Bridges to Advanced Algebra Name:_____

Mr. Maurer is racing a student in the 100 meter dash, and he gives the student a head start. Maurer knows that the winner of the race depends on how much of a head start he gives the student. He decides to run the race 2 times to figure out the perfect head start. Each race has a different head start. The runners always run their same constant speed in each race. For every table, x stands for the time (in seconds), and y stands for the distance (in meters).

1. First Race:

x	0	1	2	3	6	7	8
Y (Maurer)	0	12	24	36	72	84	96
Y (Student)	40	48	56	64	88	96	104

(+12 → ; +8 →)

a. How can you use the table to find the head start? What vocab word is the head start?
Find the difference in Y-values and work backwards to zero. The head start is the y-intercept

b. How can you use the table to find the speed of each runner? What vocab word is the speed? Find the difference in Y-values & divide by the difference in x-values. The speed is the slope.
Maurer: 72-36=36, 6-3=3, 36÷3=12
Student: 88-64=24, 6-3=3, 24÷3=8

c. Who wins the 100 meter dash?
The student, between 7 & 8 seconds

d. If they kept running, when will they meet up?
M: $y=12x+0$ S: $y=8x+40$
$M=S$
$12x=8x+40$
$-8x \quad -8x$
$\frac{4x}{4}=\frac{40}{4}$
$x=10$ 10 seconds
M: $y=12(10)=120$ S: $y=8(10)+40$, $80+40$, 120
120 meters

2. Second Race:

x	0	1	2	3	7	8	9
Y (Maurer)	0	12	24	36	84	96	108
Y (Student)	30	38	46	54	86	94	102

a. What is the head start?
$M=0, \quad S=30$

b. What is each runners speed?
$M=12, \quad S=8$

c. Who wins?
Maurer. He is ahead between 7 & 8 seconds.

d. When do they meet up?
M: $y=12x+0$ S: $y=8x+30$
$M=S$
$12x=8x+30$
$-8x \quad -8x$
$\frac{4x}{4}=\frac{30}{4}$
$x=7.5$
M: $12(7.5)$, 90 S: $8(7.5)+30$, $60+30$, 90
7.5 seconds, 90 meters

3. Mr. Maurer claims that he can figure out the perfect head start from the results of the first two races. A perfect head start would mean that the two runners tie (they finish the 100 meter race in exactly the same amount of time).

Use tables, graphs, and/or equations to find the perfect head start. Remember that each runner runs at the same speed as in the first two races.

Table Method: Know the speeds, work backwards from 100 meter tie.

X = Time									
Y_1 = Maurer Distance	100	88	76	64	52	40	28	16	4
Y_2 = Student Distance	100	92	84	76	68	60	52	44	36

I don't know the times yet. I'm left over with 4 meters for Maurer's Distance. Speed is 12 mps. So using $D=rt$, we know $t = \frac{D}{r} = \frac{4}{12} = 1/3$. Now I will use the time $1/3$ second, to find the student distance. $D = 8 \cdot 1/3 = 2\ 2/3$. Then redo the table, by subtracting D from 36

X = Time	0	1	2	3	4	5	6	7	8	$8\ 1/3$
Y_1 = Maur	0	12	24	36	48	60	72	84	96	100
Y_2 = Student	$33\ 1/3$	$41\ 1/3$	$49\ 1/3$	$57\ 1/3$	$65\ 1/3$	$73\ 1/3$	$81\ 1/3$	$89\ 1/3$	$97\ 1/3$	100

EQ Method: Know the speeds, distance. Plug in 100.

M

$y = 12x$

$\frac{100}{12} = \frac{12x}{12}$

$8\ 1/3 = x$

S

$y = 8x + b$ ← Don't know the head start yet.

$100 = 8(8\ 1/3) + b$

$100 = 66\ 2/3 + b$

$-66\ 2/3 \quad -66\ 2/3$

$33\ 1/3 = b.$

The perfect head start is $33\ 1/3$ meters. They will tie after $8\ 1/3$ seconds at the 100 meter line