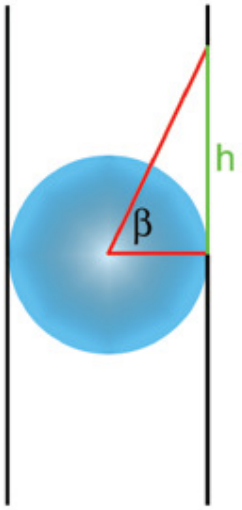
# MATHS AND CLIMATE CHANGE: THE MELTING ARCTIC

## 1. Mapping the Arctic




- In the diagram to the right the angle ß describes the latitude of the point on the Earth's surface to which it corresponds. Assume that the radius of the Earth is 1 unit. Express the height h in terms of trigonometric functions of the unit circle.

- Each point on the globe is given by its longitude α and latitude ß. These are angles measured in degrees. The Mercator projection maps each point on the Earth's surface to the point on the map with co-ordinates:

$$x = \alpha$$
$$y = R\tan(\beta)$$

- The number R is simply a scaling factor: if you want a very large map, you make R very large, and if you want a very small map, you make it small.

- Cairo has a latitude of approximately 30 degrees, London has a latitude of approximately 51 degrees, and Spitzbergen has a latitude of approximately 80 degrees. Setting R = 1, use the formula above to work out their *y*-coordinates on a map. What do you notice? Can we use this projection to map the Poles?

- Sketch the graph of the function $y = \tan(\beta)$ for ß ranging from -90 degrees to 90 degrees. How does this graph explain the distortion on the map?

- The Mercator projection is useless for anyone wanting to explore the Arctic. Can you come up with another projection which represents the Arctic more accurately?