Teachers Teaching with Technology

T^3 Scotland

T^3 EUROPE

Trigonometric Graphs

TRIGONOMETRIC GRAPHS

Aim

The aim of this unit is to investigate trigonometric functions of the form

$y = a\sin(bx) + c$ and $y = a\cos(bx) + c$.

Objectives

Mathematical objectives

By the end of this topic you should know

- how to describe and sketch a trig graphs by observation of its function.
- how to identify a trigonometric function, given a sketch.
- Know the tranformation effects of varying the values of a, b and c.

Calculator objectives

By the end of this session you should be able to

- Graph functions via [Y=].
- Draw graphs of trigonometric functions using appropriate [WINDOW] settings.
- Know how to execute (run) a program stored on the TI-83.
- Know how to [TRACE] along a graph to obtain important points

STUDENT TASK

1. Read the Calculator Skills Sheet (page 3) carefully before you start, it may prevent you encountering difficulties with your TI-83.

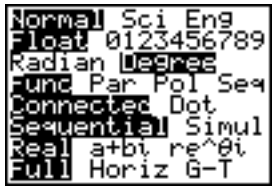
2. On the worksheets (except page 8)), for each of the given equations you must:
   i. sketch the graph obtained using the TI-83,
   ii. find the maximum and minimum value of the function,
   iii. find the period,
   iv. sketch the graph of the "general case" NOT using the TI-83.
   v. complete the statements based on your observations.

TRIGONOMETRIC GRAPHS

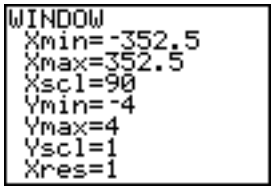
Calculator Skills Sheet

Before we can start on this unit of work we must first ensure that your TI-83 is in the correct MODE, and is going to operate as we want it to.
This is how we do this

1. Press the MODE button.
   The display should look exactly like this.
   If it does not look like this, then using the cursor keys highlight the correct item in each line and press ENTER to change the selection.
   Notice: There can only be one item in each line highlighted.



2. Now press the ZOOM and 7□.
   This sets the window range to a built in setting which will accomodate all the work in this unit.



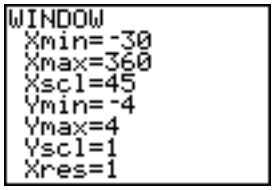
3. Press the 2 nd and FORMAT.
   This takes you to the WINDOW FORMAT screen.
   It should look like this.
   If it does not then using the cursor keys highlight the correct item in each line and press ENTER.
   Once the screen looks like this press CLEAR.
   Notice: There can only be one item in each line highlighted.

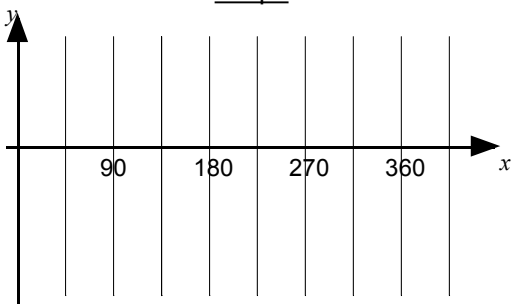
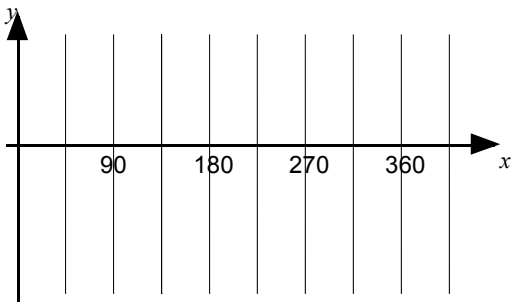
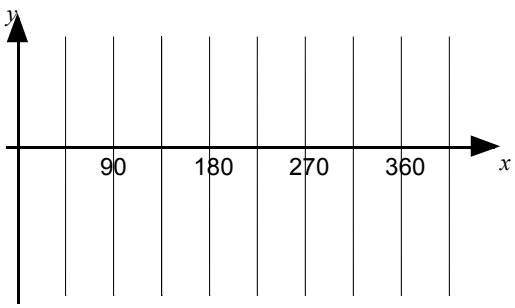
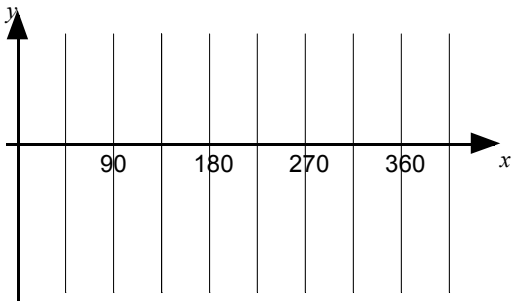
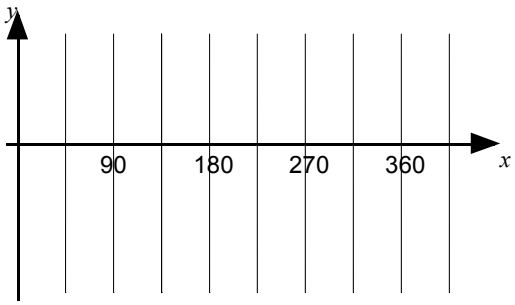
4. ALTERNATIVE WINDOW RANGE
   If you prefer the graphs on the screen to be similar to those you must sketch set the Window Range to this rather than ZTrig.

   Press the WINDOW button.

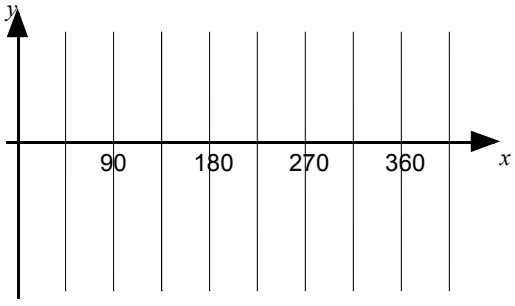
   Enter the Window Range shown.

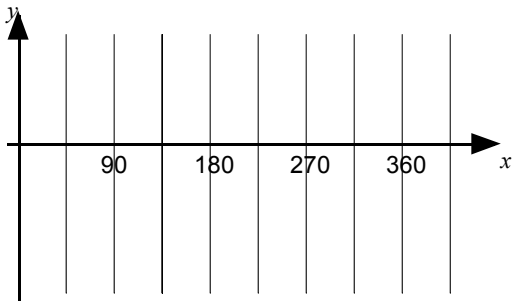
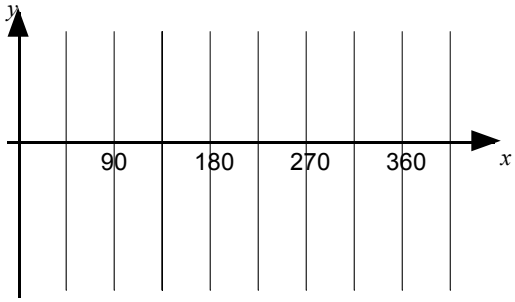
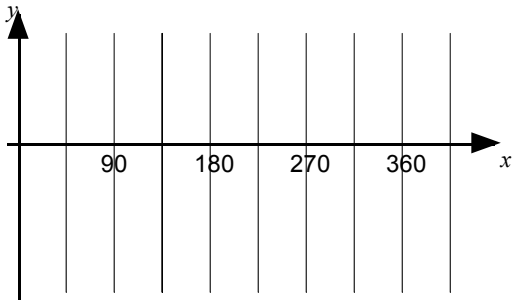
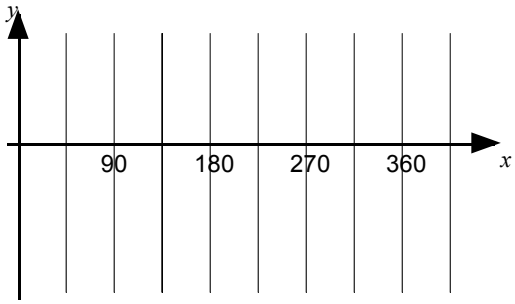
   Press ENTER after each line.



	Function	Graph	Max	Min	Period
1.	$y = \sin(x)$				
2.	$y = \sin(x) + 1$				
3.	$y = \sin(x) + 2.5$				
4.	$y = \sin(x) - 1$				
5.	$y = \sin(x) - 2$				

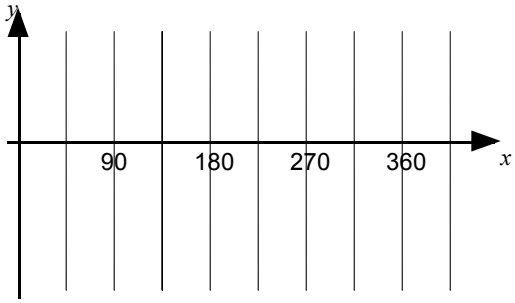
General Case

6.	$y = \sin(x) + c$				

Function	Graph	Max	Min	Period
7. $y = \cos(x)$				
8. $y = \cos(x) + 1$				
9. $y = \cos(x) + 2.5$				
10. $y = \cos(x) - 1$				

General Case

11. $y = \cos(x) + c$

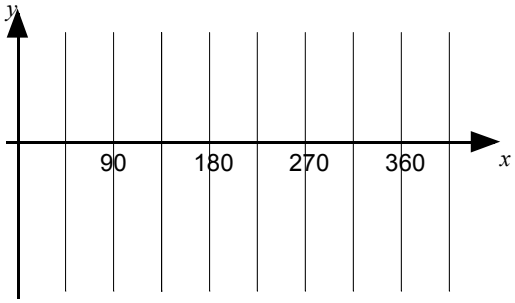
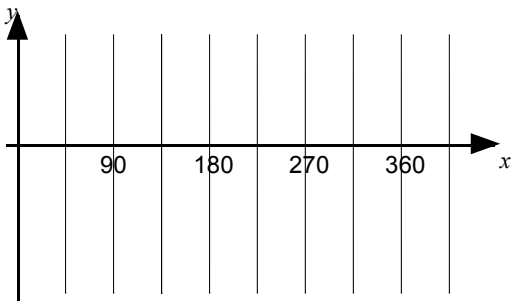
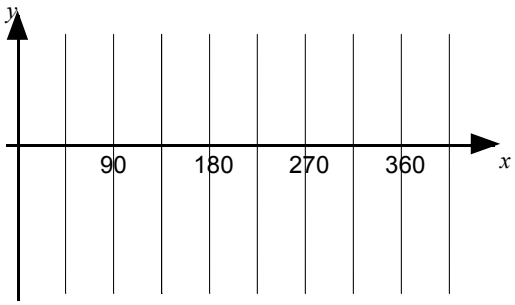
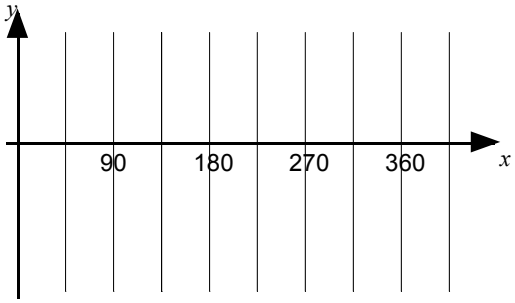
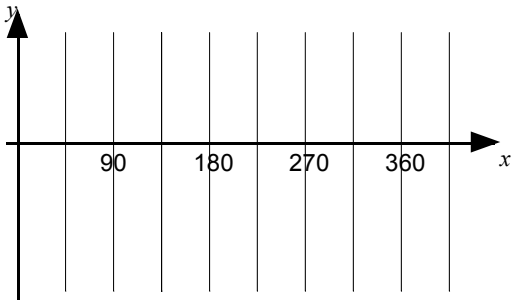


Complete these statements

In equations of the form $y = \sin(x) + c$ or $y = \cos(x) + c$ changing the value of c moves the graph _____

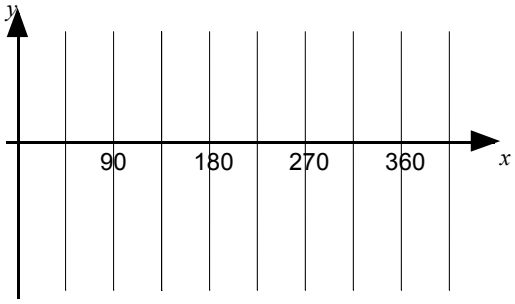
If c is positive then _____

If c is negative then _____

	Function	Graph	Max	Min	Period
12.	$y = \sin(x)$				
13.	$y = 3\sin(x)$				
14.	$y = 5\sin(x)$				
15.	$y = \frac{1}{2}\sin(x)$				
16.	$y = \frac{1}{4}\sin(x)$				

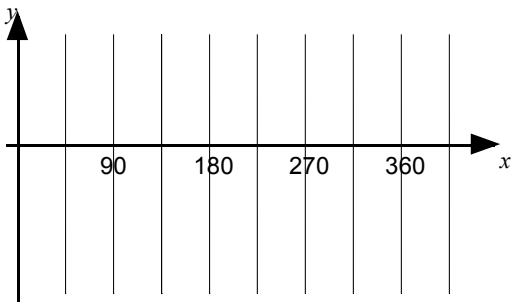
General Case

17. $y = a \sin(x)$

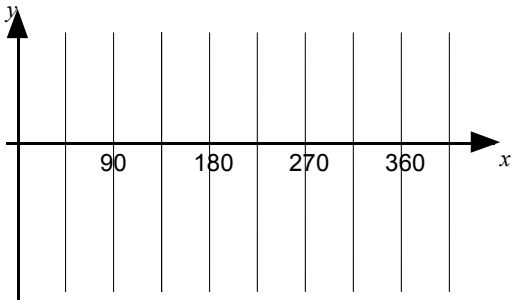


Function	Graph	Max	Min	Period

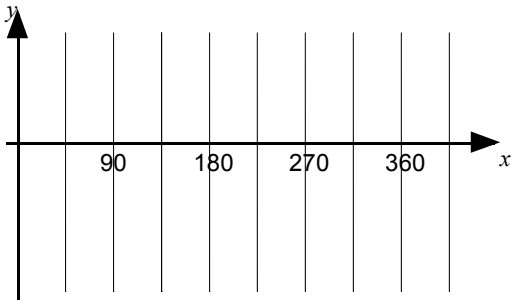
18. $y = \cos(x)$



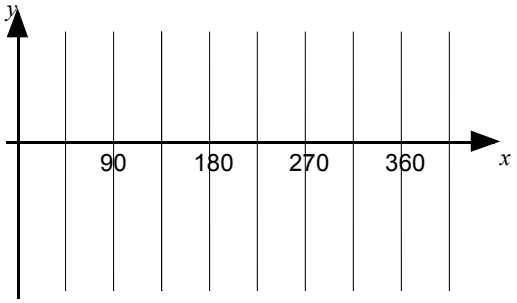
19. $y = 2\cos(x)$



20. $y = 3\cos(x)$

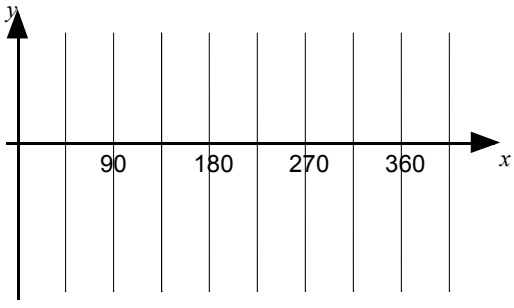


21. $y = \frac{1}{2}\cos(x)$



General Case

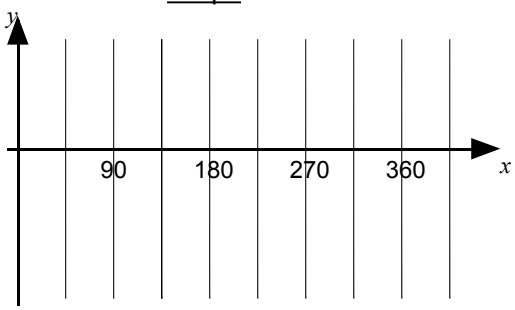
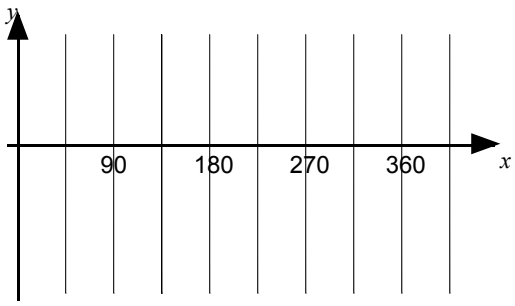
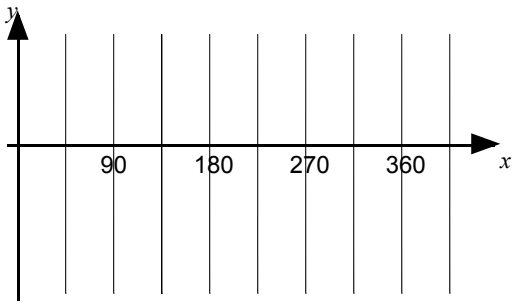
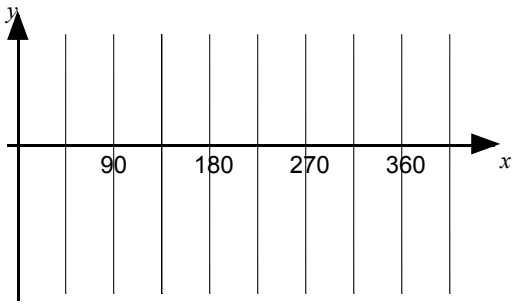
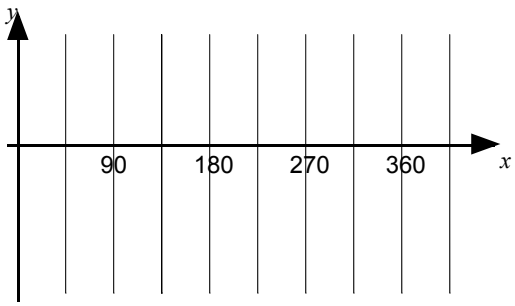
22. $y = a\cos(x)$

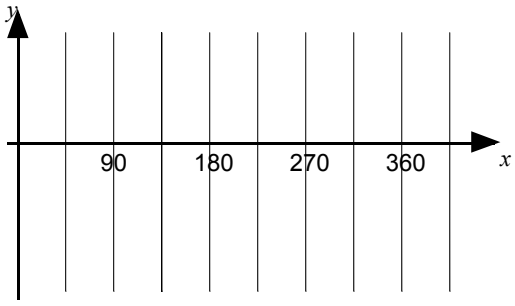


Complete these statements

In equations of the form $y = a\sin(x)$ or $y = a\cos(x)$ changing the value of a changes the _____.

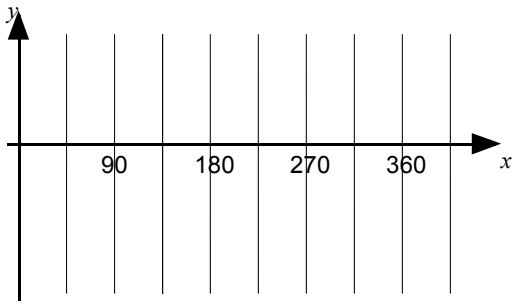
a gives the _____of the function.

Function	Graph	Max	Min	Period
23. $y = \sin(x)$				
24. $y = \sin(2x)$				
25. $y = \sin(3x)$				
26. $y = \sin(4x)$				
27. $y = \sin(\frac{1}{2}x)$				

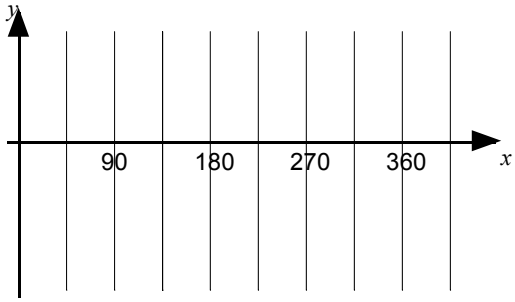
General Case				
28. $y = \sin(bx)$				

Function	Graph	Max	Min	Period

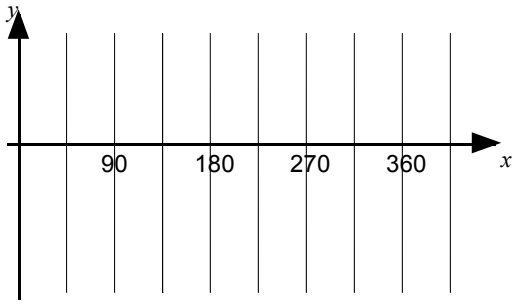
29. $y = \cos(x)$



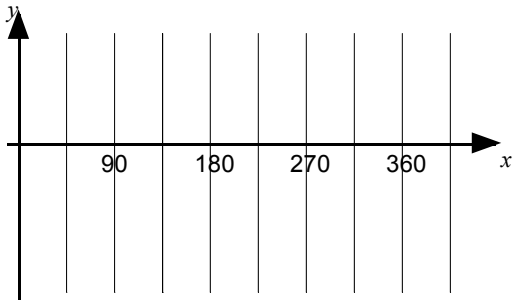
30. $y = \cos(2x)$



31. $y = \cos(3x)$

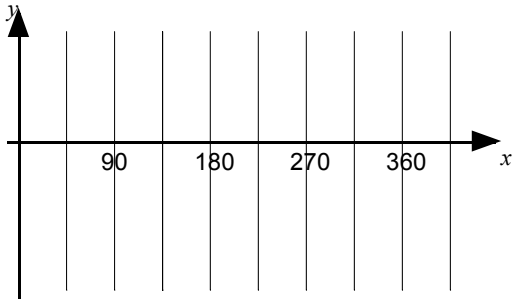


32. $y = \cos(\frac{1}{2}x)$



General Case

33. $y = \cos(bx)$



Complete these statements

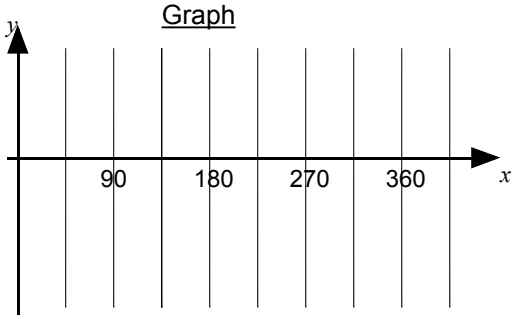
In equations of the form $y = \sin(bx)$ or $y = \cos(bx)$ changing the value of b changes the _____.

b gives the _____.

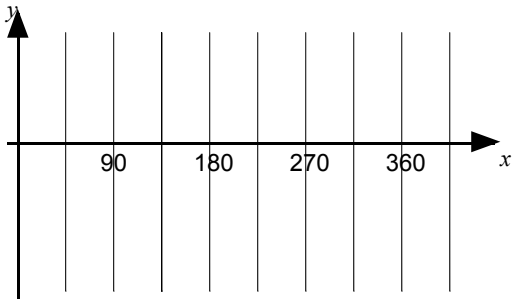
The _____ of the graph is always $\frac{\quad}{b}$°

Function	Graph	Max	Min	Period

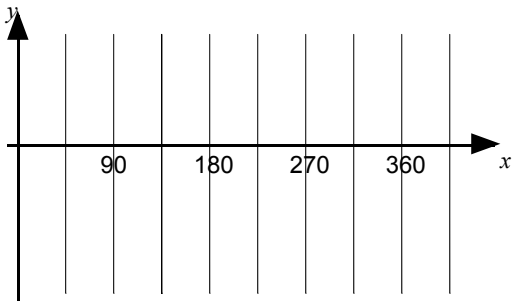
34. $y = \sin(x)$



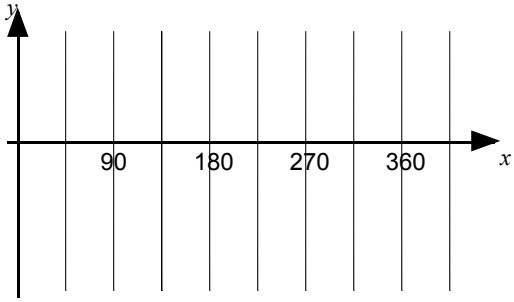
35. $y = 3\sin(2x) + 1$



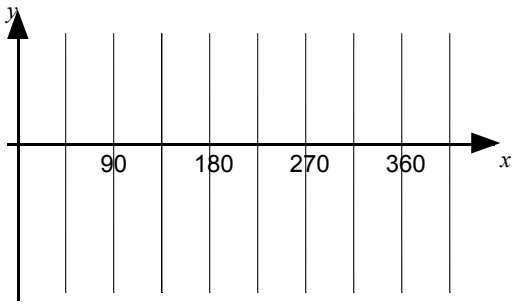
36. $y = 2\sin(3x) - 2$



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

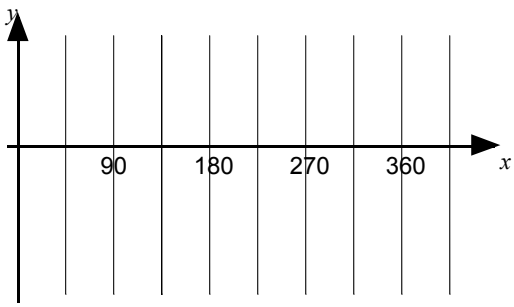


38. $y = 2\sin(\frac{1}{2}x) - \frac{1}{2}$



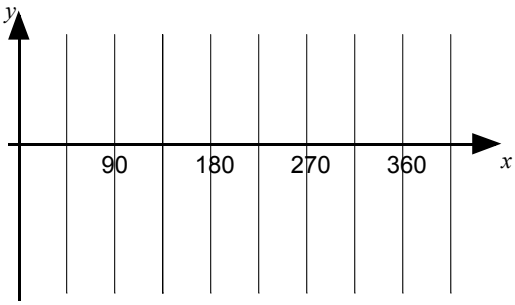
General Case

39. $y = a\sin(bx) + c$

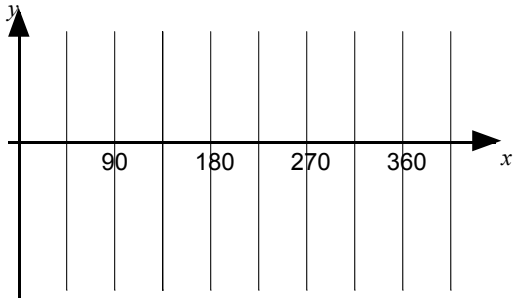


Function	Graph	Max	Min	Period

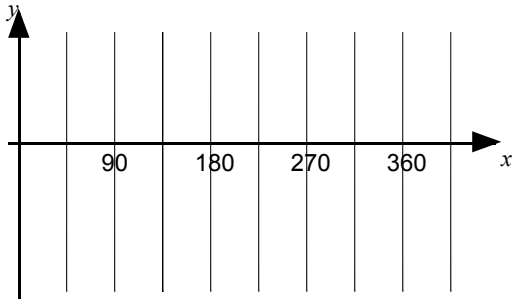
40. $y = \cos(x)$



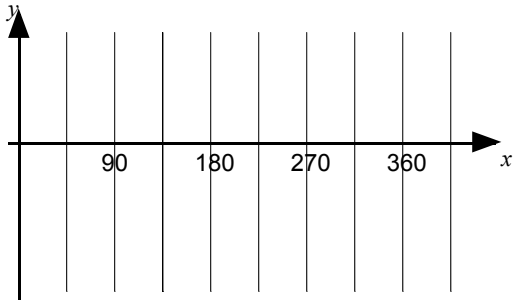
41. $y = 3\cos(2x) + 1$



42. $y = 2\cos(3x) - 2$

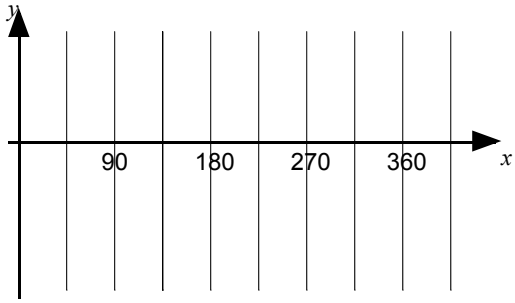


43. $y = 2\cos(\frac{1}{2}x) - 1$



General Case

44. $y = a\cos(bx) + c$



Complete these statements

In equations of the form $y = a\sin(bx) + c$ or $y = a\cos(bx) + c$

a changes the _____. b changes the _____.

c changes the _____

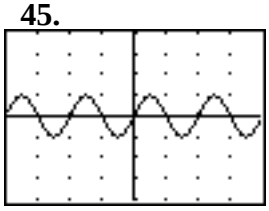
The **Maximum** is always _____. The **Minimum** is always _____

The **Period** is always _____.

Can you name each of these functions?

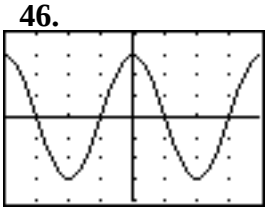
Scale:
Vertical: Each dot is 1 unit.
Horizontal: -360º to 360º, each dot is 90º

45.



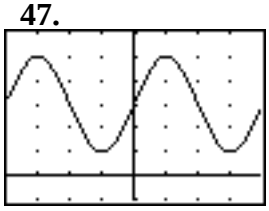
y =_____

46.



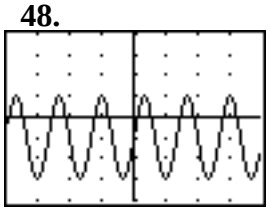
y =_____

47.



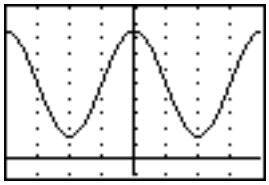
y =_____

48.



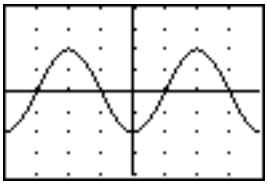
y =_____

49.



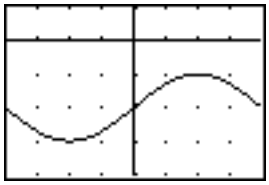
y =_____

50.



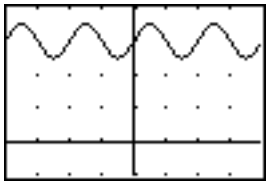
y =_____

51.



y =_____

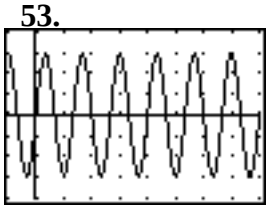
52.



y =_____

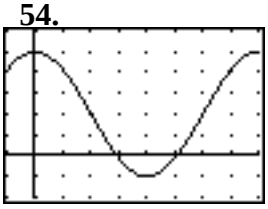
Scale:
Vertical: Each dot is 1 unit.
Horizontal: -90º to 720º, each dot is 90º

53.



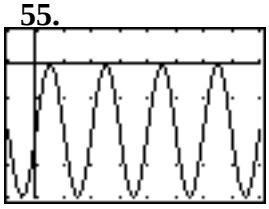
y =_____

54.



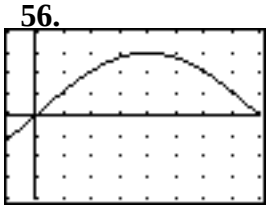
y =_____

55.



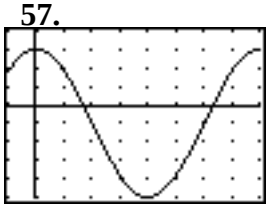
y =_____

56.



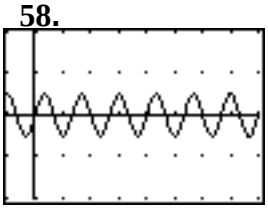
y =_____

57.



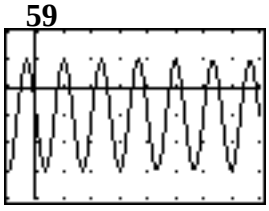
y =_____

58.



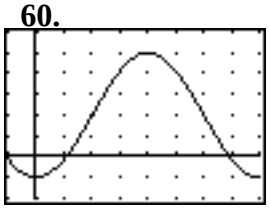
y =_____

59



y =_____

60.

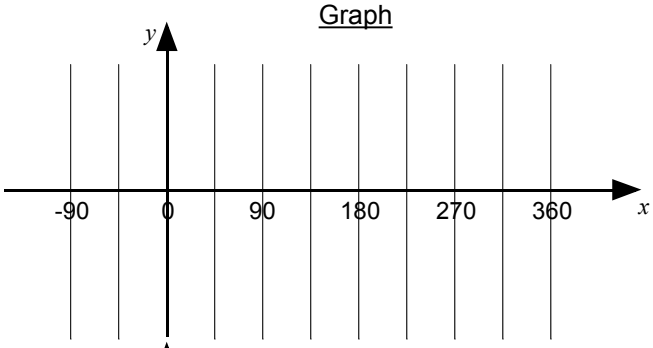


y =_____

Function

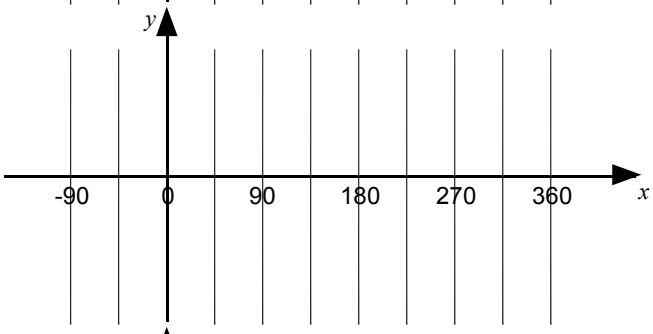
Graph

61. $y = \sin(x)$



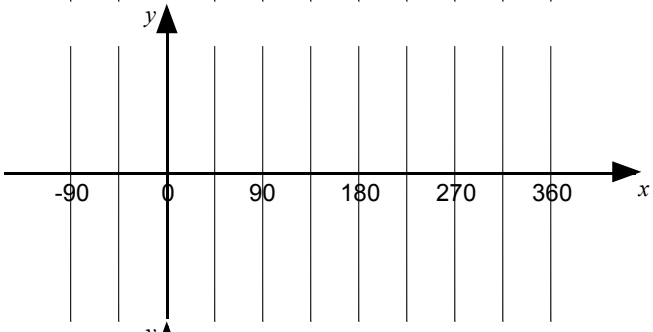
Max ☐ Min ☐ Period ☐

62. $y = \sin(x + 45)$



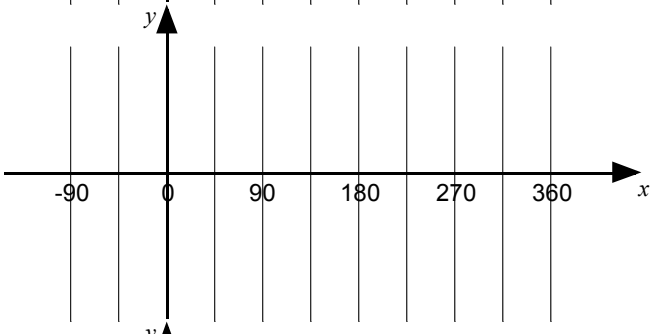
Max ☐ Min ☐ Period ☐

63. $y = \sin(x - 30)$



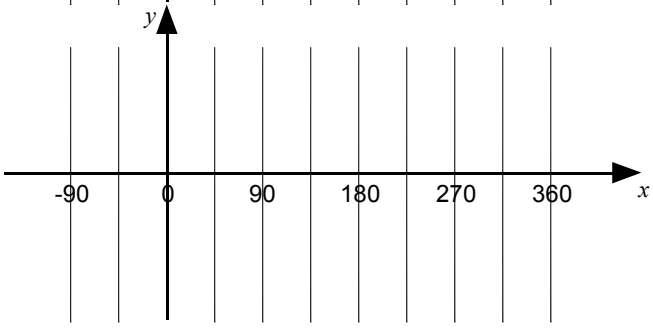
Max ☐ Min ☐ Period ☐

64. $y = \cos(x + 30)$



Max ☐ Min ☐ Period ☐

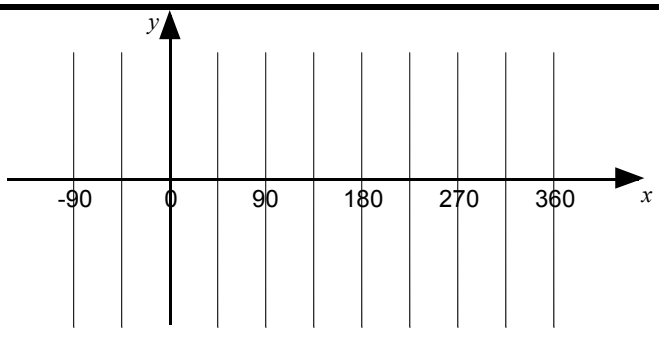
65. $y = \cos(x - 45)$



Max ☐ Min ☐ Period ☐

General Case

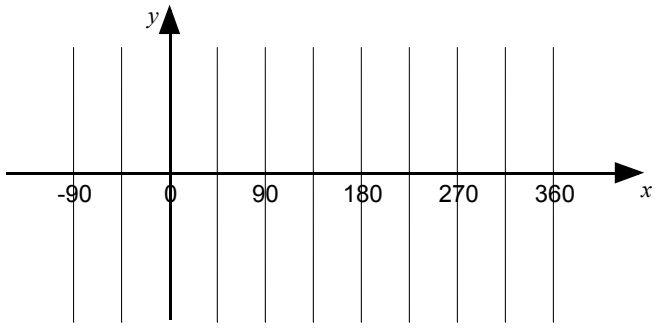
66. $y = \sin(x + \alpha)$



Max ☐ Min ☐ Period ☐

Function | Graph

67. $y = \sin(x + 90)$



Max ☐

Min ☐

Period ☐

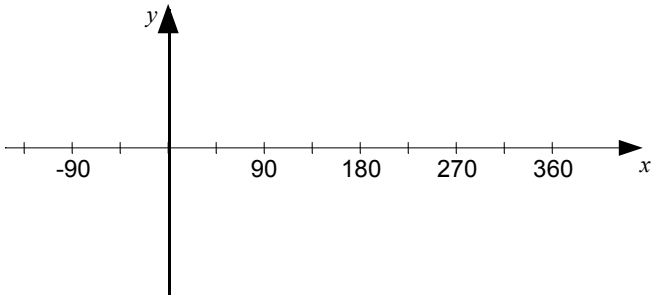
Complete these statements

In equations of the form $y = \sin(x + \alpha)$ or $y = \cos(x + \alpha)$

\+ moves the graph _____.

This has the effect of making the graph of $\sin(x + 90)$ = the graph of _____.

68. $y = \cos(x - 90)$



Max ☐

Min ☐

Period ☐

Complete these statements

In equations of the form $y = \sin(x - \alpha)$ or $y = \cos(x - \alpha)$

\- moves the graph _____.

This has the effect of making the graph of $y = \cos(x - 90)$ = the graph of _____.

Now run the program **MADTRIG**.
This program will generate a trig. graph of the form
$y = c \sin(dx)$ *or* $y = c \cos(dx)$.
You have look at the graph and identify the values of c and d.
The program will prompt you.
Good Luck

How do I run a program?
See Calculator Hint Sheet 4

Answers:

67. $y = \sin(x)$	68. $y = 2\sin(3x)$	69. $y = -3\sin(3x) + 1$
70. $y = 3\sin(x) - 1$	71. $y = \sin(2x) - 3$	72. $y = 3\cos(2x) + 3$
73. $y = 4\cos(2x) - 1.28$	74. $y = 2\sin(3x)$	75. $y = -3\cos(2x) + 3$
76. $y = 3\cos(x)$	77. $y = 2.5\sin(3x) + 3.23$	78. $y = 3\sin(3x)$
79. $y = 3.2\cos(x) + 2$	80. $y = 3\sin(3x) - 3$	81. $y = 3\sin(0.35x)$
82. $y = \sin(3x)$	83. $y = 3\cos(x)$	84. $y = -3\cos(x)$
85. $y = 3\sin(x) - 1$	86. $y = 3\sin(x) + 3$	