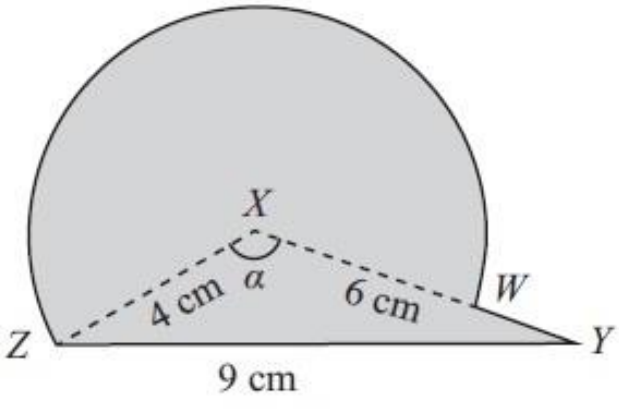
(50 Marks)

(a) Celtic Designs Ltd are designing a logo for their new company. They have decided upon the shape and are planning their merchandise, as illustrated by the shaded region in the diagram below.



The triangle *XYZ* has *XY* = 6 cm, *YZ* = 9 cm, *ZX* = 4 cm and angle *ZXY* = α.

The point *W* lies on the line *XY*.

The circular arc *ZW* is a major arc of the circle with centre *X* and radius 4 cm.

(i) Show that, to 3 significant figures, α = 2·22 radians.

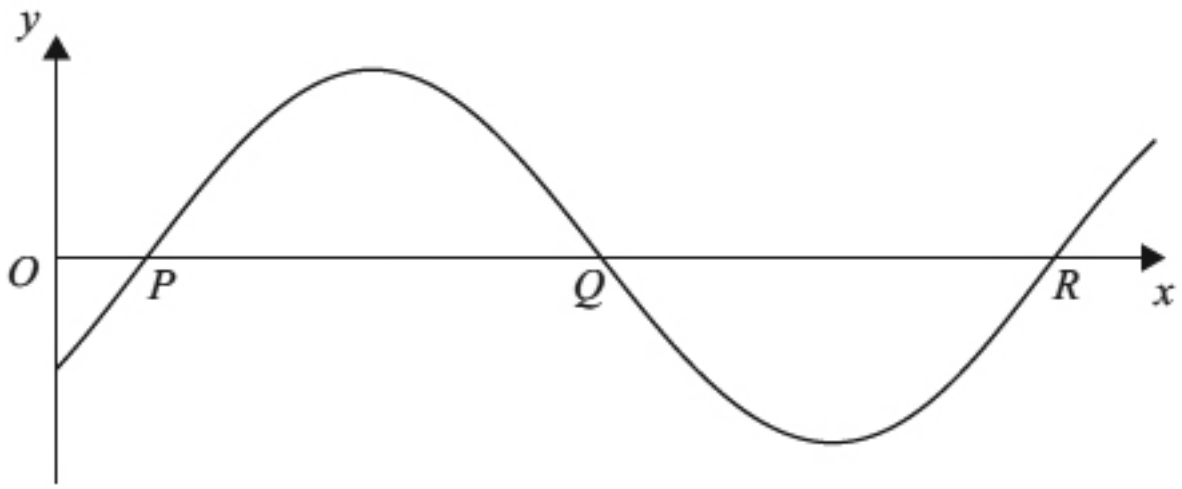
(ii) Find the area, in cm^2, of the sector *XZWX*. Give you answer correct to 1 decimal place.

The logo is shown in the shaded diagram above.

(iii) Calculate, to 1 decimal place, the area of the entire shaded region.

(iv) Show that the perimeter of the entire shaded region is 27cm.

(b)



The graph shows part of the curve with equation

$$y = \sin(ax - b), \text{ where } a > 0, \quad 0 < b < \pi$$

The curve cuts the *x*-axis at the points *P*, *Q* and *R* as shown.

Given that the coordinates of *P*, *Q* and *R* are $\left(\frac{\pi}{10}, 0\right)$, $\left(\frac{3\pi}{5}, 0\right)$ and $\left(\frac{11\pi}{10}, 0\right)$ respectively, find the values of a and b.