

TEMPERATURE TRANSFORMATIONS

PART A

1. Log on and access Internet.
2. In the location box, type:

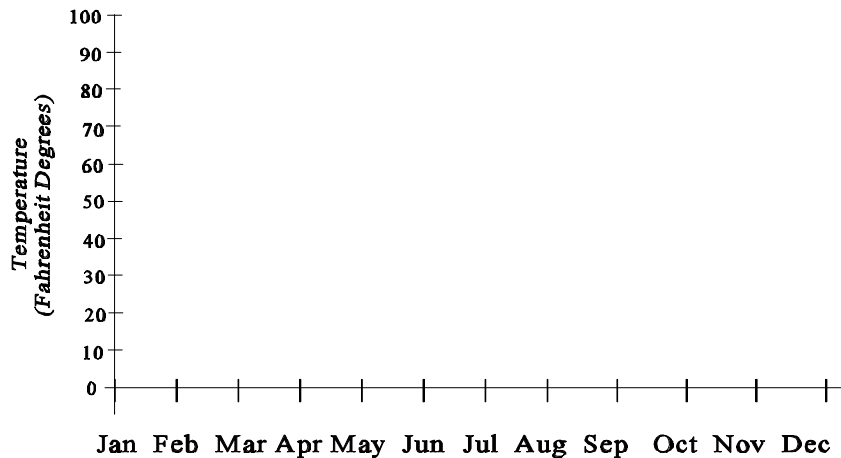
<http://www.usatoday.com/weather/waverage.htm>

3. Scroll down to University of Utah WWW links and choose “**Normal high temperatures.**”
4. Locate **Washington National Airport, D.C.** and record the data in the chart below.
5. Press **Back**. Choose “Normal low temperatures” and complete the table for Washington D.C.

Wash.D.C.	J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
HIGH TEMP												
LOW TEMP												

6. a. Enter the data on your TI 82/83. Use L1 for months (0-11), L2 for Highs, and L3 for Lows
- b. Use L1 and L2 to create Stat Plot #1 for Highs and L1 and L3 to create Stat Plot #2 for Lows.
(For specific instructions, please see Activity 1.)
- c. Graph both Stat Plots on the same axes and sketch the result below:

Washington, D.C.



7. Write an equation, $h(x)$, for the function graphed in Stat Plot #1 (average high temperatures in Wash. D.C.).

$h(x) =$ _____

8. a. Describe the graph of Stat Plot #2 (average low temperatures) in terms of the highs.

- b. Write an equation, $w(x)$, to represent the low temperatures in terms of the function $h(x)$.

- c. What type of transformation is represented by these two graphs?

- d. Check to see if this is the correct transformation by entering $w(x)$ in **Y1=** . Graph and compare results to Stat Plot #2. Discuss with your partner(s). What do you conclude?

PART B

1. In the location box, type:

gopher://gilgamesh.ho.BoM.GOV.AU/

2. Click on **Australian Climate Data**.
3. Click on **Mean Temperatures and Rainfall for Australian Locations**.
4. Click on **Capital Cities**.
5. Scroll to **Melbourne** and record data in the chart below. (Note that temperatures are degrees Celsius.)

Melbourne (° C)	J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
HIGH TEMP												

6. Enter the data in Celsius in L4 of your TI 82/83.

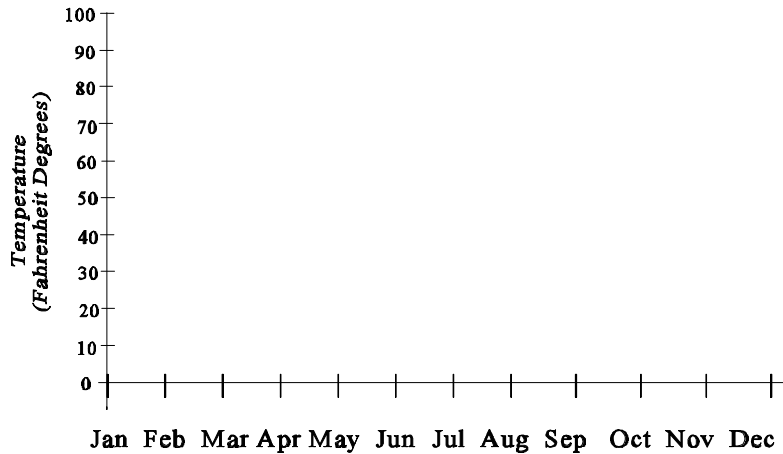
7. To compare the data to previously collected data, you will need to convert to **Fahrenheit**. (Discuss with your group how to do this.) When you have the conversion equation, enter the data in L5 of your TI 82/83. Note: To check your results, return to the “Intellicast” WWW weather site accessed in Activity 1 and select “**Dr. Dewpoint**” and “**Questions from Visitors.**” (Or in header of L5 column type $(9/5)(L4) + 32$ and press enter --this changes all Melbourne’s °C to °F.)

Record the **Fahrenheit** temperatures below.

Melbourne (°F)	J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
HIGH TEMP												

8. Create a Stat Plot using L1 and L5 (degrees F for Melbourne) Copy the graph here:

Melbourne, Australia



9. What do you observe about this graph? How is it the same as other graphs in this lesson?

How is it different from other graphs? _____

How do you account for this difference geographically? _____

10. a. Write the equation for this graph in the form $y = A\cos(Bx) + D$.

b. What is the amplitude? _____ the period? _____

c. Verify your answer using your calculator.

d. Equation (a) could be rewritten in the form $y = A\cos B(x - C) + D$ to obtain

$$y = -10.5 \cos((\pi/6)(x - 6)) + 68$$

What does the “C” value 6 represent in terms of the real world? _____

11. Review all the graphs you have made in Activities 1 and 2.

Find one city whose graph approximates a reflection of Melbourne’s graph. _____

State the equation of the line of reflection. _____

12. Comparing Melbourne’s graph with the other graphs, what kind of mathematical transformation(s) would best describe the real-world data? (Vertical shift, Horizontal or Phase shift, Reflection, Dilation)

Write complete sentences to justify your answer.

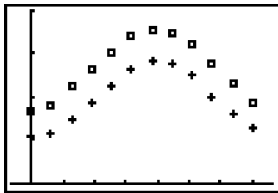
5. List the four cities in order from greatest to least variation.

Fairbanks
Chicago
Dallas
Miami

Activity 2 Page 1

Wash.D.C	J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
HIGH TEMP	42.3	45.9	56.5	66.7	76.2	84.7	88.5	86.9	80.1	69.1	58.3	47
LOW TEMP	26.8	29.1	37.7	46.4	56.6	66.5	71.4	70	62.5	50.3	41.1	31.7

- 6.



Activity 2, Page 2

7. WASHINGTON D.C. Write an equation, $h(x)$, for the function graphed in Stat Plot #1 (average high temperatures in Washington D.C.)

$$h(x) = -23.1\cos(\pi x/6) + 65.4$$

8. a. Describe the graph of Stat Plot #2 (average low temperatures) in terms of the highs.

All values are below the corresponding high temperatures.

- b. Write an equation, $w(x)$, to represent the low temperatures in terms of the function $h(x)$.

$$w(x) = \underline{h(x) - 16}$$

- c. What type of transformation is represented by these two graphs?

Vertical translation 16 units

- d. Check to see if this is the correct transformation by entering $w(x)$ in **Y1=** . Graph and compare results to Stat Plot #2. Discuss with your partner(s). What do you conclude?

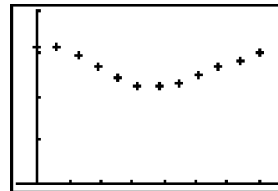
Answers will vary.

Melbourne (° C)	J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
HIGH TEMP	25.8	25.7	23.7	20.2	16.6	13.9	13.3	14.8	17.1	19.5	21.8	24.1

Activity 2, Page 3

Note: To have the calculator convert the Celsius temperatures to Fahrenheit, in the header of L5 type (9/5)L4+32 and press enter. This changes all of Melbourne’s °C to °F.

Melbourne (° F)	J A N	F E B	M A R	A P R	M A Y	J U N	J U L	A U G	S E P	O C T	N O V	D E C
HIGH TEMP	78.44	78.26	74.66	68.36	61.88	57.02	55.94	58.64	62.78	67.1	71.24	75.38



MELBOURNE

9. What do you observe about this graph? How is it the same as other graphs in this lesson?

The graph starts up. Period is the same. Cosine curve.

How is it different from other graphs? The A value is positive.

How do you account for this difference geographically? Southern hemisphere

Activity 2, Page 4

10. a. Write the equation for this graph in the form $y = A \cos(Bx) + D$.

$$y = 10.5 \cos(\pi x/6) + 68$$

b. What is the amplitude? 10.5 the period? 12

d. What does the “C” value 6 represent in terms of the real world?

The highest point of the curve occurs 6 months later (or earlier) than in the northern hemisphere.

11. Find one city whose graph **approximates** a reflection of Melbourne’s graph. Miami

State the equation of the line of reflection. $y = 75$

12. Comparing Melbourne’s graph with the other graphs, what kind of mathematical transformation(s) would best describe the real-world data? (Vertical shift, Horizontal or Phase shift, Reflection, Dilation) Answers will vary.