

Exploring Periodic Functions

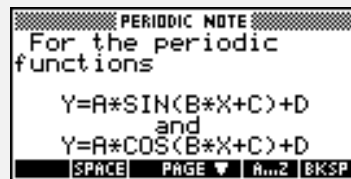
For the Teacher

Objectives:

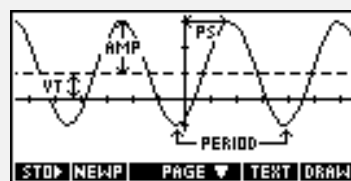
Using the **PERIODIC** applet, the student will explore the four different parameters that effect the graph of $y=A\sin(BX+C)+D$ and/or $y=A\cos(BX+C)+D$, and will be able to analyze these symbolically and graphically.

Functionality:

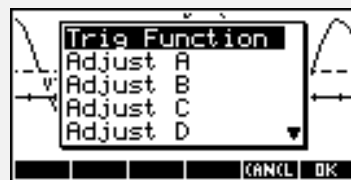
When the student selects **START**, the **PERIODIC NOTE** will be displayed.



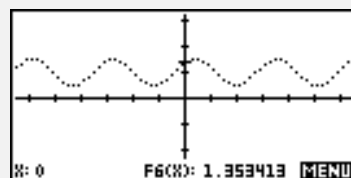
The student should then view the **SKETCH** for further explanation.



To select the type of periodic function to be explored as well as to adjust the parameters **A**, **B**, **C**, and **D**, the student should press **VIEWS** and make the appropriate adjustment(s). The basic function will appear in dot mode for comparison to the new function.



After the parameters have been fully explored, students should select **Target**. The calculator will display a periodic graph for the student to match by adjusting the parameters A, B, C, and D.



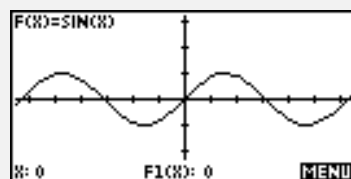
The student may also enter any value for the parameters **A**, **B**, **C**, and **D**, by selecting

Enter A, B, C, D from the views menu. A series of input boxes will prompt the student. The type of function is displayed at the top of the input box.

Note: This option is not designed to be used with **TARGET**.



Reset in the choose box in the views window will reset the parameters back to the default values ($A=1$, $B=1$, $C=0$, and $D=0$) and plot the function.

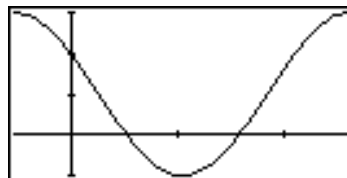
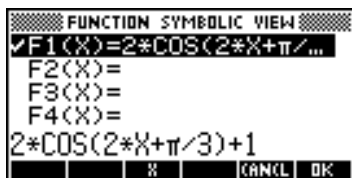


Note: In order to use this applet, all of the calculator's memory must be available.
To clear the calculator's memory before loading this applet, press the **ON** key, the top-left key, and the top-right key simultaneously.

Additional Exploration:

Using the **Function** applet, have the student adjust the **PLOT SETUP** so that exactly one period of the function fits into the window. An example would be:

Graph one period of $y = 2 \cos(2x - \frac{\pi}{3}) + 1$.



Ideas can be applied to:

Trigonometry, Precalculus, Calculus

Programs associated with this applet:

.PE.S, .P.A, .P.B, .P.C, .P.D, .P.T, .P.E, .P.R, .P.P, .P.TF, .P.SV

Exploring Periodic Functions

Name _____

Amplitude, Period, Shifts with $y = \sin x$

Date _____

Directions: Choose **PERIODIC** from the library. Press **START**. After reading the note and seeing the sketch, press **VIEWS** to select the type of function to be explored and then to adjust the parameters as indicated.

- Highlight **Trig Function** from the choose box displayed when **VIEWS** is pressed and press OK. Highlight **sine** and press OK. Adjust A to be 2. Record the ordered pairs for the values in the table below. Repeat for A = 0.5 and A = -1.

x (radian)	$y = \sin x$	$y = 2 \sin x$	$y = 0.5 \sin x$	$y = -\sin x$
0	(0, 0)			
$\pi/2$	($\pi/2$, 1)			
π	(π , 0)			
$3\pi/2$	($3\pi/2$, -1)			
2π	(2π , 0)			

- Discuss how the coefficient **A** effects the graph of $y = A \sin x$.

- Reset**. Adjust B to be 2. Record the ordered pairs for the values in the table below. Repeat for B = 1/2.

x (radian)	$y = \sin x$	$y = \sin 2x$	$y = \sin 0.5x$
0	(0, 0)		
$\pi/2$	($\pi/2$, 1)		
π	(π , 0)		
$3\pi/2$	($3\pi/2$, -1)		
2π	(2π , 0)		

- Discuss how the coefficient **B** effects the graph of $y = \sin Bx$.

- Reset**. Adjust **C** to be $\pi/4$. Record the ordered pairs for the values in the table below. Repeat for **C** = $-\pi/4$.

x (radian)	$y = \sin x$	$y = \sin(x+\pi/4)$	$y = \sin(x-\pi/4)$
0	(0, 0)		
$\pi/2$	($\pi/2$, 1)		
π	(π , 0)		
$3\pi/2$	($3\pi/2$, -1)		
2π	(2π , 0)		

- Discuss how the coefficient **C** effects the graph of $y = \sin(x+C)$.

- Reset**. Adjust **D** to be 1. Record the ordered pairs for the values in the table below. Repeat for **D** = -1.

x (radian)	$y = \sin x$	$y = \sin x + 1$	$y = \sin x - 1$
0	(0, 0)		
$\pi/2$	($\pi/2$, 1)		
π	(π , 0)		
$3\pi/2$	($3\pi/2$, -1)		
2π	(2π , 0)		

8. Discuss how the coefficient **D** effects the graph of $y = \sin x + \mathbf{D}$.

Exploring Periodic Functions

Name _____

Amplitude, Period, Shifts with $y = \cos x$

Date _____

Directions: Choose **PERIODIC** from the library. Press **START** . After reading the note and seeing the sketch, press **VIEWS** to select the type of function to be explored and then to adjust the parameters as indicated.

1. Select **Trig Function** from the choose box displayed when **VIEWS** is pressed and press OK . Highlight **cosine** and press OK . Adjust A to be 2. Record the ordered pairs for the values in the table below. Repeat for $A = 0.5$ and $A = -1$.

x (radian)	$y = \cos x$	$y = 2 \cos x$	$y = 0.5 \cos x$	$y = -\cos x$
0	(0, 1)			
$\pi/2$	($\pi/2$, 0)			
π	(π , -1)			
$3\pi/2$	($3\pi/2$, 0)			
2π	(2π , 1)			

2. Discuss how the coefficient **A** effects the graph of $y = \mathbf{A} \cos x$.

3. **Reset** . Adjust B to be 2. Record the ordered pairs for the values in the table below. Repeat for $B = 1/2$.

x (radian)	$y = \cos x$	$y = \cos 2x$	$y = \cos 0.5x$
0	(0, 1)		
$\pi/2$	($\pi/2$, 0)		
π	(π , -1)		
$3\pi/2$	($3\pi/2$, 0)		
2π	(2π , 1)		

4. Discuss how the coefficient **B** effects the graph of $y = \cos \mathbf{B}x$.

5. **Reset** . Adjust **C** to be $\pi/4$. Record the ordered pairs for the values in the table below. Repeat for $\mathbf{C} = -\pi/4$.

x (radian)	$y = \cos x$	$y = \cos(x+\pi/4)$	$y = \cos(x-\pi/4)$
0	(0, 1)		
$\pi/2$	($\pi/2$, 0)		
π	(π , -1)		
$3\pi/2$	($3\pi/2$, 0)		
2π	(2π , 1)		

6. Discuss how the coefficient **C** effects the graph of $y = \cos(x+\mathbf{C})$.

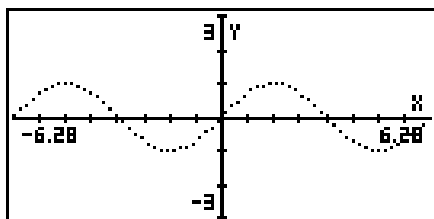
7. **Reset** . Adjust **D** to be 1. Record the ordered pairs for the values in the table below. Repeat for $\mathbf{D} = -1$.

x (radian)	$y = \cos x$	$y = \cos x + 1$	$y = \cos x - 1$
0	(0, 1)		
$\pi/2$	($\pi/2$, 0)		
π	(π , -1)		
$3\pi/2$	($3\pi/2$, 0)		

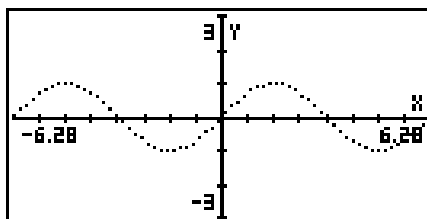
2π	$(2\pi, 1)$		
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8. Discuss how the coefficient **D** effects the graph of $y = \cos x + D$.
9. Sketch the graph of the following, applying the ideas of amplitude, period, and shifts. The graph of $y = \sin x$ is sketched for reference.

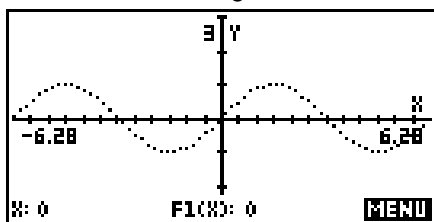
a. $y = 2\sin(\frac{1}{2}x) + 1$



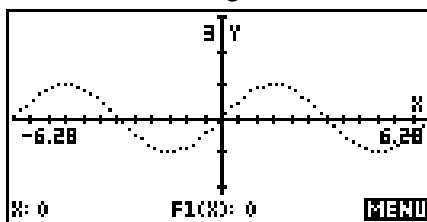
b. $y = -\sin(2x + \frac{P}{2})$



c. $y = 2\sin(x - \frac{P}{6})$

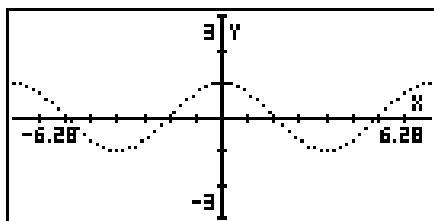


d. $y = \sin(2x + \frac{P}{3}) - 1$

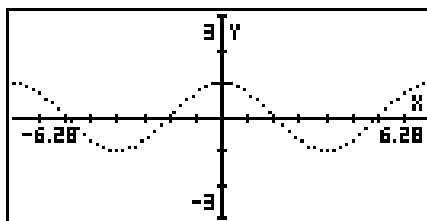


10. Sketch the graph of the following, applying the ideas of amplitude, period, and shifts. The graph of $y = \cos x$ is sketched for reference.

a. $y = 2\cos(2x)$

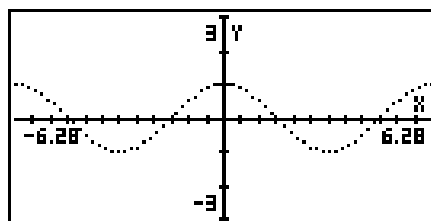
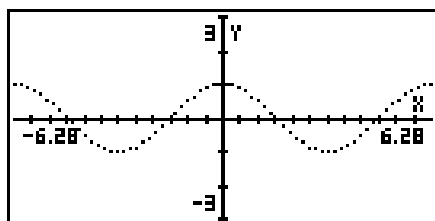


b. $y = -3\cos(x + \frac{P}{4})$



c. $y = 2\cos(\frac{1}{2}x - \frac{P}{3})$

d. $y = -2\cos(x + \frac{P}{6}) + 1$



Exploring Periodic Functions

Name _____

Matching Curves to Equations

Date _____

Directions: Choose **PERIODIC** from the library. Press **START**. Press **VIEWS** to select the type of function to be explored and then to **Enter A, B, C, D**. Match each equation to its graph.

_____ 1. $y = 2 \sin(x)$

_____ 2. $y = 2 \cos(x)$

_____ 3. $y = 2 \sin(x + \frac{\pi}{4})$

_____ 4. $y = -\cos(x - \frac{\pi}{6})$

_____ 5. $y = \frac{3}{2} \sin(2x)$

_____ 6. $y = 2 \cos(2x + \frac{\pi}{4})$

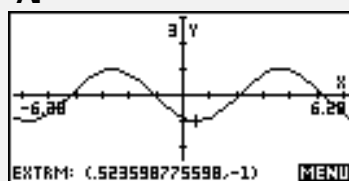
_____ 7. $y = \frac{5}{2} \cos(\frac{1}{2}x)$

_____ 8. $y = -2 \sin(3x - \frac{\pi}{2})$

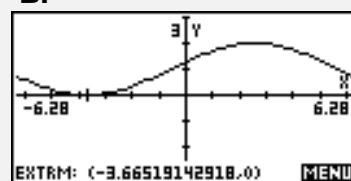
_____ 9. $y = \sin(\frac{1}{2}x + \frac{\pi}{12})$

_____ 10. $y = 2 \cos(\frac{2}{3}x + \frac{\pi}{6}) + 1$

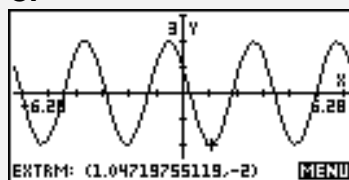
A.



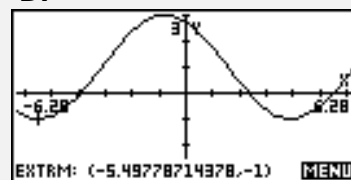
B.



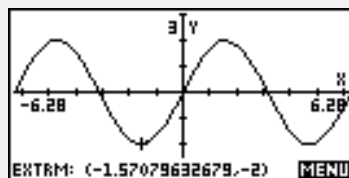
C.



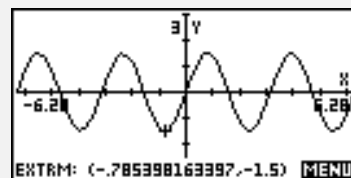
D.



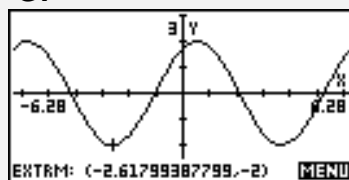
E.



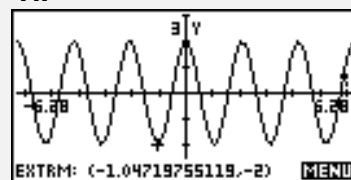
F.



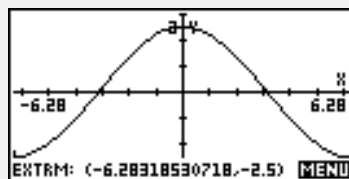
G.



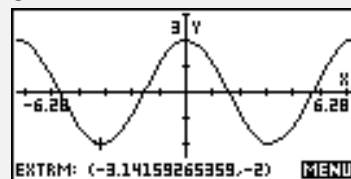
H.



I.



J.



11-14. Write an equation given the specifics of each of the following curves.

	curve type	amplitude	period	phase shift	vertical shift	equation
11.	sine	2	3π	$\pi/2$		
12.	cosine	$2/3$	π	$-\pi/3$		
13.	sine	3	$\pi/6$	$-2\pi/3$		
14.	cosine	5	$2\pi/3$	$\pi/6$		