**Conic sections**

<table>
<thead>
<tr>
<th>Ellipse</th>
<th>Parabola</th>
<th>Hyperbola</th>
<th>Specials</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x^2 + y^2 = 1$</td>
<td>$y = x^2$</td>
<td>$x^2 - y^2 = 1$</td>
<td>$x^2 = y^2$</td>
</tr>
</tbody>
</table>

**Quadrics**

<table>
<thead>
<tr>
<th>Ellipsoid</th>
<th>Paraboloid</th>
<th>Hyperboloid</th>
<th>Specials</th>
</tr>
</thead>
</table>
| $x^2 + y^2 + z^2 = 1$ | $z = x^2 + y^2$
$z = x^2 - y^2$ | $x^2 + y^2 - z^2 = 1$
$x^2 + y^2 - z^2 = -1$ | $x^2 + y^2 = 1$
$x^2 + y^2 = z^2$ |

**Advise**

You will have to know the quadrics in the exam. Here are some pointers:

- There is no need to memorize the quadrics. You can derive them: look at the traces (put one of the variables to zero) to see what conic section you get.

- The name usually reveals what the surface is: elliptic paraboloids contain ellipses and parabola, hyperbolic paraboloids contain hyperbola and parabola as traces.

- The paraboloids can be written as graphs $z = f(x, y)$. This is not possible for ellipsoids or hyperboloids.

- The special surfaces are non-generic but useful and important. The cone or cylinder appear a lot in applications.

- Make sure to recognize the surfaces also if the variables are turned, scaled shifted or signs switched. $2x^2 - (y - 5)^2 - 4z^2 = -1$ for example is a one-sheeted hyperboloid.