}}{\text{h}}$ faster than the car. Find the speed of the car if it takes 5 hours until the train and car meet.

8. A bicycle leaves Chicago, heading West at $15\frac{\text{mi}}{\text{h}}$. Two hours later, a second bicycle leaves Chicago, heading West at $20\frac{\text{mi}}{\text{h}}$. How long will to take for the second bicycle to overtake the first bicycle?

9. Milwaukee, WI and Albuquerque, NM are about 1500 miles apart. A plane leaves Milwaukee to Albuquerque at the same time as a train leaves Albuquerque for Milwaukee. The plane is $120\frac{\text{mi}}{\text{h}}$ faster than the train. Find the speed of the plane if it takes 3 hours until the plane and train meet.

## Sample Problems - Answers

1. $50\frac{\text{mi}}{\text{h}}$
2. 15 hours
3. $4\frac{\text{mi}}{\text{h}}$ and $7\frac{\text{mi}}{\text{h}}$
4. 7 hours
5. 25 seconds
6. 30 minutes earlier
7. $75\frac{\text{mi}}{\text{h}}$
8. 14 hours
9. $85\frac{\text{mi}}{\text{h}}$ and $415\frac{\text{mi}}{\text{h}}$

## Practice Problems - Answers

1. $36\frac{\text{mi}}{\text{h}}$
2. 8 hours after the second bicylce started
3. The speed of the jogger is $6\frac{\text{mi}}{\text{h}}$ and that of the bicycle is $11\frac{\text{mi}}{\text{h}}$
4. 9 hours
5. 12 seconds
6. $\frac{1}{5}$ hour or 12 minutes earlier
7. $80\frac{\text{mi}}{\text{h}}$
8. 6 hours
9. The speed of the train is $190\frac{\text{mi}}{\text{h}}$ and that of the plane is $310\frac{\text{mi}}{\text{h}}$

# Sample Problems - Solutions

1. We traveled for nine hours. Then we increased our velocity by 10 miles per hour and traveled an additional five hours. What was our original velocity if all together we have traveled 750 miles? 50 $\frac{\text{mi}}{\text{h}}$

   Solution: Let us denote our velocity in the first nine hours by $x$. During the second part of the trip our velocity was $x + 10$.

| | $v\ \left(\frac{\text{mi}}{\text{h}}\right)$ | $t\ (\text{h})$ | $s\ (\text{mi})$ |
|---|---|---|---|
| Part 1 | $x$ | 9 | $9x$ |
| Part 2 | $x + 10$ | 5 | $5\,(x + 10)$ |

   The distance traveled in the first part and the distance traveled in the second part add up to 750 miles.

$$\begin{aligned} 9x + 5\,(x + 10) &= 750 \\ 9x + 5x + 50 &= 750 \\ 14x + 50 &= 750 \\ 14x &= 700 \\ x &= 50 \end{aligned}$$

   Thus the original velocity was $50\frac{\text{mi}}{\text{h}}$.

2. A bicycle leaves Chicago, heading East at $10\frac{\text{mi}}{\text{h}}$. Three hours later, a second bicycle leaves Chicago, heading East at $12\frac{\text{mi}}{\text{h}}$. How long will to take for the second bicycle to overtake the first bicycle? 15 hours

   Solution: Let $x$ denote the time that the second bicycle spent traveling. Then the first bicycle had $x + 3$ hours to travel.

| | $v\ \left(\frac{\text{mi}}{\text{h}}\right)$ | $t\ (\text{h})$ | $s\ (\text{mi})$ |
|---|---|---|---|
| bicycle 1 | 10 | $x + 3$ | $10\,(x + 3)$ |
| bicycle 2 | 12 | $x$ | $12x$ |

   The distances are equal. They both start at Chicago and meet at the meeting point.

$$\begin{aligned} 10\,(x + 3) &= 12x \\ 10x + 30 &= 12x \\ 30 &= 2x \\ 15 &= x \end{aligned}$$

   Thus it will take 15 hours after the second bicylce started.

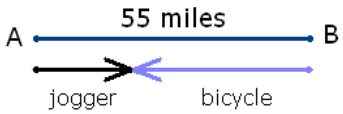
 

3. Town $A$ and town $B$ are located 55 miles apart. A jogger starts in town $A$ and jogs toward town $B$. At the same time, a bicycle starts in town $B$ and travels toward town $A$. The difference between the speed of the jogger and that of the bicycle is 3 miles per hour. Find the speeds if the jogger and the bicycle meet exactly 5 hours after the start. $4\ \frac{\text{mi}}{\text{h}}$ and $7\frac{\text{mi}}{\text{h}}$

   Solution: Let $x$ denote the speed of the jogger. Then the speed of the bicycle is $x+3$.

| | $v\ \left(\frac{\text{mi}}{\text{h}}\right)$ | $t$ (h) | $s$ (mi) |
|---|---|---|---|
| jogger | $x$ | 5 | $5x$ |
| bicycle | $x+3$ | 5 | $5(x+3)$ |

   The equation expresses that when they meet, the jogger and the bicycle has covered the 55 miles between A and B.




$$\begin{aligned} 5x+5(x+3) &= 55 \\ 5x+5x+15 &= 55 \\ 10x+15 &= 55 \\ 10x &= 40 \\ x &= 4 \end{aligned}$$

   Thus the speed of the jogger is $4\frac{\text{mi}}{\text{h}}$ and that of the bicycle is $7\frac{\text{mi}}{\text{h}}$.

4. Ann headed south at 35 miles per hour. Two hours later Sue followed her, at 45 miles per hour. How long until Sue catches up with Ann? 7 hours

   Solution: Let $x$ denote the time that Sue has traveled, measured in hours. Since she started two hours earlier, Ann traveled for $x+2$ hours.

| | $v\ \left(\frac{\text{mi}}{\text{h}}\right)$ | $t$ (h) | $s$ (mi) |
|---|---|---|---|
| Ann | 35 | $x+2$ | $35(x+2)$ |
| Sue | 45 | $x$ | $45x$ |

   The distances are equal.

$$\begin{aligned} 35(x+2) &= 45x \\ 35x+70 &= 45x \\ 70 &= 10x \\ 7 &= x \end{aligned}$$

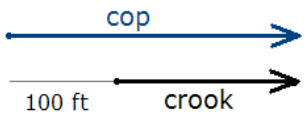
   Thus it will take 7 hours until Sue catches up with Ann.

5. The cop was chasing the crook who had a 100 ft head start. The velocity of the cop was 15 feet per second while that of the crook was 11 feet per second. How long until the cop catches up with him? 25 seconds
Solution: Let $x$ denote the time they both had to travel.

| | $v\ \left(\frac{\text{ft}}{\text{s}}\right)$ | $t$ (s) | $s$ (ft) |
|---|---|---|---|
| crook | 11 | $x$ | $11x$ |
| cop | 15 | $x$ | $15x$ |

The cop had to run as much as the crook ran, in addition to the headstart.




$$\begin{aligned} 11x + 100 &= 15x \\ 100 &= 4x \\ 25 &= x \end{aligned}$$

Thus it will take 25 seconds.

6. A plane leaves an airport and flies south at 300 miles per hours. Later, a second plane leaves the same airport and flies south at 450 miles per hour. If the second plane overtakes the first one in 1 hour, how much earlier did the first plane leave? 30 minutes earlier

Solution: Let $x$ denote the time that the first plane traveled before the second plane started. Then the faster plane traveled for one hour, and the slower on has traveled $x + 1$ hour unti they meet.

| | $v\ \left(\frac{\text{mi}}{\text{h}}\right)$ | $t$ (h) | $s$ (mi) |
|---|---|---|---|
| slower plane | 300 | $x + 1$ | $300\,(x + 1)$ |
| faster plane | 450 | 1 | 450 |

The equation expresses that when they meet, the distances traveled by tha planes are equal.

$$\begin{aligned} 300\,(x + 1) &= 450 \\ 300x + 300 &= 450 \\ 300x &= 150 \\ x &= \frac{150}{300} \\ x &= \frac{1}{2} \end{aligned}$$

Thus the first plane left $\frac{1}{2}$ hour (or 30 minutes) earlier.

7. Chicago, IL and Montpelier, VT are about 1000 miles apart. A car leaves Chicago to Montpelier at the same time as a train leaves Montpelier for Chicago. The train is $50\frac{\text{mi}}{\text{h}}$ faster than the car. Find the speed of the car if it takes 5 hours until the train and car meet. $75\frac{\text{mi}}{\text{h}}$

   Solution: Let $x$ denote the speed of the car, measured in miles per hour. Then the speed of the train is $x + 50$.

| | velocity $\left(\frac{\text{mi}}{\text{h}}\right)$ | time (h) | distance (mi) |
|---|---|---|---|
| car | $x$ | 5 | $5x$ |
| train | $x + 50$ | 5 | $5(x + 50)$ |

   The equation expresses that the distances traveled are equal.

$$\begin{aligned} 5x + 5(x + 50) &= 1000 \\ 5x + 5x + 250 &= 1000 \quad \text{subtract } 250 \\ 10x &= 750 \quad \text{divide by } 10 \\ x &= 75 \end{aligned}$$

   Then the speed of the car is $75\frac{\text{mi}}{\text{h}}$.

8. A bicycle leaves Chicago, heading East at $14\frac{\text{mi}}{\text{h}}$. Three hours later, a second bicycle leaves Chicago, heading East at $17\frac{\text{mi}}{\text{h}}$. How long will to take for the second bicycle to overtake the first bicycle? 14 hours

   Solution: Let us denote by $x$ the time it took for the second bicycle to overtake the first bicycle. Then the other bicycle had $x + 3$ hours, since it started three hours earlier.

| | velocity $\left(\frac{\text{mi}}{\text{h}}\right)$ | time (h) | distance (mi) |
|---|---|---|---|
| slower | 14 | $x + 3$ | $14(x + 3)$ |
| faster | 17 | $x$ | $17x$ |

$$\begin{aligned} 14(x + 3) &= 17x \\ 14x + 42 &= 17x \quad \text{subtract } 14x \\ 42 &= 3x \quad \text{divide by } 3 \\ 14 &= x \end{aligned}$$

   so it takes 14 hours for the second bicycle to overtake the first bicycle.

9. Milwaukee, WI and Albuquerque, NM are about 1500 miles apart. A plane leaves Milwaukee to Albuquerque at the same time as a train leaves Albuquerque for Milwaukee. The plane is $330\frac{\text{mi}}{\text{h}}$ faster than the train. Find the speed of the plane if it takes 3 hours until the plane and train meet. $85\frac{\text{mi}}{\text{h}}$ and $415\frac{\text{mi}}{\text{h}}$

   Solution:

| | velocity $\left(\frac{\text{mi}}{\text{h}}\right)$ | time (h) | distance (mi) |
|---|---|---|---|
| train | $x$ | 3 | $3x$ |
| plane | $x+330$ | 3 | $3(x+330)$ |

$$\begin{aligned} 3x+3(x+330) &= 1500 \\ 3x+3x+990 &= 1500 \\ 6x+990 &= 1500 \\ 6x &= 510 \\ x &= 85 \end{aligned}$$

Thus the speed of the train is $85\frac{\text{mi}}{\text{h}}$ and that of the plane is $415\frac{\text{mi}}{\text{h}}$.

