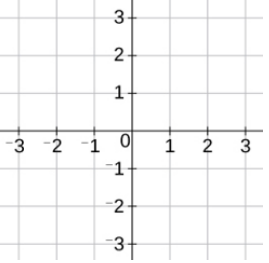
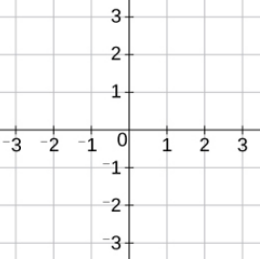
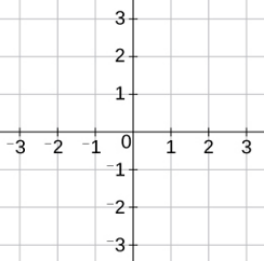


## Reflections Using Matrices

Reflections Using Matrices		
<p><b>(a)</b></p> <p>By considering the unit square, determine the matrix which describes a reflection in the <math>x</math>-axis.</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;"> <math display="block">\begin{pmatrix} 1 &amp; 0 \\ 0 &amp; -1 \end{pmatrix}</math> </div>  </div>	<p><b>(b)</b></p> <p>Describe fully the single transformation represented by the matrix <math>\begin{pmatrix} 0 &amp; 1 \\ 1 &amp; 0 \end{pmatrix}</math></p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;"> <math display="block">\begin{pmatrix} 0 &amp; 1 \\ 1 &amp; 0 \end{pmatrix}</math> </div>  </div> <p style="text-align: center; color: red;"><i>Reflection in the line <math>y = x</math></i></p>	<p><b>(c)</b></p> <p>By considering the unit square, determine the matrix which describes a reflection in the line <math>y = -x</math>.</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 20px;"> <math display="block">\begin{pmatrix} 0 &amp; -1 \\ -1 &amp; 0 \end{pmatrix}</math> </div>  </div>
<p><b>(d)</b></p> <p>The point <math>(-4, 2)</math> is mapped onto the point <math>(a, b)</math> when reflected in the <math>x</math>-axis. Using matrix algebra, find the values of <math>a</math> and <math>b</math>.</p> <div style="text-align: center; margin-top: 20px;"> <math display="block">\begin{pmatrix} 1 &amp; 0 \\ 0 &amp; -1 \end{pmatrix} \begin{pmatrix} -4 \\ 2 \end{pmatrix} = \begin{pmatrix} -4 \\ -2 \end{pmatrix}</math> <p style="color: red;"><math>a = -4, b = -2</math></p> </div>	<p><b>(e)</b></p> <p>The point <math>(c, d)</math> is mapped onto the point <math>(7, -5)</math> when reflected in the line <math>y = -x</math>. Using matrix algebra, find the coordinates <math>(c, d)</math>.</p> <div style="text-align: center; margin-top: 20px;"> <math display="block">\begin{pmatrix} 0 &amp; -1 \\ -1 &amp; 0 \end{pmatrix} \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} 7 \\ -5 \end{pmatrix}</math> <p style="color: red;"><math>c = 5, d = -7</math></p> </div>	<p><b>(f)</b></p> <p>A triangle with vertices at <math>(0, 5)</math>, <math>(4, 3)</math> and <math>(1, -1)</math> is reflected in the line <math>y = x</math>. Use matrix algebra to find the coordinates of the vertices of the reflected triangle.</p> <div style="text-align: center; margin-top: 20px;"> <math display="block">\begin{pmatrix} 0 &amp; 1 \\ 1 &amp; 0 \end{pmatrix} \begin{pmatrix} 0 \\ 5 \end{pmatrix} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} \quad \begin{pmatrix} 0 &amp; 1 \\ 1 &amp; 0 \end{pmatrix} \begin{pmatrix} 4 \\ 3 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}</math> <math display="block">\begin{pmatrix} 0 &amp; 1 \\ 1 &amp; 0 \end{pmatrix} \begin{pmatrix} 1 \\ -1 \end{pmatrix} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}</math> <p style="color: red;"><i>Vertices <math>(5, 0), (3, 4)</math> and <math>(-1, 1)</math></i></p> </div>
<p><b>(g)</b></p> <p>A triangle with vertices at <math>(0, 1)</math>, <math>(1, 0)</math> and <math>(3, 2)</math> is reflected so its vertices map to <math>(0, -1)</math>, <math>(-1, 0)</math> and <math>(-2, -3)</math>. Find the transformation matrix and the line of reflection.</p> <div style="text-align: center; margin-top: 20px;"> <math display="block">\begin{pmatrix} -1 &amp; 0 \\ 0 &amp; -1 \end{pmatrix}</math> <p style="color: red;"><i>Reflection in <math>y = -x</math></i></p> </div>	<p><b>(h)</b></p> <p>The point <math>(-2, a)</math> is mapped onto the point <math>(b, 3)</math> following a reflection in the line <math>x = 0</math>. Use matrix algebra to find the values of <math>a</math> and <math>b</math>.</p> <div style="text-align: center; margin-top: 20px;"> <math display="block">\begin{pmatrix} -1 &amp; 0 \\ 0 &amp; 1 \end{pmatrix} \begin{pmatrix} -2 \\ a \end{pmatrix} = \begin{pmatrix} b \\ 3 \end{pmatrix}</math> <p style="color: red;"><math>a = 3, b = 2</math></p> </div>	<p><b>(i)</b></p> <p>The point <math>(x, 3x - 7)</math> is mapped onto the point <math>(y + 3, y)</math> following a reflection in the line <math>y</math>-axis. Use matrix algebra to find the values of <math>x</math> and <math>y</math>.</p> <div style="text-align: center; margin-top: 20px;"> <math display="block">\begin{pmatrix} -1 &amp; 0 \\ 0 &amp; 1 \end{pmatrix} \begin{pmatrix} x \\ 3x - 7 \end{pmatrix} = \begin{pmatrix} y + 3 \\ y \end{pmatrix}</math> <p style="color: red;"><math>x = 2.5, y = 0.5</math></p> </div>