

I. Without graphing answer 'yes' or 'no' if the equations below are sinusoidal.

- 1)  $y = 3\sin^2(x + 1) - 1\cos^2(x + 3)$  1) yes
- 2)  $y = 3\sin^4(x - 1) + 3\cos^2(x + 2)$  2) no
- 3)  $y = 3\sin^2(x + 1) + 2\cos^4(x + 1)$  3) no
- 4)  $y = 2\sin^3(x - 1) - 1\cos^3(x - 2)$  4) yes
- 5)  $y = 1\sin^2(x + 3) + 2\cos^1(x + 3)$  5) no

II. An engineer is designing a bridge to be built in a valley near Tacoma, Washington. The bridges under consideration have a natural vibration of:

*Bridge A:*  $y = 10\sin^2(x + \pi/2)$  and *Bridge B:*  $y = 10\sin^2(x + \pi)$

The wind in the valley acts like a wave with an equation of:  $y = 15\cos^2(x + \pi/4)$

The total vibration of the bridge will be the compound function found by adding the bridge and wind equations together. The final amplitude represents how many centimeters the bridge will move up and then down. If this movement is more than 20 cm (up or down) then the stress on the bridge will break it apart .

1) Which bridge A, B, or neither should be built? 1) B

2) Explain *why*, using complete sentences.

2) A has an amplitude of 25 which will cause it to break, while B only reaches a height of 5.

III. Use the data from your Biorhythm Worksheet to do the following. Combine the three sine equations for the *Intellectual Cycle*, *Emotional Cycle*, and *Physical Cycle* into one compound sine equation:  $y = \sin(2\pi/33)x + \sin(2\pi/28)x + \sin(2\pi/23)x$  or on TI83  $y = \sin((2\pi/33)x)$  etc.. Graph this equation using the [Window/Range] from your Biorhythm Worksheet except change the Ymin to -5 and the Ymax to 5 and answer the following: (Note: Since there are no right or wrong answers to the last two answers on the Biorhythm Worksheet do NOT change them based on what you are about to do!)

1) At what x value (day - ex. 6205) is there a maximum for this compound graph? 1) \_\_\_\_\_  
 Note: This day represents your *best* overall day.

2) a) Is this day from #1) above the same day that you had chosen on the 2a) \_\_\_\_\_  
 Biorhythm Worksheet in part IV #1)? (yes/no)  
 b) If no then how far apart was your estimate and the actual mathematical answer? b) \_\_\_\_\_

3) At what x value (day - ex. 6205) is there a minimum for this compound graph? 3) \_\_\_\_\_  
 Note: This day represents your *worst* overall day.

4) a) Is this day from #3) above the same day that you had chosen on the 4a) \_\_\_\_\_  
 Biorhythm Worksheet in part IV #3)? (yes/no)  
 b) If no then how far apart was your estimate and the actual mathematical answer? b) \_\_\_\_\_

IV. Extensions:

A) Compound functions formed by multiplying trigonometric functions

1) Graph;  $y = \sin x * \cos x$   $x[-2\pi, 2\pi]$ ;  $y[-0.6, 0.6]$  Is this sinusoidal? (yes/no) 1) yes

2) Graph;  $y = \sin x * \sin x$  Is this sinusoidal? (yes/no) 2) yes

3) Graph;  $y = (\sin x)^3$   $x[-10, 10]$ ;  $y[-2, 2]$  Is this sinusoidal? (yes/no) 3) no

4) Graph;  $y = (\cos x)^3 + (\sin x)^2$   $x[-10, 10]$ ;  $y[-2, 2]$

a) Is this sinusoidal? (yes/no) 4a) no

b) Rorschach Test: What does this graph resemble or look like to you?  
Have each person in the group write their answer down.

4b) \_\_\_\_\_

B) Compound functions formed by multiplying or adding a nontrigonometric function and a trigonometric function. (See example 1 on page 209)

1) Graph;  $y = x + 4\sin x$   $x[-25, 25]$ ;  $y[-15, 15]$  Is this sinusoidal? (yes/no) 1) no

2) Graph;  $y = x * \sin x$  using:  $x[0, 50]$ ;  $y[-50, 50]$

a) Is this sinusoidal? (yes/no) 2a) no

b) Using:  $x[0, 400]$ ;  $y[-400, 400]$  Be sure to look at the graph on a TI82 or TI83.  
Rate this graph:

(a) neat (b) wow (c) cool (d) awesome (e) OK f) \_\_\_\_\_ 2b) \_\_\_\_\_