Name _____

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

Working with word problem
Solving such problems using algebra
Knowing that 70 mph means if travel @ constant speed of 70 mph they will travel 70 miles in one hour

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

The distance (D) pink cad travels in X amount of hours is $x(70) = D$

The distance federal agent travels in (X-1) amount of hours since it left one hour after cadillac is $(x-1)(85) = D$

We want to know when these distances equal. So we would set up these two distances to equal.

So $D = (x-1)(85) = 70(x) = D$

We want to know when they meet so hour (X) is what we solve for

$$85x - 85 = 70x$$
$$85x - 70x = 85$$
$$15x = 85$$
$$x = 17/3 \text{ hours}$$

or about $5\ 2/3$ hours

So in about $5\ 2/3$ hours from when cadillac left, 11:40 am they have both travelled about 396.666. miles, we can check by

$70(17/3) = 396.666$ miles
$85(17/3) = 396.666$ miles

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

~~Several illustrations can be used to solved this one.~~

Analytical thinking, ~~Illustrations~~, ~~Drawing~~ rate, proportions. Conclusions

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

I used analytical thinking to solve this problem.

Since the cadillac gets a head start for an hour, and he travels at a rate of 70 miles/hr then he is 70 miles from the Federal agent when he starts. The Federal agent travels at 85 miles/hr therefore every hour he will gain 15 miles on the cadillac. to get our answer we would divide 70 miles which is the head start of the cadillac, by 15 miles/hr which is ~~that~~ the ~~gain~~ amount of gain the Federal agent is making each hour.

$$\Rightarrow \frac{70 \text{ miles}}{\frac{15 \text{ miles}}{\text{hr}}} = 70 \text{ miles} \times \frac{1 \text{ hr.}}{15 \text{ miles}}$$

$\frac{70}{15}$ hours which turns out to be $4\frac{2}{3}$ hours or 4 hours and 40 minutes.

Name _____

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

distance = rate × time
variables
number line

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

At time $t=0$, the Cadillac and the Toyota have travelled 0 distance. At time $t=1$, the Cadillac has travelled a distance of 70 miles at a rate of 70mph and the Toyota has travelled 0 distence. At time $t=2$, the Cadillac has travelled 140 miles at a rate of 70mph and the Toyota has travelled 85 miles at a rate of 85 mph. Using a table

Hour	t	C	T
6	0		
7	1	70	
8	2	140	85
9	3	210	170
10	4	280	255
11	5	350	340
12	6	420	425

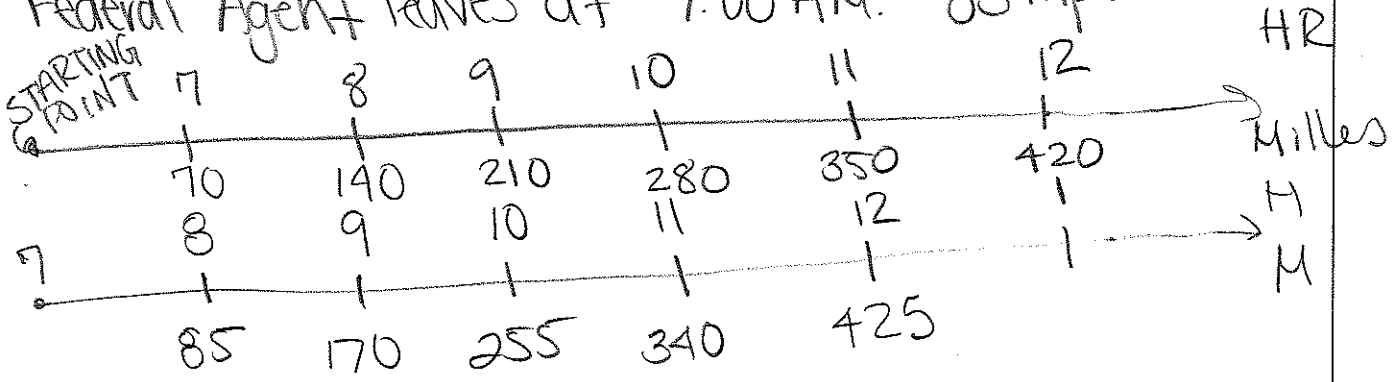
A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

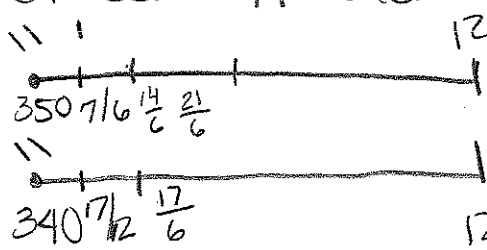
- Number Line
- Increasing of distance with time (V
- Analyze data & compare

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

Pink Cadillac leaves at 6:00 A.M 70 mph
Federal Agent leaves at 7:00 AM. 85 mph



So at
11:00 a.m PC is 350 mi from Oklahoma City while FA is 340 mi away at the same time but at
12:00 p.m PC is 420 mi from Oklahoma City while FA is 425, ∴ overpassed by 5, so F.A catch up between 11 and 12 then



$\frac{70}{60} = 7/6$ p/minute since 1hr = 60min

$350 + x\left(\frac{70}{60}\right) = 340 + x\left(\frac{17}{12}\right)$

$\frac{85}{60} = \frac{17}{12}$ p/minte

$360 = 68x$

$x = \frac{360}{68}$

85

$10 = \frac{17}{12}x - \frac{7}{6}x$

$10 = \frac{102x - 34x}{36}$

So in two minutes PC = 14/6 while FA has 36
$\frac{28}{17} = \frac{14}{6}$ therefore FA catch up at 1 hr. 28/17 min.

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

* MpH = Miles per hour
* 1 hour = 60 min
* you will go 60 miles in 1 hour traveling 60 mph
* find the facts you know first

60 min ÷ 85 mph = 1.4 miles per min
60 min ÷ 70 mph = 1.2 miles per min

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

pC is traveling @ a rate of 1.2 mpm
T is traveling @ a rate of 1.4 mpm
pC leave 1hr (60min) before T so pC has gone 70 miles while T has gone ∅. @ hour 2 pC has gone 140 miles & T has gone 85. and so on

By looking @ the table we know that T catches up to pC Between 11:00 & 12:00

pC	Time	T
70	7	0
140	8	85
210	9	170
280	10	255
350	11	340
420	12	425
490	1	510
560	2	595
630	3	680

Starting @ 11:00. In 10 min pC goes 11.4 miles & T goes 12 miles. So we know that the 2 cars catch up at about 11:09

Protocol: Name [illegible]

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

- CONVERSIONS (TIME)
- RATE (SPEED)
  - CONSTANT VS VARIABLE
- LINEAR EQUATIONS (GRAPH)
  - (SYSTEMS of EQUATIONS)

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

Cadillac leaves at 6:00 AM; Toyota leaves at 7:00AM, exactly 1 hour later. The Cadillac is moving at a constant rate of 70 mph, so the Cadillac starts 70 miles ahead of the Toyota. The Toyota is moving 15 mph faster than the Cadillac, so we must find how long it will take to close the 70 mile gap at a rate of 15 mph.

$$\frac{70 \text{ mi}}{15 \frac{\text{mi}}{\text{hr}}} = \frac{14}{3} \text{hr} = 4\frac{2}{3} \text{hr}.$$

It will take $4\frac{2}{3}$ hours to close the gap, we began at 7:00Am. We must convert $\frac{2}{3}$hr to minutes:

$\frac{2}{3}\text{hr} \cdot \frac{60 \text{ min}}{1 \text{ hr}} = 40 \text{ min}$, Thus the Toyota will catch the Cadillac at 11:40 AM.

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

On the middle school level, some ideas that this problem could be used to illustrate would be functions, solutions to sets of functions, graphing functions and rate of change (also involving unit rate, & proportion).

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

The pink Cadillac travels at an average speed of 70 mph, which is equal to 1 1/6 mile/minute. The Toyota travels at an average speed of 85 mph, which is equal to 1 5/12 miles/minute. First, create a function table to illustrate how far each car traveled ~~to~~ per hour. I ~~and~~ found ~~they~~ the Toyota passed the Cadillac by hour 6. To find the time and/or mile that the Toyota caught up to the Cadillac, I took the unit rate to find the exact time/mile. The time the two cars meet up is at 11:40 or 5 hr and 40 minutes after the Cadillac left, 3962/3 miles west of Oklahoma City on I-40.

time	hrs driven	PC	T
6 AM	0	0	0
7 AM	1	70	0
8 AM	2	140	85
9 AM	3	210	170
10 AM	4	280	255
11 AM	5	350	340
12 PM	6	420	425
1	7		

11:00	350	340
11:10	361 2/3	354 1/6
11:20	373 1/3	368 1/3
11:30	385	382 1/2
11:40	396 2/3	396 2/3
11:50	408 1/3	410 5/6
12:00	420	425

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

*multiplication

*the concept of multiples + LCM

*the application of least common multiple + multiples

*deciding which information is needed where

*unit rates

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

This will help them see that @ some point the toyota passed the Caddi!!

1) Least common multiple →

70, → 70 (7), 140 (8), 210 (9), 280 (10), 350 (11), 420 (12), 490

85 → 85 (8), 170 (9), 255 (10), 340 (11), 425 (12), 510

2.) Secondly they need to figure out the time frame for each hour spent driving. They will be able to see that somewhere between 11 + 12 the Toyota caught up with the Cadillac + passed him.

3.) Unit Rates come into play here. Initially they can figure out how fast each car traveled per minute.

Cadillac → 70 mph = 1.17 or $1\frac{2}{12} \rightarrow 1\frac{1}{6}$ mile per minute

Toyota → 85 mph = 1.42 or $1\frac{5}{12}$ mile per minute

4.) From here essentially they can calculate exactly what mile they were on @ what time.

⇒

Project: Name: _____

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

- problem solving skills
- picking important info out of word problems
- creating equations
- solving equations
- use of variables
- graph
- setting equations = to solve
- creating tables

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

I-40 → 70mph

speed ↓ start time 6am = 0 ↓

$y = 70x + 0$

I-40 → 85mph

$y = 85(x - 1)$

$70x = 85(x - 1)$

$-85x \quad -85x$

$-15x = -85$

$-15 \quad -15$

$x = 5.6$ hours

$y = 70(5.6) = 392$ miles

∴ 5.6 hours or 392 miles

hours	time	1	2
0	6am	0	0
1	7am	70	0
2	8	140	85
3	9	210	170
4	10	280	255
5	11	350	340
6	12	420	425

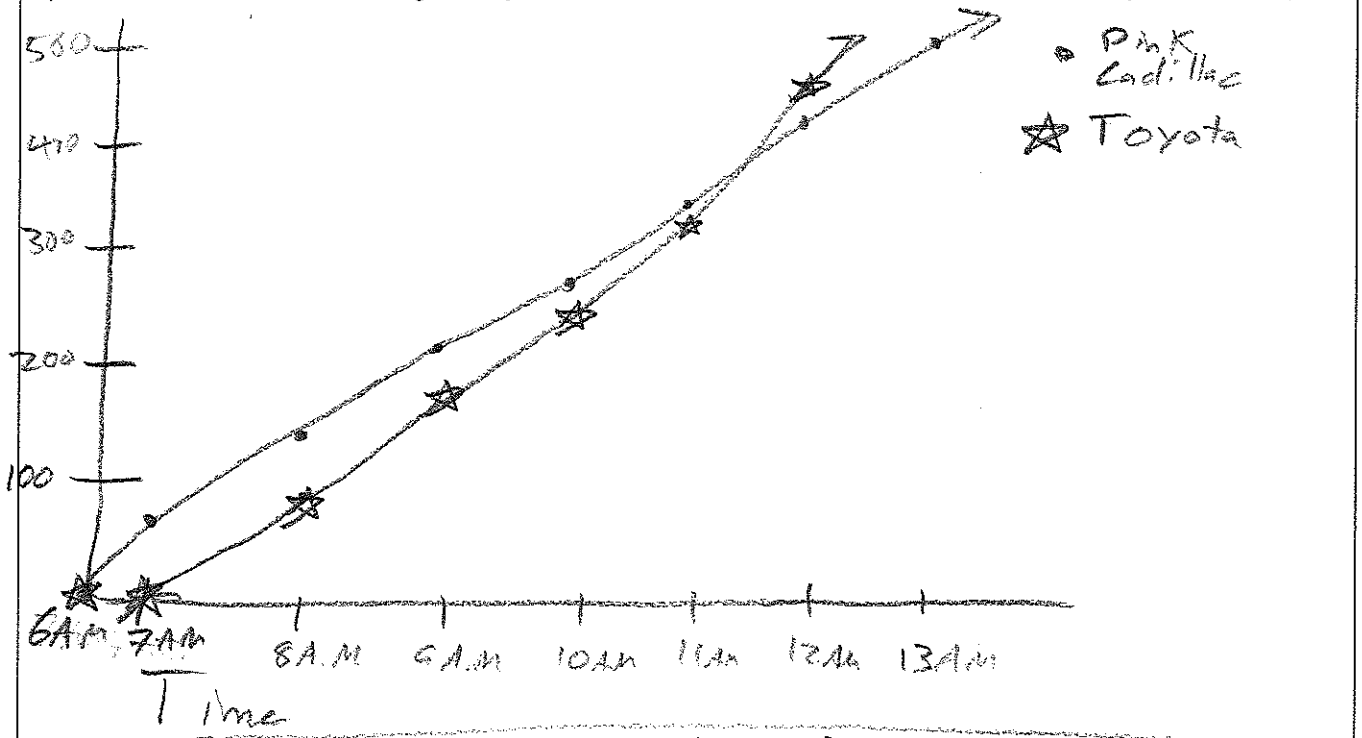
← when 2 passes 1 between 5 and 6 hours

explanation on back →

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate. Distance = Rate • time, Rate seen as slope (m) on a graph and start time as the y-intercept (b). Algebraic modeling. Estimation + exact answer. Time + fractions of hours.

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).



If $D = r \cdot t$ Then $D_p = D_T$ when

$r_p t_p = r_T t_T$

If the Toyota left one hour later $t_p = t_T - 1$

So $70 \text{ mi/hr}\ t = 85 \text{ mi/hr}\ (t-1)$

$70t = 85t - 85$

$-85t \quad -85t$

$\frac{-15t}{-15} = \frac{-85}{-15}$

$t = 5\frac{2}{3}$

Since the Cadillac left at 6AM, the Toyota will catch up at **11:40 A.M**

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

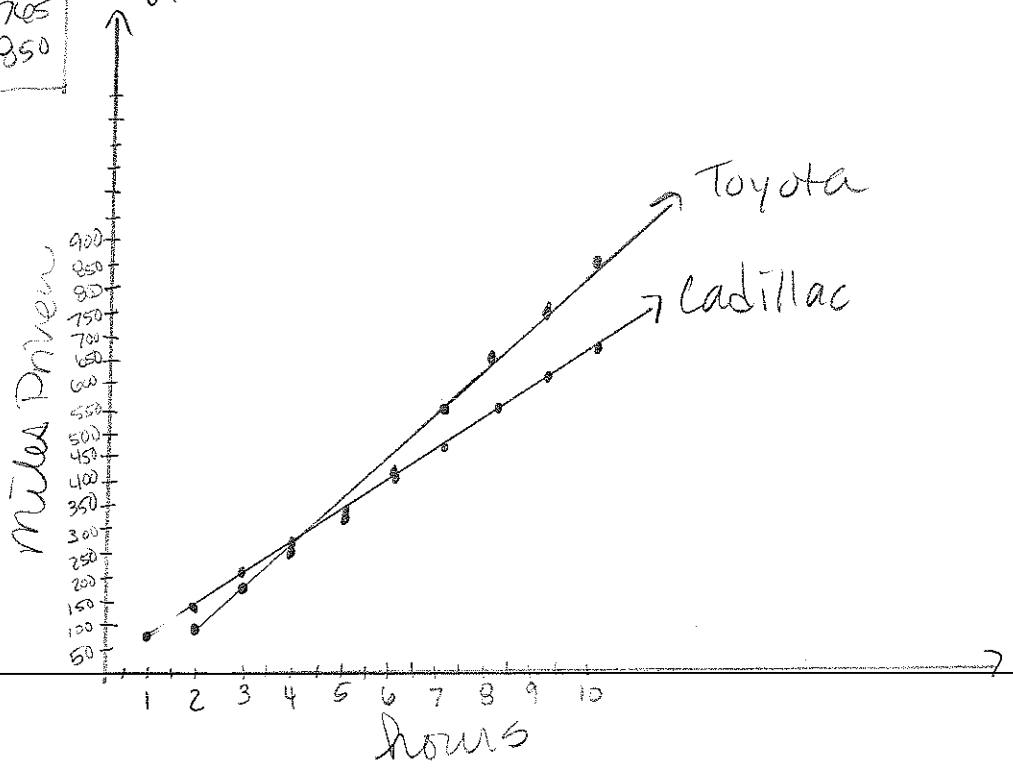
1) Comparing two linear equations by creating a domain and range chart then using the chart to create a graph of the two equations
2) Writing equations that fit the two situations
3) Examining the terms used in the problem to make sure we are answering correctly
4) Discussing constant rates of change and the slope of a line.

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

-First determine two equations that fit the problem above.
The total mileage of the cadillac can be found using $C=70h$
The total mileage of the Toyota can be found using $T=70(h-1)$
-Next create a chart listing total mileage of both vehicles.

hours (h)	Cadillac	Toyota
1	70	0
2	140	85
3	210	170
4	280	255
5	350	340
6	420	425
7	490	595
8	560	680
9	630	765
10	700	850

-Third, use the chart to get an idea of when the Toyota will catch up to the Cadillac. We can see from the chart that after the Toyota has been driving for five(5) hours, it will pass up the cadillac if they are both driving at constant speeds.
-Fourth, graph the data from the chart to get a visual of the data.



A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

1) Graphing linear functions
2) Solving system of linear equations
3) finding intersection point and explaining what this intersecting point is in terms of the problem; ie, time and distance

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

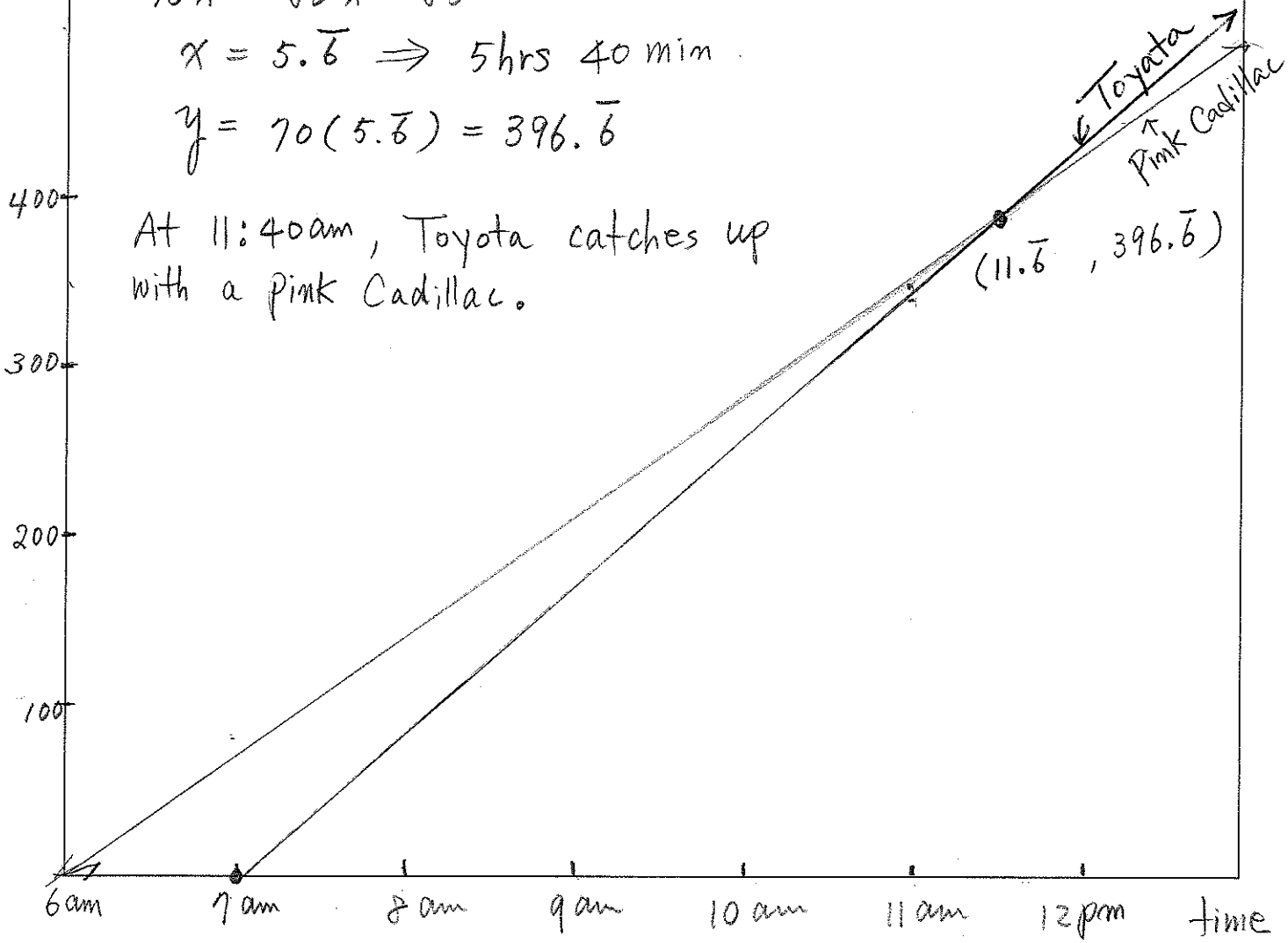
$$\begin{cases} y_1 = 70x \\ y_2 = 85x - 85 \end{cases}$$

$70x = 85x - 85$

$x = 5.\overline{6} \Rightarrow$ 5hrs 40 min

$y = 70(5.\overline{6}) = 396.\overline{6}$

At 11:40am, Toyota catches up with a pink Cadillac.



Pretest: Name [redacted]

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

*multiplication
* speed (time) = distance
*problem solving
*variables
* Substitution
* Distributive Property
* Fractions

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

speed (time) = distance

$70(h) = \text{distance}$ $\quad 85(t) = \text{distance}$

$70h = 85t$ $\quad t = h - 1$

$70h = 85(h-1)$ $\quad$ *t is the time the toyota traveled

$70h = 85h - 85$ $\quad$ *h is the time the cadillac traveled

$15h = 85$

$h = \frac{17}{3}$ = 6 hours 40 minutes so @ 12:40 pm

[redacted]

If we want the Cadillac's total distance to equal the total distance traveled by the toyota we must set up an equation using variables and Substitution. Distance is equal to speed x time and once equal for both cars then the toyota has "caught up." The cadillac's distance is equal to 70 mph(h) where h represents time. The toyotas distance is equal to 85mph(t) where t is equal to time. By substitution, we have $70h = 85t$ but still having two variables presents a problem. We then must determine how

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate. Least Common Multiple, elapsed time, multiplication, Rate, Distance

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

$D = RT$

Cadillac

Rate = 70 mph

$70 \frac{mi}{} \times 6hr = 420mi$

~~The~~ The cadillac took 6hrs to make it 420miles.

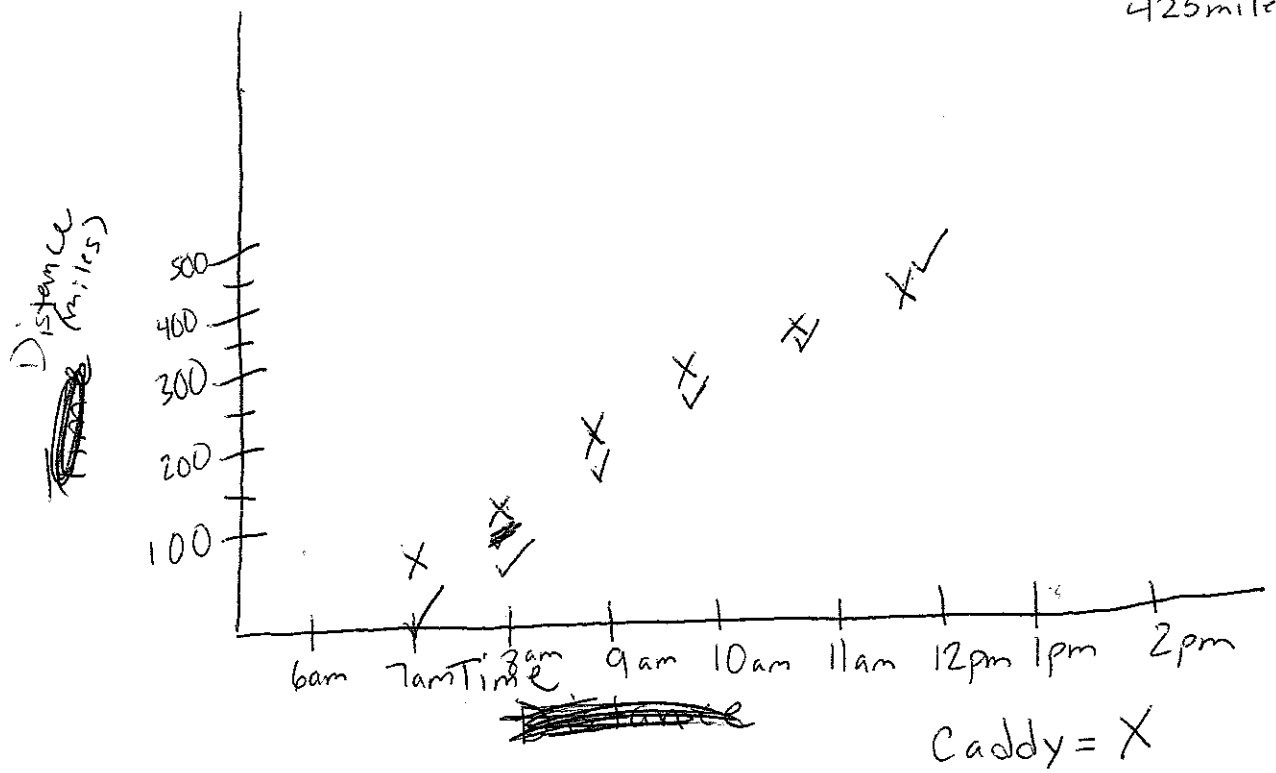
Toyota

Rate = 85mph

$85 \times 5hrs$

425mi

The Toyota took five hours to make it 425miles.



[illegible] graders learn about rate = d/t multiplied by time. Another GLE in the 6th grade curriculum encompasses the calculation of elapsed time. This problem utilizes both skills as students can calculate the rate to see at which time the Toyota overtakes the Cadillac, and also the exact time that it occurs. Adding another question asking at which point both cars will travel the same distance, utilizes a different skill, finding the least common multiple.

Problem: _____ Name: _____

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

Some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate are:

- the distance formula ($d = rt$),
- ratios and proportions,
- time conversions, and
- solving equations

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

- In order to solve this problem, the reader must first establish the 1-hour time interval in which the "catching up" phase happens. We can use proportional reasoning to establish this time by performing the following:

Ex

Cadillac: $\frac{70 \text{ miles}}{1 \text{ hr}} = \frac{?}{2 \text{ hrs}}$ $x = 140$ miles

Toyota: $\frac{85 \text{ miles}}{1 \text{ hour}} = \frac{?}{2 \text{ hrs}}$ $x = 190$ miles.

- Here, we would see that the cars would have crossed paths between the interval of Hour 1 and Hour 2. Next, we would use subtraction to determine the distance the Toyota travelled before catching up to the Cadillac.

Ex $\underset{\text{(caddy)}}{140 \text{ miles}} - \underset{\text{(toyota)}}{85 \text{ miles}} = 55 \text{ miles}$
[1 hour + 2nd hour] [Hour 1]

- The Toyota would have maintained its speed for 55 miles before meeting the Cadillac.
- Our next objective would be to use the distance formula and existing knowledge of time conversions to determine the unit rate of the Toyota in minutes

Ex 85 miles in 1 hour = 85 miles in 60 mins

$d = rt \rightarrow 85 \text{ miles} = r(60)$ $\frac{60r}{60} = \frac{85}{60}$ $r = 1.416 \text{ miles/min}$

(Next)

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

One mathematical idea to illustrate the problem is the use of a x-y axis. Another illustration could be on a number line. Third illustration could be the use of systems of Equations

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

(A) (Systems)

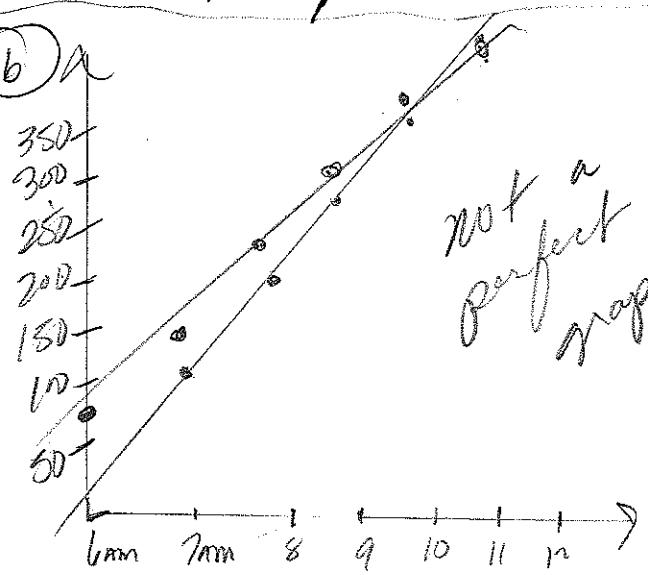
Cadillac $70x = y$

Toyota $85x - 85 = y$

$70x = 85x - 85$

~~$x = 4.13$ hours~~ $x = 5.66$ hours to catch up.

(b)



not a perfect graph

graph

(c)

Cadillac		Toyota	
6am	70 miles	7am	85 miles
7	140	8	170
8	210	9	255
9	280	10	340
10	350	11	425
11	420		

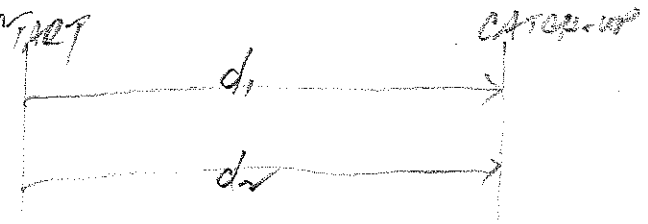
Using a x/y Chart it shows that the 2 cars will meet up at a little after 11am.

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

$D = RT$

$d_1 = d_2$



WHERE:
D - DISTANCE
R - RATE
T - TIME

d_1 - dist of Cad
d_2 - " " Toy

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

$$d_1 = d_2$$
$$R_1 T_1 = R_2 T_2$$
$$70(x+1) = 85x$$
$$70x + 70 = 85x$$
$$70 = 15x$$
$$x = 4.67 \text{ hrs} \sim 4 \text{ hrs } 40 \text{ min}$$

$\sim$ 11:40 AM

Name: [illegible]

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

Solving for a variable, algebraic representation of a real-life problem, ~~slope~~, systems of equations, substitution, addition, Conversion (its in the problem but represented in this particular solution)

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

The essence of this problem is to find out when the distance traveled by both vehicles will be equal. We begin by finding a relationship between the distance traveled, the time traveled, and the speed at which it is traveled. This relationship is expressed in the equation distance = rate · time, also expressed (d) (r) (t) as $d = rt$. To show when the two cars will have traveled the same distance we prepare an equation for each car using the information given for each and our distance equation.

Cadillac: $d = (70\text{mph})(t)$ t = hours

Toyota: $d = (85\text{mph})(t-1)$ we use $t-1$ for the time of the Toyota because he left one hour later.

Because the distance traveled by each vehicle will be congruent upon their meeting we can set the two equations equal to each other, hence substituting for d in one of the equations as such:

$$70t = 85t - 85$$

We will isolate our variable on one side of the equal

sign by moving the smaller coefficient to the larger as such:

$$70t = 85t - 85$$
$$-70t \quad -70t$$

resulting in $0 = 15t - 85$

now we continue isolating the variable by moving our constant term to the other side of the equal sign using addition.

$$0 = 15t - 85$$
$$+85 \quad +85$$

resulting in: $85 = 15t$

The coefficient of t must be 1 at our solution, so we divide each side of the equation by 15.

$$\frac{85}{15} = \frac{15t}{15}$$

$$85/15 = t$$

Through simplifying of the fraction $(\frac{85}{15})$ we result in the fraction $5\frac{1}{3}$.
As a mixed number, this would be $5\frac{2}{3}$.
No one understands $\frac{2}{3}$ of an hour. We need to convert the $\frac{2}{3}$ to something that makes sense for most people.
We know that an hour contains 60 minutes so $\frac{2}{3}$ of 60 would be

$$\frac{2}{3} \cdot \frac{60}{1} = \frac{120}{3} = 40 \text{ minutes.}$$

Hence, the cars will meet after 5 hours and 40 minutes of travel.
The original start time was 6 AM so
6 + 5 = 11 am 11am + 40 min. = 11:40 am

A pink Cadillac leaves Oklahoma City 6 AM, headed west on I-40 with the cruise control set at 70 mph. A federal agent in a Toyota follows, leaving at 7 AM and travelling 85 mph. When does the Toyota catch up?

1) List some important mathematical ideas in the middle/high-school curriculum that this problem could be used to illustrate.

① Distance, rate and time.
② How speed/velocity have an effect on time.
③ Write equations
④ Solve a system of equations.

2) Write a solution that models good exposition and shows the use of the mathematical ideas you listed in 1).

	Time	Rate	Equation
Cadillac	t	70	$70t$
Toyota	$t-1$	85	$85(t-1)$

$d = rt$ $\quad d = 85(t-1)$

System $\longrightarrow$ $d = 70t$ $\quad d = 85t - 85$

Determining the value of t:

$85t - 85 = 70t$

$-85 = -15t$

$5\frac{2}{3} = t$

5 hours and 36 min.

At 5 hours + 36 min the cars will meet.

This means that at 12AM the toyota will catch up with the the Cathalic.