1. Find the vector equation of the line $2x + 3y = 1$ in $\mathbb{R}^2$.

   Point on line: $(-1, 1)$
   Direction of line: $(-3, 2)$

   $\Rightarrow$ The vector eqn is $\mathbf{r}(t) = (-1, 1) + t(-3, 2)$. 

2. Find the vector equation of the line of intersection of the planes in $\mathbb{R}^3$ given by

   $x+y-z=-1$ and $x+2y-2z=1$

   Solving the system:
   \[
   \begin{pmatrix}
   1 & 1 & -1 \\
   1 & z & -2 \\
   \end{pmatrix}
   \begin{pmatrix}
   x_1 \\
   x_2 \\
   x_3 \\
   \end{pmatrix}
   =
   \begin{pmatrix}
   -1 \\
   1 \\
   \end{pmatrix}
   \]

   Subtracting the second row from the first row,

   \[
   x = -3, \quad z = 1 \text{ (Free), } \quad y = t + z
   \]

   $\Rightarrow$
   \[
   \begin{pmatrix}
   x \\
   y \\
   z \\
   \end{pmatrix}
   =
   \begin{pmatrix}
   -3 + 0t \\
   t + 1 \\
   t \\
   \end{pmatrix}
   \]

   So the vector equation is

   $\mathbf{r}(t) = (-3, 1, 0) + t(0, 1, 1)$

3. Show that every point $(x, y, z)$ on the line in $\mathbb{R}^3$ with vector equation $\mathbf{r}(t) = \mathbf{b} + t\mathbf{a}$ satisfies

   $\frac{x-b_1}{a_1} = \frac{x-b_2}{a_2} = \frac{x-b_3}{a_3}$

   as long as $a_1, a_2, a_3 \neq 0$. This is called the symmetric form of the line.

   $(x, y, z) = (b_1 + ta_1, b_2 + ta_2, b_3 + ta_3)$

   Solving for $t$ in each coordinate gives:

   $t = \frac{x-b_1}{a_1} = \frac{y-b_2}{a_2} = \frac{z-b_3}{a_3}$
4. Sketch the curve in $\mathbb{R}^2$ parametrised by $r(t) = (\cos(t), \sin(t))$.

5. Sketch the curve in $\mathbb{R}^2$ parametrised by $r(t) = (t \cos t, t \sin t)$ for $t \geq 0$.

6. Sketch the curve in $\mathbb{R}^3$ parametrised by $r(t) = (\cos t, \sin t, t)$.