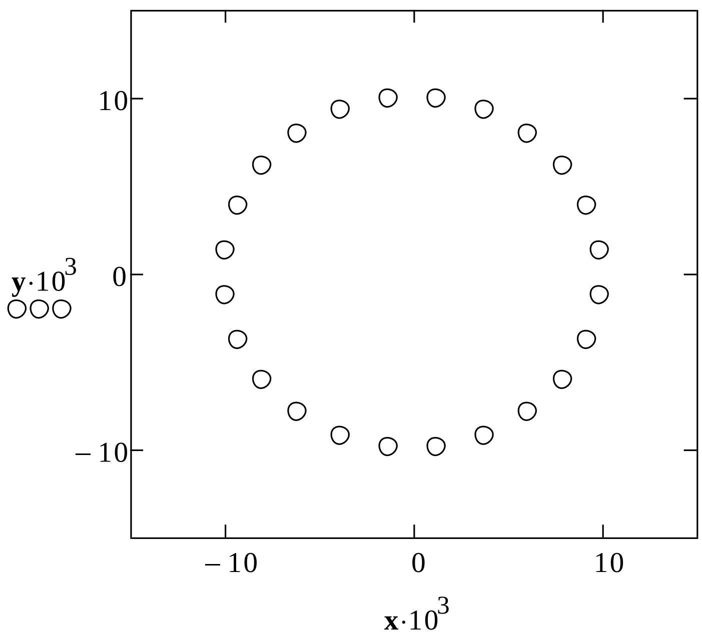
Worksheet 3.1 page 1

$Rad := 10 \cdot 10^{-3}$	radius of composite conductor, m
$l := 10$	length of composite conductor, m
$n := 24$	number of elements
$i := 1 .. n$	control variable
$\theta_i := \frac{2 \cdot \pi}{n} \cdot (i - 0.5)$	angle at which each element is located, radian
$\mathbf{x}_i := Rad \cdot \cos(\theta_i)$	x co-ordinate of each elemental conductor, m
$\mathbf{y}_i := Rad \cdot \sin(\theta_i)$	y co-ordinate of each elemental conductor, m
$r_i := \frac{Rad}{n}$	radius of each elemental conductor, m



plot of co-ordinates

Figure 3.1.3 Defining the physical parameters of the composite conductor worksheet 3.1 page 2

$\mu_o := 4 \cdot \pi \cdot 10^{-7}$ H/m

$\mu_r := 1$

$K := \dfrac{\mu_o \cdot \mu_r \cdot l}{2 \cdot \pi} = 2 \times 10^{-6}$ H

K is a constant for this computation

$$
\begin{aligned}
Zp := \; & \text{for } i \in 1..n \\
& \quad \text{for } j \in 1..n \\
& \quad\quad h \leftarrow \mathbf{x}_j - \mathbf{x}_i \\
& \quad\quad v \leftarrow \mathbf{y}_j - \mathbf{y}_i \\
& \quad\quad rad \leftarrow \sqrt{h^2 + v^2} \\
& \quad\quad rad \leftarrow r_i \;\text{ if }\; rad = 0 \\
& \quad\quad Lp_{i,j} \leftarrow K \cdot \ln\left(\frac{l}{rad}\right) \\
& Lp
\end{aligned}
$$

Zp = array of n*n inductance values, H

rad = separation between pair of elements
= radius of element if separation = 0

see equation (2.3.2)

$Vp_i := 1$ input voltage, V

$Ip := \text{lsolve}(Zp, Vp)$ output current, A

$Iq := \sum_{i=1}^{n} Ip_i = 7.238 \times 10^{4}$ sum of currents in elements

$\omega := 1$ radian/s

$Lq := \dfrac{Vp_1 \cdot \omega}{Iq}$

$Lq = 1.382 \times 10^{-5}$ H

Check:- $Lp := 2 \cdot 10^{-7} \cdot l \cdot \ln\left(\dfrac{l}{Rad}\right)$

$Lp = 1.382 \times 10^{-5}$ H

$\varepsilon_o := 8.854 \cdot 10^{-12}$ F/m

$\varepsilon_r := 1$

$Cq := \dfrac{\varepsilon_o \cdot \varepsilon_r \cdot \mu_o \cdot \mu_r \cdot l^2}{Lq}$

$Cq = 8.053 \times 10^{-11}$ F

Figure 3.1.4 Partial inductance and capacitance of single composite conductor