Teacher/Educator pages

1. … We plan on a **minimum speed of 10** mph and a **maximum distance of 100** miles. From this, we need an **x-axis from 0-10** hours an **y-axis from 0-100** miles.

   A: D=ST or 100miles=10mph · T so T=10 hours.

4.… Q: **Click** in max box and change to 600. Why 600?

   A: tm is in minutes and Time on the horizontal axis is in hours. We want 10 hours so 600 minutes.

10. … Q: Why does it look normal in the geogebra file? Remember our scaling!

   A: Using image adjusting software, the image was stretched 20 times in height so that when we put it into geogebra with scaling **x:y=1:20** the image will appear normal.

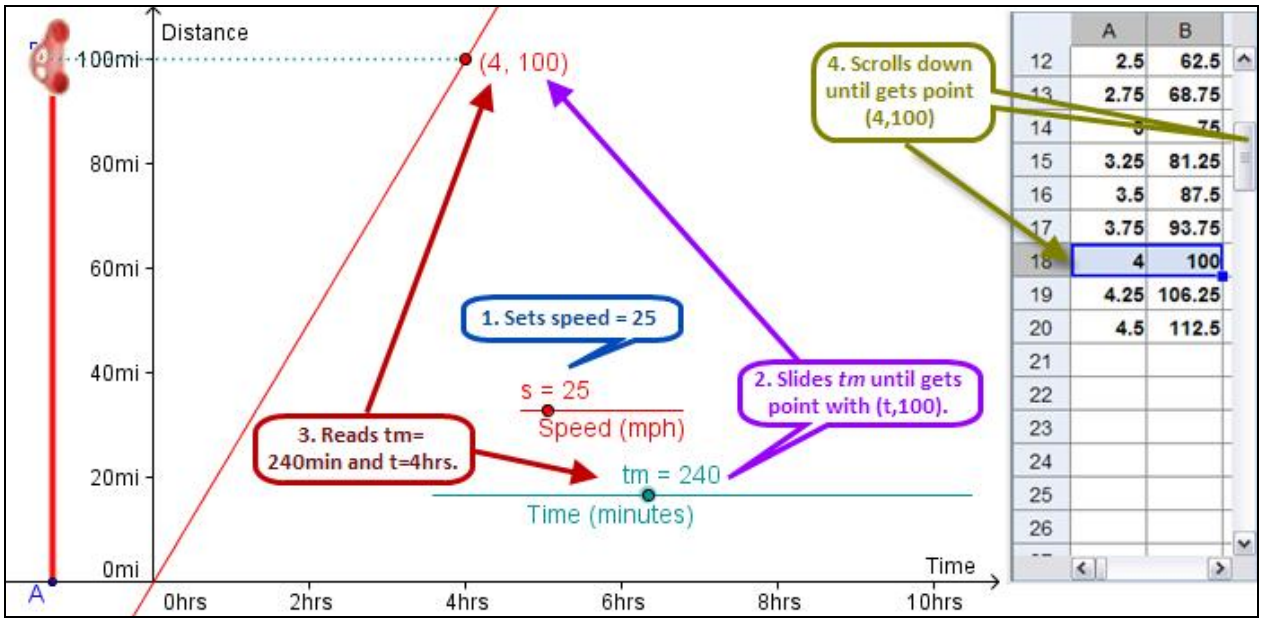
Note about scaling: To maximize visibility, the ready-to-use projector sized simulators are scaled 1:15 (and not 1:20 as in the directions). To scale 1:15, right-click in the drawing pad and choose *Properties.* At the bottom of the dialog box is x-axis:y-axis. Type in 1 and then 15; click on Close.

One Car

A little more mathematics to think about …

First do each problem with the simulator. Then write down the answers with mathematics.

- Set s = 25mph, r = 0 miles. How long does it take the car to reach the endpoint (at 100 miles)? Find your answer both in minutes and in hours on the graph and in the spreadsheet of the simulation.



D = distance = 100 mi

S = speed = 25 $mph = 25\frac{mi}{hr}$

$D = ST$

$100\ mi = 25\ \frac{mi}{hr} \cdot T$

$100\ \cancel{mi} \cdot hr = 25\ \cancel{mi} \cdot T$

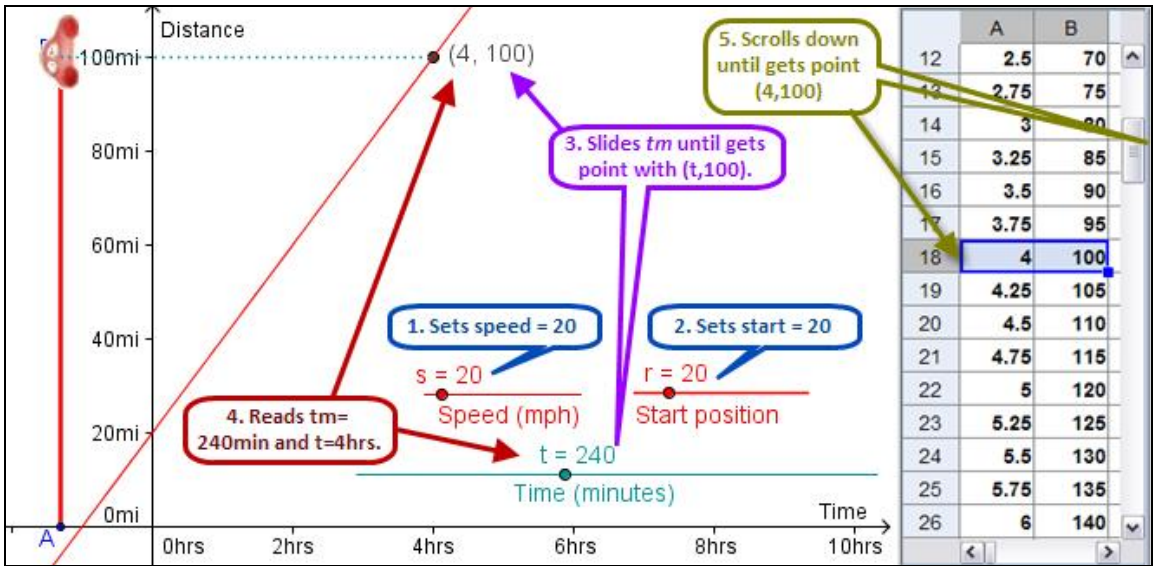
$100\,hr = 25T$

$T = \frac{100\ hr}{25}$

$T = 4\ hr$

$tm = 240min$

- Set s = 20mph, r = 20 miles. How long does it take the car to reach the endpoint?



D = distance $= 100\ mi - start$

$D = 100\ mi - 20\ mi = 80\ mi$

S = speed $= 20\ mph = 20\dfrac{mi}{hr}$

$D = ST$

$80\ mi = 20\ \dfrac{mi}{hr} \cdot T$

$80\ \cancel{mi} \cdot hr = 20\ \cancel{mi} \cdot T$

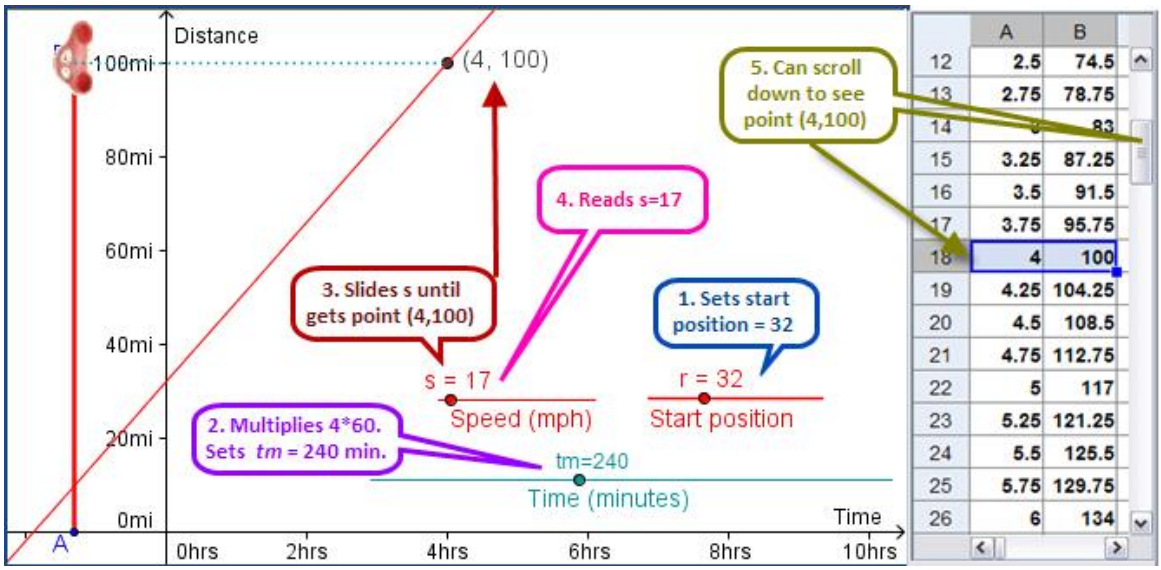
$80\,hr = 20T$

$T = \dfrac{80\ hr}{20}$

$T = 4\ hr$

$tm = 240min$

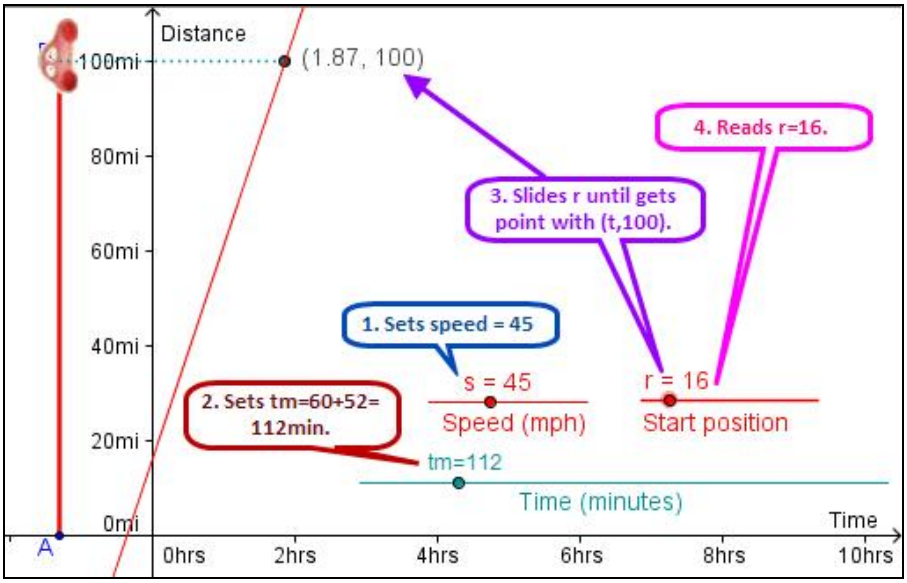
- Set r = 32 miles. How fast must red car go to reach the endpoint in 4 hours?



$start = 32$ mi
$T = 4$ hr
$D = 100 - start$
$D = 100 - 32$
$D = 68$ mi

$D = ST$
$68 = S \cdot 4$
$S = \frac{68}{4}$
$S = 17$ *mph*

- Set s = 45mph. Red car reached the endpoint in 1hr and 52 minutes. Where did he start?



$S = 45$ mph
$T = 1$ hr 52 min
$T = 1 + \frac{52}{60} = 1.87$

$D = 100 - start$
$D = 100 - r$
$D = ST$
$100 - r = 45 \cdot 1.87$

$100 - r = 45 \cdot 1.87$
$100 - r = 84$
$r = 100 - 84$
$r = 16$ *mi*

(Here the spreadsheet doesn't help because the time is not a multiple of 15 minutes.)

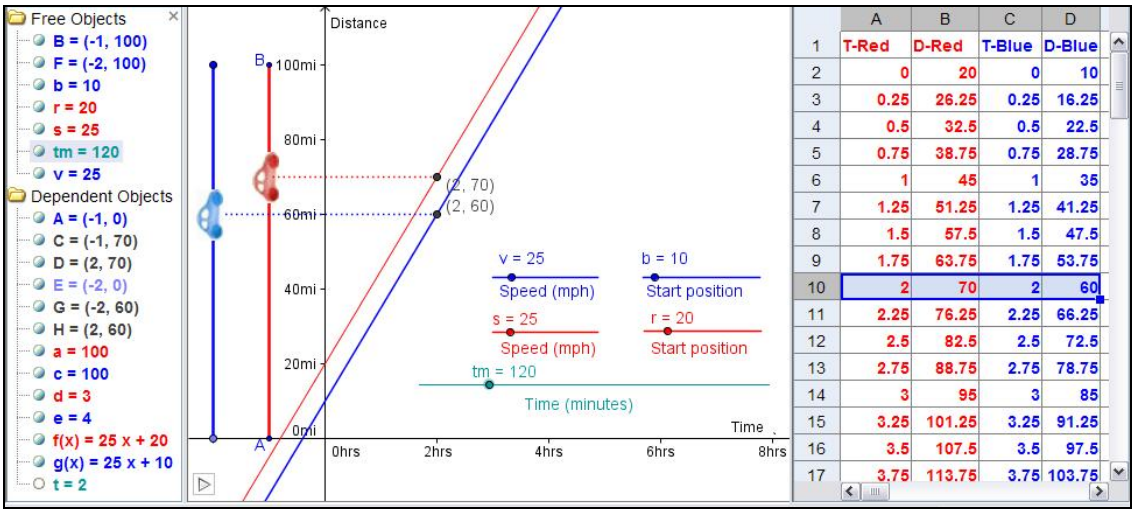
Two cars

A little more mathematics to think about …

First do each problem with the simulator. Then write down the answers with mathematics.

Note: The way the mathematics is done depends on the student's math level, but regardless the answer should always be written in standard form with units.

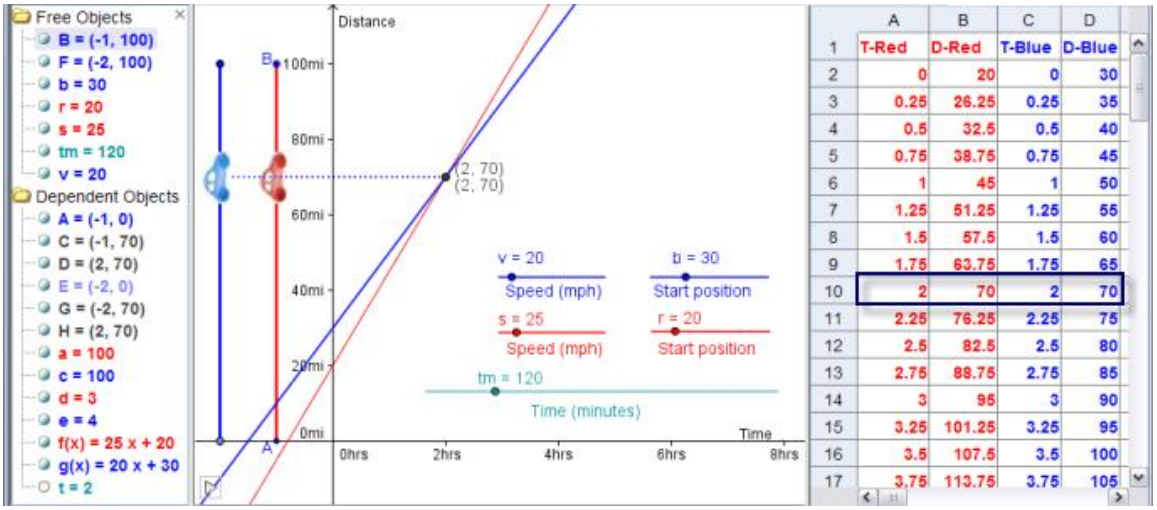
- Set s = 25mph, r = 20 miles, v=25 mph and b =10 miles. Which car starts out ahead? Do they meet before getting to the endpoint (at 100 miles). What can you say about the distance between the two cars?



	A	B	C	D
1	T-Red	D-Red	T-Blue	D-Blue
2	0	20	0	10
3	0.25	26.25	0.25	16.25
4	0.5	32.5	0.5	22.5
5	0.75	38.75	0.75	28.75
6	1	45	1	35
7	1.25	51.25	1.25	41.25
8	1.5	57.5	1.5	47.5
9	1.75	63.75	1.75	53.75
10	2	70	2	60
11	2.25	76.25	2.25	66.25
12	2.5	82.5	2.5	72.5
13	2.75	88.75	2.75	78.75
14	3	95	3	85
15	3.25	101.25	3.25	91.25
16	3.5	107.5	3.5	97.5
17	3.75	113.75	3.75	103.75

Because they are traveling at the same speed, the distance between them remains the same as at the start: $d = bigger\ \ start - smaller\ start = 20 - 10 = 10\,mi$. The cars never meet.

- Set s = 25mph, r = 20 miles, v=20 mph and b =30 miles. Which car starts out ahead? Do they meet before getting to the endpoint (at 100 miles). If so, how long and far have they travelled when the meet?



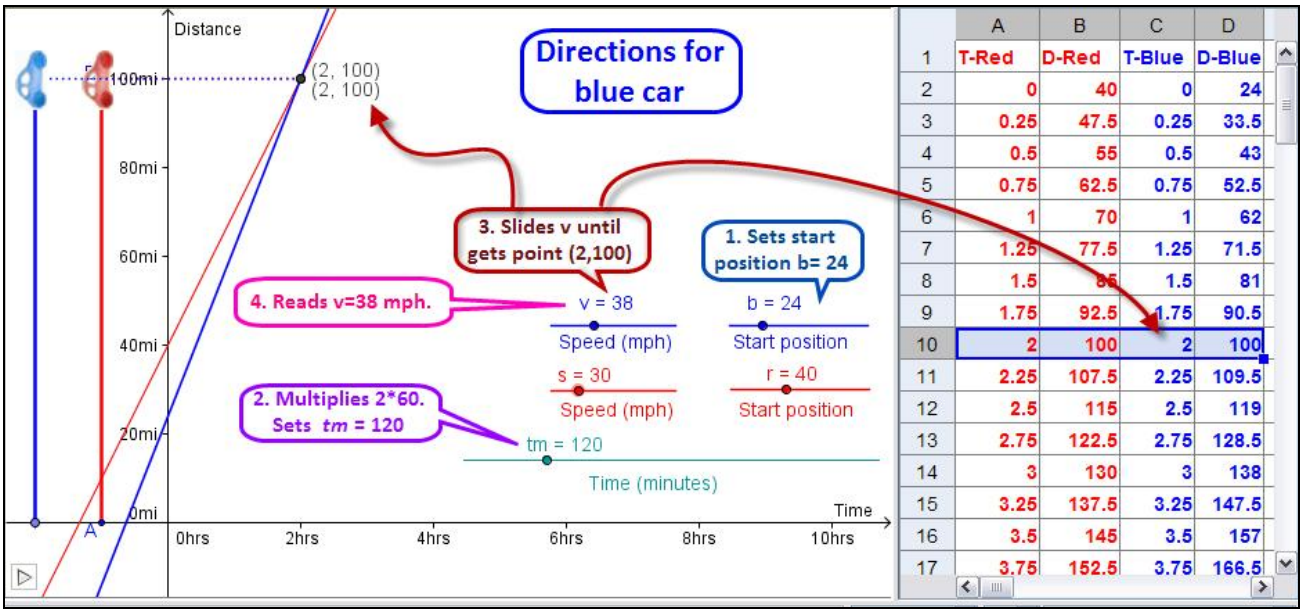
	A	B	C	D
1	T-Red	D-Red	T-Blue	D-Blue
2	0	20	0	30
3	0.25	26.25	0.25	35
4	0.5	32.5	0.5	40
5	0.75	38.75	0.75	45
6	1	45	1	50
7	1.25	51.25	1.25	55
8	1.5	57.5	1.5	60
9	1.75	63.75	1.75	65
10	2	70	2	70
11	2.25	76.25	2.25	75
12	2.5	82.5	2.5	80
13	2.75	88.75	2.75	85
14	3	95	3	90
15	3.25	101.25	3.25	95
16	3.5	107.5	3.5	100
17	3.75	113.75	3.75	105

To meet means that the two lines intersect, that is: $f(x) = g(x)$ or

$$\begin{aligned} 25x + 20 &= 20x + 30 \\ 5x &= 10 \\ x &= 2 \end{aligned}$$

The answer is: $T = 2\,hr$. (The student should always write the final answer with units.)

- Set r =40 miles and b =24 miles. What speeds do you need to set for the cars to meet at the endpoint (at 100 miles) in t =2hrs.



	A	B	C	D
1	T-Red	D-Red	T-Blue	D-Blue
2	0	40	0	24
3	0.25	47.5	0.25	33.5
4	0.5	55	0.5	43
5	0.75	62.5	0.75	52.5
6	1	70	1	62
7	1.25	77.5	1.25	71.5
8	1.5	85	1.5	81
9	1.75	92.5	1.75	90.5
10	2	100	2	100
11	2.25	107.5	2.25	109.5
12	2.5	115	2.5	119
13	2.75	122.5	2.75	128.5
14	3	130	3	138
15	3.25	137.5	3.25	147.5
16	3.5	145	3.5	157
17	3.75	152.5	3.75	166.5

Red car	$T = 2\,\text{hr}$	$D = ST$
	$start = r = 40\,mi$	$60 = S \cdot 2$
	$D = 100\,mi - start$	$S = 30$
	$D = 100 - 40 = 60$	$s = 30\,mph$
Blue car	$T = 2\,\text{hr}$	$D = ST$
	$start = b = 24\,mi$	$76 = S \cdot 2$
	$D = 100\,mi - start$	$S = 38$
	$D = 100 - 24 = 76$	$v = 38\,mph$