Name:_____ Period:_____ Date:_____

Hometown Planets: Scaling the Planetary Orbits to your Hometown

Objective:

Bring the planets to your hometown with Delcastle High School as the center of the universe…at least in this modeling activity. You will use scaling to convert astronomical distances between planets to distances you are familiar with such as miles. With Delcastle as the sun, you will draw the planetary orbits on maps and identify a landmark (example: a building, major, intersection, city, etc.) that falls on each planetary orbit.

Scaling Planetary Orbits to Hometown Distances:

Below is a table of the planets in our solar system and their distance from the sun. However, the unit of distance is in kilometers (*km*) and they need to be in miles (*mi*).

Table 1: Actual distance of planets from the sun

Planet	**Distance from the Sun (km)**	**Planet**	**Distance from the Sun (km)**
Mercury	5.79×10^7	Saturn	1.43×10^9
Venus	1.08×10^8	Uranus	2.87×10^9
Earth	1.50×10^8	Neptune	4.50×10^9
Mars	2.28×10^8	Pluto (dwarf planet)	5.91×10^9
Jupiter	7.78×10^8		

Use the equation below to determine how many miles are in 1.0 kilometer. Since there are 2.54 *cm* in 1.0 *in*, that ratio was used below in the equation. Fill in the remaining blanks with the appropriate ratios and do the math to figure out how many miles are in 1.0 *km*.

$$1.0\ km \times \frac{\_\_\_\_\_\ m}{1.0\ km} \times \frac{\_\_\_\_\_\ cm}{1.0\ m} \times \frac{1.00\ in}{2.54\ cm} \times \frac{1.0\ ft}{\_\_\_\_\_\ in} \times \frac{1.0\ mi}{5{,}280\ ft} = \_\_\_\_\_ \text{mi}$$

(number **A**)

Let's call this number of miles **A**. Since **A** *mi* = 1.0 *km*, there are **A** *mi* in 1.0 *km* or **A** *mi* per 1.0 *km*. This can be written as a fraction, $\frac{\mathbf{A}\ mi}{1.0\ km}$ and this is the same as **A** *mi/km*. This number **A** will be used to change the planetary orbits from units of *km* to *mi* on the next page with **Table 2**.

To make sure that most of the planetary orbits are within our hometown area, set the largest planetary orbit equal to 40 miles. Write the correct scale ratio below (in *mi*), then write it as a fraction and determine the scale factor (**B**), which you will use for calculations in **Table 3.**

_____*mi*: _____ *mi* or $\frac{\_\_\_\_\_\ mi}{mi}$ = _____

(actual distance) (model distance) (number **B**)

Find the scale bar on the map that the planetary orbits are to be plotted. Use a ruler and measure how long the scale bar is in millimeters (*mm*). What is the scale ratio for the map? Divide the ratio as you did above to get a new number (**C**) that you will use in **Table 4**.

_____*mm*: _____ *mi* or $\frac{\_\_\_\_\_\ mm}{mi}$ = _____ $\frac{mm}{mi}$

(number **C**)

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Table 2: Use the actual planetary orbit distances from **Table 1** and conversion number **A** in the formula below. This calculation will change the planetary distances from *km* to *mi*.

Planet	**Formula (Symbols)**	**Formula (Numbers)**	**Orbit (*mi*)**
Mercury	Mercury's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	
Venus	Venus's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	
Earth	Earth's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	
Mars	Mars's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	
Jupiter	Jupiter's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	
Saturn	Saturn's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	
Uranus	Uranus's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	
Neptune	Neptune's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	
Pluto	Pluto's orbit (*km*) × **A**	_____*km* × _____*mi/km* =	

Table 3: Use the planetary orbit distances from **Table 2** and the scale factor (number **B**) for the calculations in the table below. This calculation will scale down the planetary orbit distances from astronomical sizes to model sizes.

Planet	**Formula (Symbols)**	**Formula (Numbers)**	**Orbit (*mi*)**
Mercury	Mercury's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	
Venus	Venus's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	
Earth	Earth's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	
Mars	Mars's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	
Jupiter	Jupiter's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	
Saturn	Saturn's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	
Uranus	Uranus's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	
Neptune	Neptune's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	
Pluto	Pluto's orbit (*mi*) ÷ **B**	_____*mi* ÷ _____ =	

Table 4: Use the model planetary orbit distances from **Table 3** and conversion number **C** in the table below. This calculation will change the planetary distances from model *mi* to model *mm*.

Planet	**Formula (Symbols)**	**Formula (Numbers)**	**Orbit (*mm*)**
Mercury	Mercury's orbit (*mi*) × **C**	_____*mi* × _____*mm/mi* =	
Venus	Venus's orbit (*mi*) × **C**	_____*mi* × _____*mm/mi* =	
Earth	Earth's orbit (*mi*) × **C**	_____*mi* × _____*mm/mi* =	
Mars	Mars's orbit (*mi*) × **C**	_____*mi* × _____*mm/mi* =	
Jupiter	Jupiter's orbit (*mi*) × **C**	_____*mi* × _____*mm/mi* =	
Saturn	Saturn's orbit (*mi*) × **C**	_____*mi* × _____*mm/mi* =	
Uranus	Uranus's orbit (*mi*) × **C**	_____*mi* × _____*mm/mi* =	
Neptune	Neptune's orbit (*mi*) × C	_____*mi* × _____*mm/mi* =	
Pluto	Pluto's orbit (*mi*) × **C**	_____*mi* × _____*mm/mi* =	

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Mapping the Planetary Orbits

Whew, now all of the math is finished we can get on to the fun stuff! Using the planetary distances you calculated above from **Table 4** and a compass (the kind with a pencil, not the kind that points north!), plot as many of the orbits as you can on your map. Delcastle is the sun in this model. Once the orbits have been plotted, take a look at what roads each orbit falls on and identify some popular landmarks along each planet's orbit. For example, the planetary orbit may fall on a well-known building, a major intersection or a nearby city. List at least one landmark for each planet on your map in the table below.

Hometown Model Map:_____

Planet	**Landmarks Identified on Hometown Model Map**
Mercury	
Venus	
Earth	
Mars	
Jupiter	
Saturn	
Uranus	
Neptune	
Pluto	

Bring it all together: After discussing all four maps with your classmates, write down some landmarks for the planets that you did not plot on your map. Again, you must list at least one landmark!