Create a Dynagraph   Name:

In this lesson you'll combine two geometric functions in an interesting way. By modifying your construction to use two parallel number lines, you'll make it particularly easy to observe and analyze the relative motion of the variables.

COMPOSE TWO FUNCTIONS

1. Construct a number line and put a Dilate function on it. (This Dilate tool always uses the origin of the number line as its center point.)

2. Vary *x* to see the function in action.

3. To review how the Dilate function works, change the function by making *s* negative, and vary *x* again.

Q1 How do positive and negative values of *s* affect the motion of the dependent variable?

4. Using the Translate tool, attach its independent variable to $D(x)$, and attach *v* to the number line.

5. Vary *x* to see the combined function in action.

6. Experiment with different settings of *v* and *s* and observe how the different variables move as you vary *x*.

Q2 Write down at least two things you noticed as you tried different values of *s* and *v*.

Use pages 2 and 3 to construct and test different function compositions, using different values of s and v.

Q3 Identify a particularly interesting composition and record its values of *s* and *v*. Explain why you thought this composition was interesting.

CONSTRUCT A DYNAGRAPH

1. Construct a number line and put a Dilate function on it.

2. Drag *x* back and forth. Then make a *Vary x* button to vary it automatically.

3. Use the **Transfer** tool to transfer both the origin point and *D(x)* downward.

4. Construct a new number line using the transferred origin point.

5. Using the **Translate** tool, attach its independent variable to *D(x)*, and attach *v* to the new number line.

6. Vary *x* to see the combined function in action.

7. To see just the original variable *x* and the final variable *T(D(x))*, press the *Hide Dilation and Transfer* button.

8. Connect *x* and *T(D(x))*, and drag to see how the connecting line shows their motion.

Q4 Write down at least two things you noticed as you tried different values of *s* and *v*.

Q5 For each row of the table, set *s, v* and *x* to the indicated values. Then record the values for *D(x)* and *T(D(x))*.

s	*v*	*x*	*D(x)*	*T(D(x))*
2.50	−3.00	−2.00		
−2.00	1.00	−3.00		
0.50	2.50	2.00		

9. Turn on tracing for the connecting line and vary *x* again.

10. Try different values of *s* and *v*, and use your button to make smoothly spaced traces.

11. Use pages 2 and 3 to make functions with particularly interesting traces.

Q6 Make a drawing of the most interesting, surprising, or attractive traces that you created. On your drawing be sure to include the values of *s* and *v*. Also show the origins of the number lines.

Q7 For the traces on the left, circle the correct words on the right, and tell how you know.

	$T(D(x))$ is moving **| faster | slower | at the same speed |** as *x*. $T(D(x))$ is moving in the **| same | opposite |** direction as *x*. I know this because:
	$T(D(x))$ is *moving* **| faster | slower | at the same speed |** as *x*. $T(D(x))$ is moving in the **| same | opposite |** direction as *x*. I know this because:
	$T(D(x))$ is *moving* **| faster | slower | at the same speed |** as *x*. $T(D(x))$ is moving in the **| same | opposite |** direction as *x*. I know this because:

Q8 Write down two things you figured out as you played the Dynagraph Game.