Task 1:

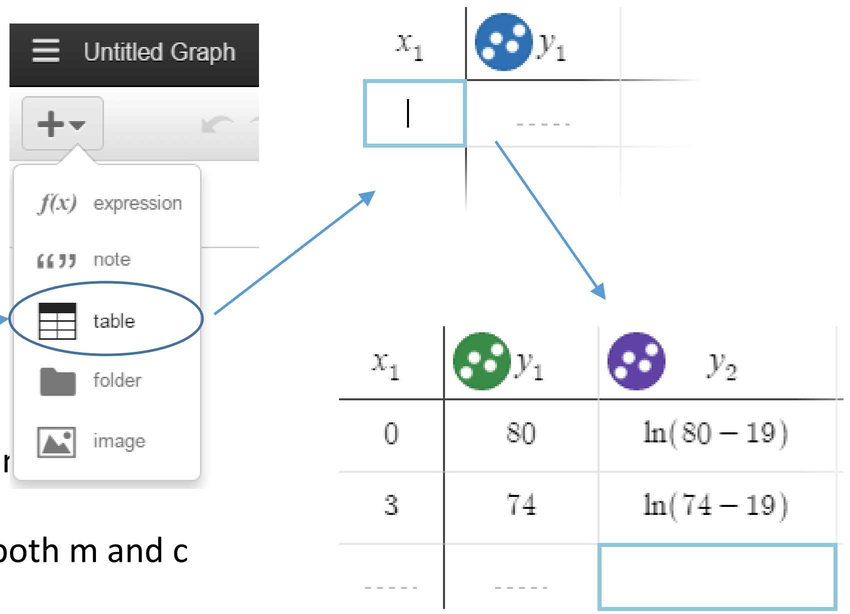
1. Measure the temperature of a hot drink. Repeat every two minutes.

2. Open desmos.com or download the desmos app

3. Enter your time (x) and temperature (y_1) data in a table

   - can you predict the next temperature?

4. In a new y_2 column on your table, enter the natural log, $\ln(y_1 - R)$ where R is room ter



5. In a new equation box, enter the equation $y_3 = mx + c$ and agree to have sliders for both m and c

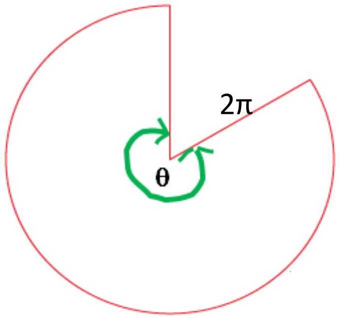
6. Manipulate m and c sliders (try editing the interval constrains for greater accuracy) to create a line of best fit for the log data

7. Can you work backwards on paper to work out the equation of the temperature data in the form $y=Ae^{-kx}$
   - Plot the graph – is it what you expected?

8. Can you use this equation to predict the temperature of the hot drink after 40 minutes?

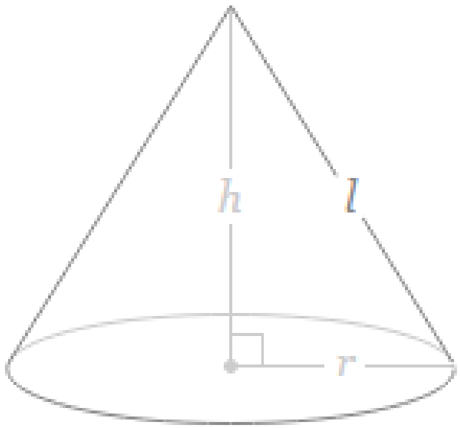
DISCUSSION TASK: How could you make this work in a classroom?
How would you present the problem?
How would the students be working?
Would this be the first/middle/final task in a scheme of work?

Task 2 – Differing approaches at A Level



Q: A circle has radius 2π. You can cut out a sector **leaving** an angle ϴ (in radians)
a) What is the length of the remaining arc?

The resultant shape can be formed into a cone.
b) What is the base circumference of the cone in terms of ϴ?
c) Show that r, the radius of the cone equals ϴ.
d) Find the height, h of the cone in terms of ϴ.



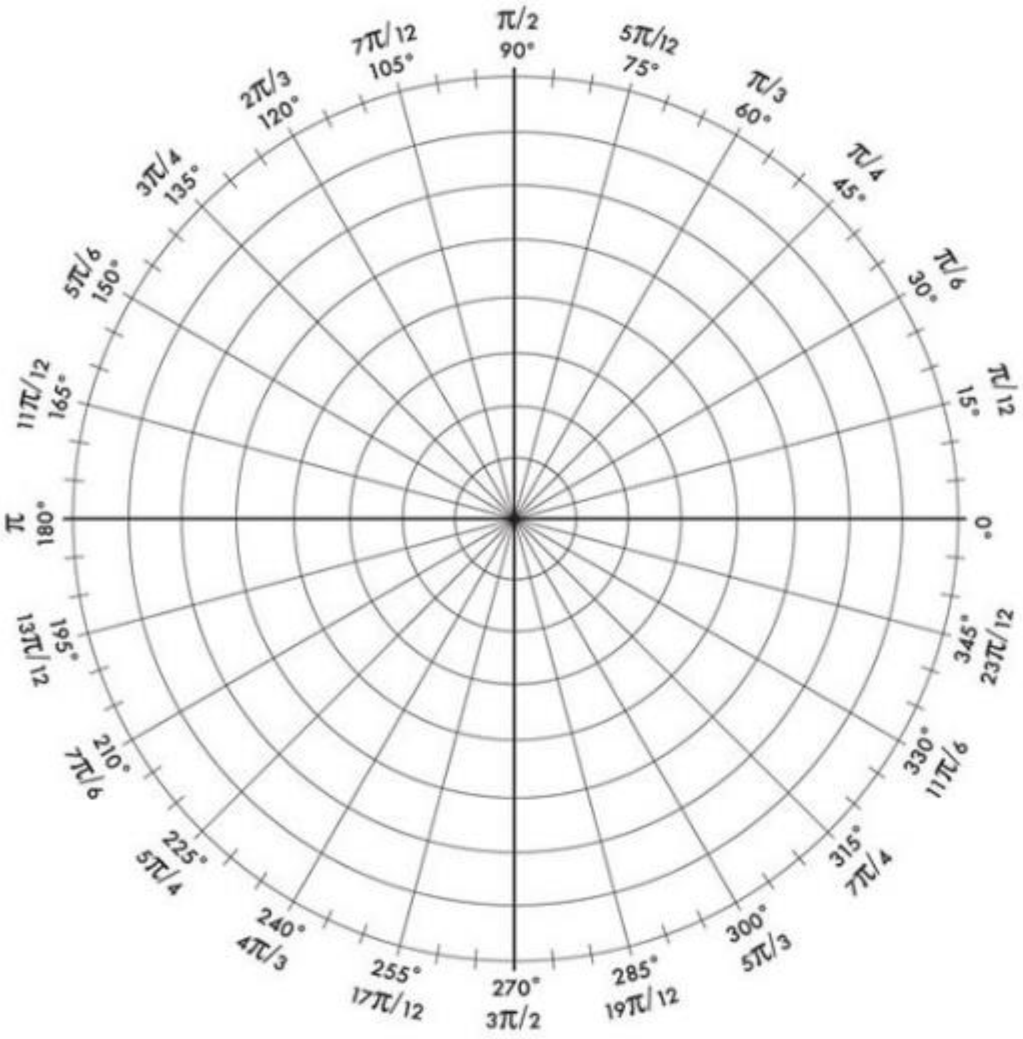
e) By first finding the volume of the cone, show that

$$\frac{dV^2}{d\theta} = \frac{2\pi^2}{9}\theta^3\left(8\pi^2 - 3\theta^2\right)$$

f) Hence find the angle ϴ for which Volume is maximised

Alternative:

- A sector of what angle should be removed from a circle in order to maximise the volume of the cone that can be created from the resulting net?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60°
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330°
11π/6
315°
7π/4
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5π/3
285°
19π/12
270°
3π/2
255°
17π/12
240°
4π/3
225°
5π/4
210°
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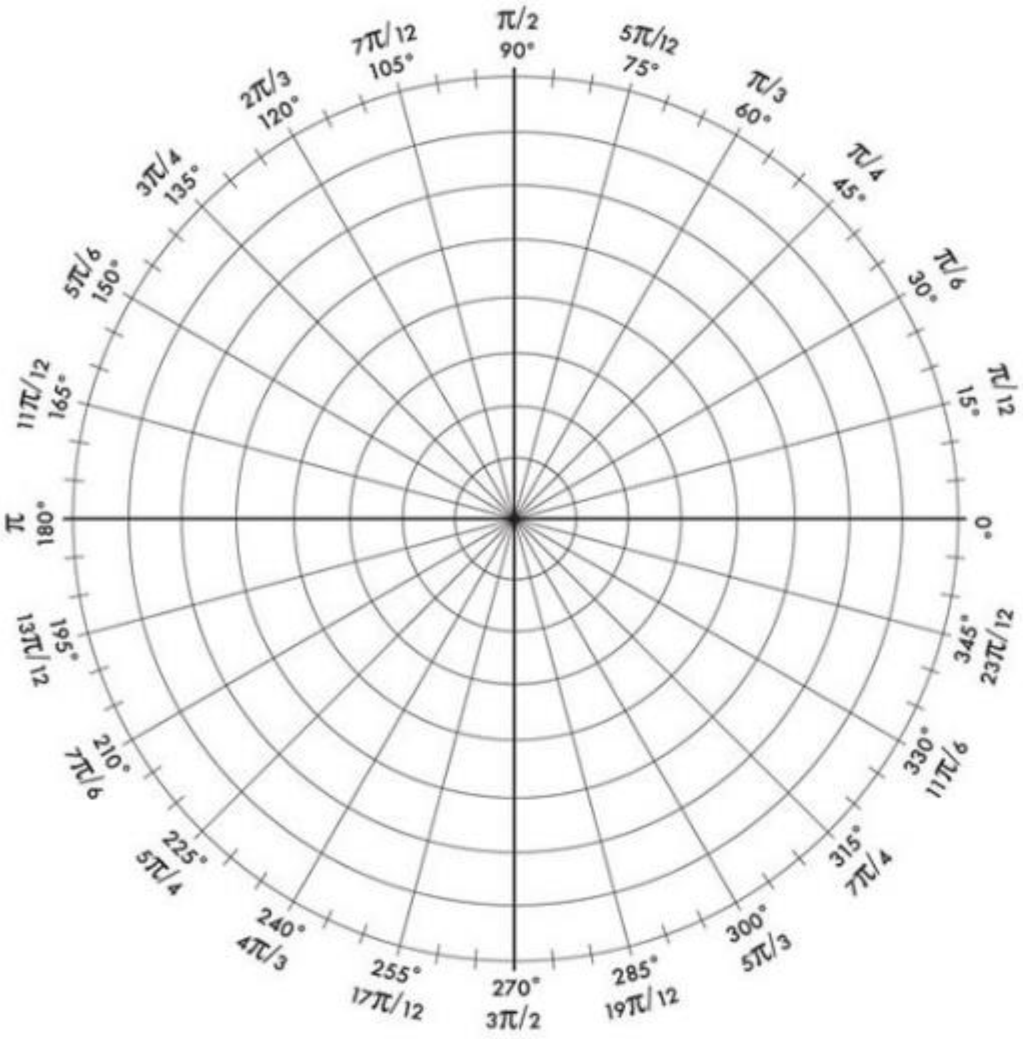
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