Nicholas begins a long distance walk at a rate of 4 miles per hour. Forty five minutes after he leaves, his girlfriend Kristen realizes that he has forgotten his wallet. Kristen gets on her bicycle and begins riding at a rate of 24 miles per hour along the same path that Nicholas is on.

a. How long will it take Kristen to catch Nicholas?

b. How far from the starting point will they be when catch-up occurs?
Answer

Let $T =$ the time that it takes Kristen to catch Nicholas

<table>
<thead>
<tr>
<th></th>
<th>Rate</th>
<th>Time</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicholas</td>
<td>4 mph</td>
<td>$T + \frac{3}{4}$</td>
<td>$4(T + \frac{3}{4})$</td>
</tr>
<tr>
<td>Kristen</td>
<td>24 mph</td>
<td>$T$</td>
<td>$24T$</td>
</tr>
</tbody>
</table>

After Kristen catches up to Nicholas they have traveled the same distance. So we can write:

$$4(T + \frac{3}{4}) = 24T$$

$$4T + 3 = 24T$$

$$-4T = 20T$$

$$3 = 20T$$

$$T = \frac{3}{20} \text{ hours} = 0.15 \text{ hours} (\text{same as 9 minutes}) \leftarrow \text{Answer to part a}$$

The distance from the starting point can be calculated from using either $24T$ or $4(T + \frac{1}{4})$, where $T = 0.15 \text{ hours}$.

$24(0.15) = 3.6 \text{ miles}$ or

$4(0.15 + \frac{1}{4}) = 4(0.15 + 0.75) = 4(0.90) = 3.6 \text{ miles} \leftarrow \text{Answer to part b}$