A parameter is a third, non-coordinate value that can be used to define coordinate variables in functions.

e.g. the following function is defined in terms of a third non-coordinate variable $t$.

\[ x = 5t + 3 \]
\[ y = 2t - 4, \text{ where } 0 \leq t \leq 5 \]

To sketch this we can create a table of $x$ and $y$ values.

<table>
<thead>
<tr>
<th>$t$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x$</td>
<td>3</td>
<td>8</td>
<td>13</td>
<td>18</td>
<td>23</td>
<td>28</td>
</tr>
<tr>
<td>$y$</td>
<td>-4</td>
<td>-2</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

In table mode on the calculator:

- $f(x) = 5x + 3$
- $g(x) = 2x - 4$
- Table Range: Start:0, Step:1

Graph of the parametric equations:

- Line $x = 5t + 3$
- Line $y = 2t - 4$ for $0 \leq t \leq 5$
When a curve is defined in such a way, the equations given are called parametric equations.

When written only in terms of the coordinate variables \((x, y)\) this is called a Cartesian equation.

e.g. Write \(x = 5t + 3\) \(\{ 0 \leq t \leq 5 \}\) as a Cartesian equation.
\[ y = 2t - 4 \]

(1) Rearrange any of the two equations to say \(t = \ldots\).

\(\text{(2)}:\ \ \frac{x-3}{5} = t\)

(2) Substitute into the other equation

\[ y = 2\left(\frac{x-3}{5}\right) - 4 = \frac{2x}{5} - \frac{6}{5} - 4 \]
\[ y = \frac{2}{5}x - \frac{6}{5} - \frac{20}{5} \]
\[ y = \frac{2}{5}x - \frac{26}{5} \]

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e.g. Write \(x = \cos \theta\)
\[ y = \sin \theta \]

in Cartesian form

Note: For trig functions, the method of elimination can be different

(1) Square both equations
\[ x^2 = \cos^2 \theta \]
\[ y^2 = \sin^2 \theta \]

(2) Add equations together
\[ x^2 + y^2 = \cos^2 \theta + \sin^2 \theta \Rightarrow x^2 + y^2 = 1 \]

\(\therefore \) a circle \(c(0,0)\)
e.g. Write $x = 5 \cos t + 1 \quad 0 \leq t \leq \pi$

$y = 6 \sin t$

in cartesian form

\[
\cos t = \frac{x - 1}{5} \quad \sin t = \frac{y}{6}
\]

\[
\Rightarrow \cos^2 t = \left(\frac{x - 1}{5}\right)^2 \quad \sin^2 t = \frac{y^2}{36}
\]

\[
\Rightarrow \cos^2 t + \sin^2 t = \left(\frac{x - 1}{5}\right)^2 + \frac{y^2}{36} \quad \Rightarrow \quad 1 = \left(\frac{x - 1}{5}\right)^2 + \frac{y^2}{36}
\]