

$$\begin{pmatrix} a & b \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} a & b \end{pmatrix} \begin{pmatrix} \textcircled{x} \\ \textcircled{y} \end{pmatrix} = ax + by$$

The diagram illustrates the dot product of two vectors. On the left, the row vector  $\begin{pmatrix} a & b \end{pmatrix}$  is multiplied by the column vector  $\begin{pmatrix} x \\ y \end{pmatrix}$ . The result is shown as the dot product of the row vector  $\begin{pmatrix} a & b \end{pmatrix}$  with the column vector  $\begin{pmatrix} \textcircled{x} \\ \textcircled{y} \end{pmatrix}$ , where the elements  $x$  and  $y$  are highlighted with green circles. Red arrows indicate the multiplication of  $a$  by  $x$  and  $b$  by  $y$ . The final result is the scalar expression  $ax + by$ .