A8(b)

By definition, the squared Euclidean norm of Ax is:

$$\|Ax\|_2^2 = (Ax)^\top (Ax).$$

Using the associative property of matrix multiplication:

$$(Ax)^\top (Ax) = x^\top (A^\top A)x.$$

Since A is orthonormal, it satisfies $A^\top A = I$, where I is the identity matrix:

$$x^\top (A^\top A)x = x^\top Ix = x^\top x.$$

The expression $x^\top x$ is exactly the squared Euclidean norm of x, so:

$$\|Ax\|_2^2 = \|x\|_2^2.$$

Thus, we have shown that:

$$\|Ax\|_2^2 = \|x\|_2^2.$$

■