Activity 12 Radian measure

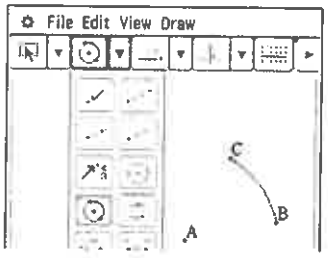
Aim: Explore radian measure and its relationship with degree measure.

Radians are a measure of angle derived from a simple relationship between arc length and radius.

Construct a Sector

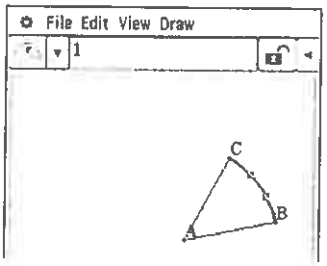
Draw an arc

- Open the Geometry application
- Select the arc tool from the Draw pull down menu
- Tap once in free space for the centre. Tap again for the start of the arc, then again for the end of the arc.



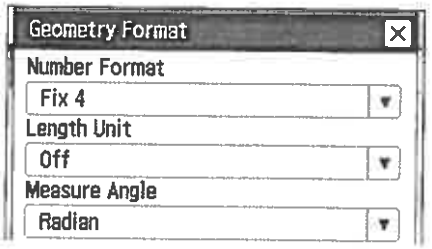
Complete the sector and set radius

- Tap from the Draw pull down menu
- Tap once on the centre of the arc and again at one end of the arc
- Repeat to complete a closed sector
- Tap in open space then select the arc
- Tap to go round the corner
- Tap in the Measurement box and set the radius of the arc to 1 unit



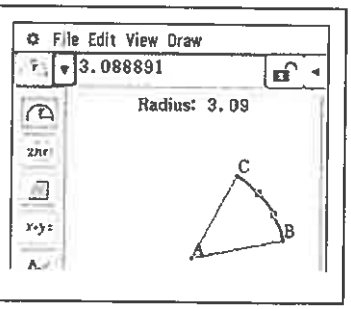
Settings

- Select [| Geometry Format]
- Set Measure Angle to Radian
- Set the Number Format to Fix 4 (round measurements to 4 decimal places)



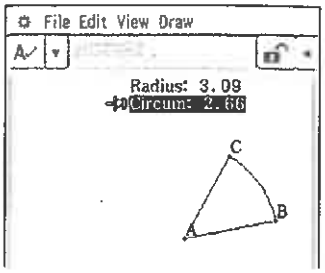
Measure radius

- Tap to select the arc then tap to go round the corner
- In the Measurement pull down menu, select the radius option then tap this button. This should insert a dynamically changing measure of the radius.



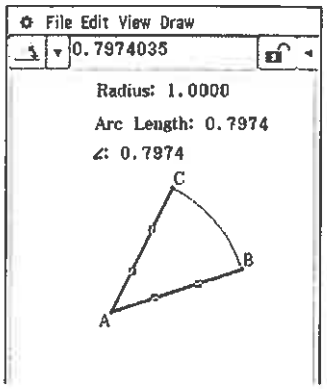
Measure arc length

- Tap in free space then tap to select the arc
- In the Measurement pull down menu, select the circumference option [2πr] then tap this button. This will insert a dynamically changing measure of the arc length (currently called Circum).
- With the Circum selected, tap in the text box at the top of the screen and change the word to Arc Length to avoid confusion, then press [EXE] to confirm



Measure angle

- Tap in free space, then tap to select both radii
- In the Measurement box, the angle [∠] (in radians) should be displayed. If not, select this from the pull down menu.
- Tap on the angle button [∠]. This will insert the measure of the angle between the two radii.
- With the angle selected, tap in the text box at the top of the screen and change the symbol ∠ to *Angle* to avoid confusion, then press [EXE] to confirm



Tips: 1. The measurements are selectable and movable.
2. Selecting [View | Zoom to Fit] should give a nice view if the object becomes too large for the screen.

We will now investigate the link between the radius of the arc, the angle subtended by the arc and the length of the arc.

1. Tap to select the two radii. Change the angle in the Measurement box and record your results in the table below.

Radius	Angle	Arc length
1	1 radian	
1	2.3 radians	
1	3.1 radians	

- Tap in free space then tap to select the arc. Change the radius to 3 units.

2. Tap to select the two radii. Change the angle in the Measurement box and record your results in the table below.

Radius	Angle	Arc length
1	1 radian	
1	2.3 radians	
1	3.1 radians	

3. Describe the relationship between the radius of the arc, the angle subtended by the arc and the length of the arc. *Hint:* What is the length l of an arc of radius r units that subtends an angle of θ radians?

4. Select the two radii and change the angle to $\frac{\pi}{2}$ radians (use your Keyboard to enter the π symbol). What is the degree equivalent of this angle?

5. Change the angle to π radians. What is the degree equivalent of this angle?

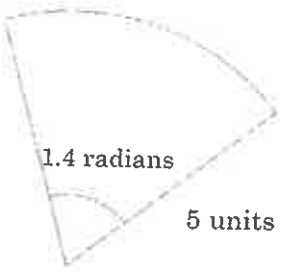
6. Describe a process or formula for converting an angle in radians to its equivalent degree measure.

7. Complete the following table, leaving angles in radians in terms of π.

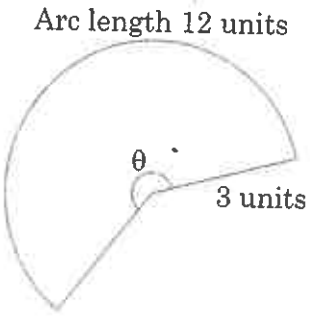
Degrees	Radians
60°	
225°	
	$\frac{\pi}{4}$
	$\frac{11\pi}{12}$

8. Determine:

a) the arc length in this diagram:

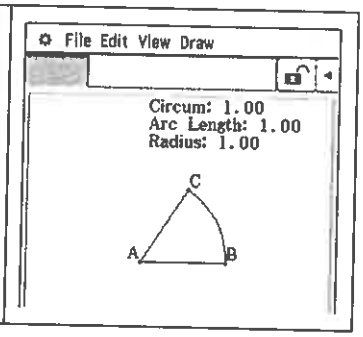


b) the angle θ in this diagram:



Learning notes

The screen shown at right gives the definition of an angle of 1 radian, i.e. the angle subtended by an arc of length 1 unit with a radius of 1 unit.



Activity 13 Trigonometric graph transformations

Aim: Modify equations to investigate transformations of the basic trigonometric functions.

We will make use of the Modify function in the Graph and Table application. We will be working with changing parameters a, b, h and v and must initialise these before starting the investigation.

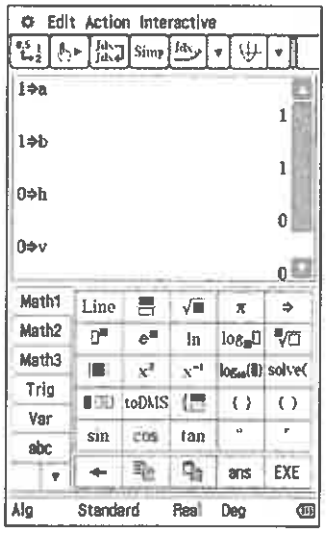
Setup

- Open Main
- Select [⚙ | Graph Format]
- Ensure G-Controller is checked
- Tap Set

Note the angle setting is degree (DEG)

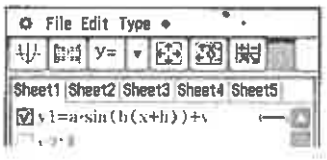
Initialise the parameters

- 1 ⇒ a EXE
- 1 ⇒ b EXE
- 0 ⇒ h EXE
- 0 ⇒ v EXE



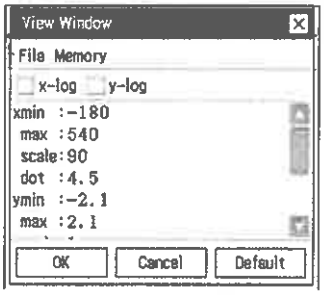
Enter the function $y = a\sin(b(x+h))+v$

- Open the Graph and Table application
- Type the expression a × $\sin(b$ × $(x+h))+v$ EXE into y1



Setup the view window

- Tap ⊞ to open the View Window settings
- Select [Memory | Trigonometric]
- Tap OK
- Adjust to match screen shot
- Tap ⊞ to graph the function
- With the graph window active tap Resize to fill the screen



With our initial values for the parameters, $a = 1$, $b = 1$, $h = 0$ and $v = 0$, we have displayed the graph of $y = \sin x$.

1. Describe the main features of the graph of $y = \sin x$ i.e. x- and y- intercepts, period and amplitude.

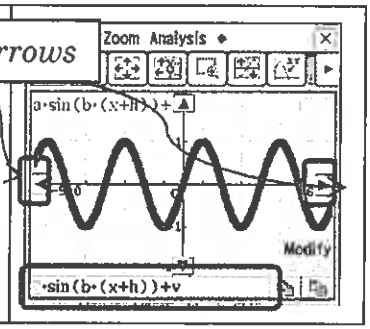
For Q's 2 – 12 use terms such as translation, dilation and reflection when describing changes to the graphs.

2. Describe the effect of a on the graph of $y = a \sin x$.

Modify the parameter *a*

- Select [Analysis | Modify]
- With Step set to 1, tap [OK]. A bold graph will be overlaid.
- Highlight the parameter a in the equation and tap the right controller arrow to increase its value. Tap the left controller arrow to decrease its value

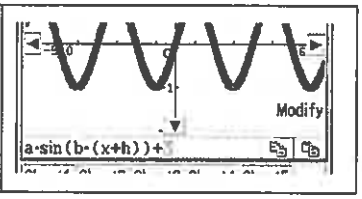
G-controller arrows



3. Describe the effect of v on the basic graph of $y = \sin x + v$.

Modify the parameter *v*

- Set a to 1
- Highlight the parameter v. Adjust its value using the controller arrows.



4. Describe the effect of b on the basic graph of $y = \sin bx$.

Modify the parameter *b*

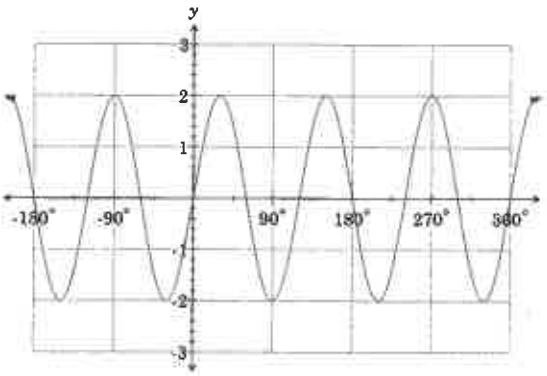
- Set v to 0
- Highlight the parameter b Adjust its value using the controller arrows.

5. Describe the effect of h on the basic graph of $y = \sin(x + h)$. Return the value of h to 0 when finished.

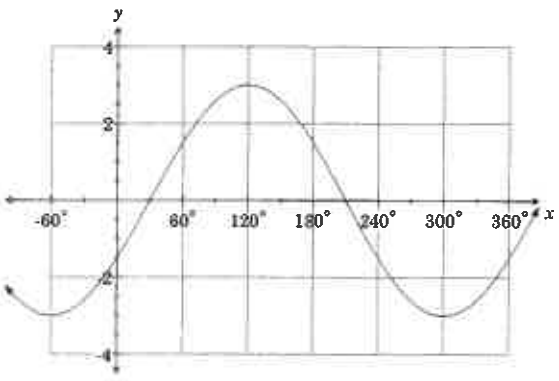
Modify the parameter *h*	
• Set b to 1 • Press Esc • Select [Analysis | Modify], change the step to 15 then tap OK • Highlight the parameter h Adjust its value using the controller arrows	a·sin(b·(x+))+v

6. Determine equations for the following sine graphs.

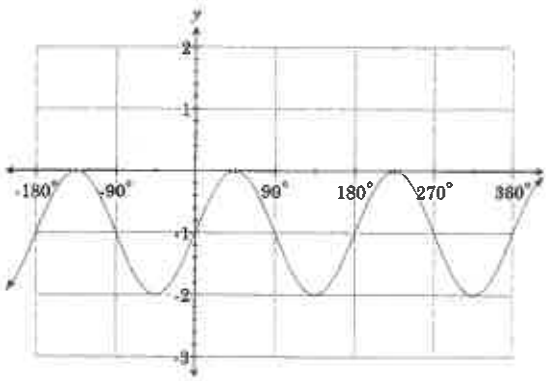
a)



b)



c)



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