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Cadillac and Toyota 1.4. A pink Cadillac leaves Oklahoma City at 6AM headed west on I-40 with the cruise control set at V mph. A federal agent in a green Toyota follows, leaving d minutes later and traveling W mph. Does the Toyota catch up? If so, when and where?

GIVEN INFO

PINK CADILLAC	6 AM	V mph
GREEN TOYOTA	d mins	W mph

Does the toyota catch up? when? where?

Let x = number of minutes travelled by toyota

$x+d$ = number of minutes travelled by PINK CADILLAC

	RATE	TIME
PINK CADILLAC	V mph	$x+d$
GREEN TOYOTA	W mph	x

$$V(x+d) = Wx$$

$$Vx + Vd = Wx$$

$$Vx - Wx = -Vd$$

$$\frac{x(V-W)}{V-W} = \frac{-Vd}{V-W}$$

$$\boxed{x = \frac{-Vd}{V-W}}$$

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Pink Cadillac traveling at speed V mph

Green Toyota traveling at speed W mph

Cadillac leaves at 6:00 am

T = Time

Green Toyota leaves at T + d

x = distance

$$X = \frac{r}{t}$$

distance to Pink Cadillac = $\frac{V}{T}$

distance to Toyota = $\frac{W}{T+d}$

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We want to conclude whether or not the Toyota catches up with the cadillac, i.e. their distances from OKC are the same.

First, we need equations to represent the distance of each car using $d = rt$ where d is the dist. from OKC, r is the rate (or speed) & t is the time traveled.

① Cadillac's dist: $d_C = Vt$

Toyota's dist: $d_T = W(t-d)$

We set these equations equal to find where their distances are the same.

② $Vt = W(t-d)$

$Vt = Wt - Wd$

$Vt - Wt = -Wd$

$\frac{t(V-W)}{V-W} = \frac{-Wd}{V-W}$, s.t. $V<W$

③ Plug in for distance

$d_C = \frac{-VWd}{V-W}$, s.t. $V<W$

Conclusion:

The Toyota catches up with the Caddy at 6AM + $\left(\frac{-Wd}{V-W}\right)$ ← t, and the cars are $\frac{-VWd}{V-W}$ miles away from OKC.

The Toyota must be travelling @ a greater speed for it to catch up.

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GIVEN: Pink Caddy leaves 6AM West @ V mph
green Toy leaves d minutes later West @ W mph

Set distances Equal: $D_C = D_T$

$R_C T_C = R_T T_T$

$V\left(T_t + \frac{d}{60}\right) = W T_T$

$V T_t + \frac{Vd}{60} = W T_t$

$V T_t - W T_t = \frac{Vd}{60}$

$T_t (V - W) = \frac{Vd}{60}$

$T_t = \frac{\frac{Vd}{60}}{(V-W)}$

$T_t = \frac{Vd}{60(V-W)}$

When?

Toyota will catch up at

$T_t = \frac{Vd}{60(V-W)}$ if $V > W$

Where?

$D_T = R_T T_T$

$= W \cdot \frac{Vd}{60(V-W)}$

$D_t = \frac{WVd}{60(V-W)}$ if $V > W$

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Cadillac and Toyota 1.4. A pink Cadillac leaves Oklahoma City at 6AM headed west on I-40 with the cruise control set at V mph. A federal agent in a green Toyota follows, leaving d minutes later and traveling W mph. Does the Toyota catch up? If so, when and where?

Let x = time travelled by Cadillac after it leaves Oklahoma City

$x - d$ = time travelled by Toyota after it leaves Oklahoma City

$$D = rt$$

$$D_C = Vx \quad ; \quad D_T = W(x-d)$$

We want to know if Toyota will catch up the Cadillac, so

$$Vx = W(x-d)$$

$$Vx = Wx - Wd$$

$$Wx - Wd = Vx$$

$$+Wd \qquad +Wd$$

$$Wx = Vx + Wd$$

$$-Vx \quad -Vx$$

$$Wx - Vx = Wd$$

$$\frac{x(W-V)}{W-V} = \frac{Wd}{W-V}$$

$$x = \frac{Wd}{W-V}$$

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In this problem we have 2 different vehicles traveling different speeds for different amounts of time along the same path. Since they are on the same road and the faster car is behind the cars must converge. The question then is when + where. Since the cars left from the same location and will meet up at the same location they must travel the same distance. We will use this as well as the relationship between speed, distance, and time. $D = VT$

T = time after 6 AM in hours.

For the caddy, $D = TV$

For the toyota, $D = (T-1)W$ ⇒ since the Toyota traveled for one less hr)

Knowing that the two vehicles must have traveled the same distance allows us to set the equations equal to each other.

$$TV = W(T-1)$$

$$TV = WT - W$$

$$-WT \quad -WT$$

$$TV - WT = -W$$

$$T(V-W) = -W$$

$$\frac{T(V-W)}{V-W} = \frac{-W}{V-W}$$

$$T = \frac{-W}{V-W} \text{ hours after 6AM}$$

This means that the caddy drove

$$D = TV$$

$$D = \left(\frac{-W}{V-W}\right)V$$

$$D = \frac{-VW}{V-W} \text{ miles}$$

Both cars drove $\frac{-VW}{V-W}$ miles and met up at 6AM + $\frac{W}{V-W}$ hrs.

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Cadillac and Toyota 1.4. A pink Cadillac leaves Oklahoma City at 6AM headed west on I-40 with the cruise control set at V mph. A federal agent in a green Toyota follows, leaving d minutes later and traveling W mph. Does the Toyota catch up? If so, when and where?

let v = speed of cadillac and w = speed of toyota, d = # minutes

Since traveled the same distance

$$vt = w(t-d)$$

$$vt = wt - wd$$

$$vt - wt = -wd$$

$$t(v-w) = -wd$$

$$t = \frac{-wd}{v-w}$$

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Cadillac and Toyota 1.4. A pink Cadillac leaves Oklahoma City at 6AM headed west on I-40 with the cruise control set at V mph. A federal agent in a green Toyota follows, leaving d minutes later and traveling W mph. Does the Toyota catch up? If so, when and where?

* The question "does the Toyota catch up?" is dependent on if V is bigger or smaller than W. If W is a larger number then the Toyota will catch up, if V is larger, the Toyota will never catch up with the Cadillac.

* Point intercept form $y = mx + b$, where y is distance

$D_C = Vt$ ← time

$D_T = W(t - \frac{d}{60})$ ← minutes in hours

When + where?

Set equations equal - same place / same time

$$Vt = W(t - \frac{d}{60})$$

$$Vt = Wt - W(\frac{d}{60})$$

$$W(\frac{d}{60}) = Wt - Vt$$

$$\frac{W(\frac{d}{60})}{W-V} = \frac{t(W-V)}{(W-V)}$$

$$t = \frac{W(\frac{d}{60})}{W-V} \quad t = \frac{Wd}{60(W-V)}$$

They will meet when the time after 6am is equal to the speed of the Toyota times the amount of time after the Cadillac left that the Toyota did divided by 60 (speed of Toyota minus speed of Cadillac)

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Cadillac and Toyota 1.4. A pink Cadillac leaves Oklahoma City at 6AM headed west on I-40 with the cruise control set at V mph. A federal agent in a green Toyota follows, leaving d minutes later and traveling W mph. Does the Toyota catch up? If so, when and where?

Let d_C = the distance traveled by the Cadillac,
d_T = the distance traveled by the Toyota
t_C = the traveling time of the Cadillac after 6 AM.

Then the distance travelled by the Cadillac is given by the formula $d_C = Vt_C$. The distance travelled by the Toyota is given by the formula $d_T = W\left(t_C + \frac{d}{60}\right)$. The Toyotal will catch up when $d_C = d_T$. Therefore,

$$Vt_C = W\left(t_C + \frac{d}{60}\right)$$

$$Vt_C = Wt_C + \frac{Wd}{60}$$

$$Vt_C - Wt_C = \frac{Wd}{60}$$

$$t_C(V-W) = \frac{Wd}{60}$$

$$t_C = \frac{Wd}{60(V-W)}.$$

The Toyota will catch the Cadillac after the Cadillac has driven $t_C = \frac{Wd}{60(V-W)}$ hours. and $d_C = V\left[\frac{Wd}{60(V-W)}\right]$ miles.

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Cadillac and Toyota 1.4. A pink Cadillac leaves Oklahoma City at 6AM headed west on I-40 with the cruise control set at V mph. A federal agent in a green Toyota follows, leaving d minutes later and traveling W mph. Does the Toyota catch up? If so, when and where?

The Cadillac drives for d minutes at V mph, giving a head start of $\frac{dV}{60}$ miles.
The Toyota departs at the same time, driving at W mph. The distance over the entire trip would be $W(60t - d)$, where t represents the total time traveled (in hours) from 6:00 a.m.
When the two distances are congruent, the Toyota has caught up to the Cadillac. Therefore, we need to set the two distances equal

$$\underset{\text{Cadillac}}{60tV} = \underset{\text{Toyota}}{W(60t - d)}$$

and solve for t

$$60tV = 60tW - Wd$$
$$60tV - 60tW = -Wd$$
$$t(60V - 60W) = -Wd$$
$$t = \frac{-Wd}{60V - 60W}$$

There is a solution here unless $V = W$ (the speeds are the same).

No.

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The Toyota will catch up, as long as $W > V$. If the cadillac leaves at 6am and the Toyota leaves d minutes later, we can view this with the mph in a table

	Cad	Toy
6am	0	0
7am	V	0
8am	2V	W
9am	3V	2W

Cad $\rightarrow D = V \cdot T$

Toy $\rightarrow D = W \cdot (T-d)$

Set them equal to each other.

$$V \cdot T = W \cdot (T-d)$$
$$VT = WT - Wd$$
$$Wd = WT - VT$$
$$\frac{Wd}{(W-V)} = \frac{(W-V)T}{(W-V)}$$

$\frac{Wd}{(W-V)} = T \rightarrow$ After T time, they will meet up

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Cadillac and Toyota 1.4. A pink Cadillac leaves Oklahoma City at 6AM headed west on I-40 with the cruise control set at V mph. A federal agent in a green Toyota follows, leaving d minutes later and traveling W mph. Does the Toyota catch up? If so, when and where?

The Toyota must be travelling at a speed(W) greater than the Cadillac (V) in order to catch the Cadillac.

In other words, the Toyota will only catch up if it is travelling at a speed greater than the Cadillac, since the Cadillac left d minutes earlier than the Toyota.

Let V be the rate the Cadillac is moving
Let W be the rate the Toyota is moving
Let d be the time the Toyota left Oklahoma City

We need an inequality that shows that

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In order to know if the Toyota catch up with the Cadillac, we let $D = vt$ where D is distance, v is rate + T is time.

For the cadillac let $D = vt$ and for Toyota let $D = w(t-d)$, where w is the rate and d is minute

* To solve for when did they catch up we need to solve for t of both by equating both equation.

$$vt = w(t-d)$$
$$Vt = wt - wd$$
$$Vt - 10t = -wd$$
$$t(v-10) = -wd$$
$$t = \frac{-wd}{v-10}$$

∴ Therefore from the Am we add the result of $\frac{-wd}{v-10}$ (given w, d, v have a numerical value) in order to get the exact time of when both cars will catch up.

* To solve for where both of the cars meet we need to equate both equation and solve for D.

$$\frac{D}{V} = \frac{vt}{V}$$
$$t = \frac{D}{V}$$

$$D = w(t-d)$$
$$D = wt - wd$$
$$+wd \quad +wd$$
$$\frac{D+wd}{w} = t$$

$$\frac{D}{V} = \frac{D+wd}{w}$$
$$Dw = VD + Vwd$$
$$Dw - VD = Vwd$$
$$D(w-v) = Vwd$$
$$D = \frac{Vwd}{w-v}$$

Remember these variables will only make sence if we put a numerical value.

∴ Therefore both cars will meet with the distance of $\frac{Vwd}{w-v}$ (given v, w, d have a numerical value),