1) $AB = (5\times5)\cdot(5\times5) = 3\times5$

OK

$DA = (5\times5)\cdot(3\times5)$

DNE

$BC = (6\times10)\cdot(2\times10)$

DNE

$BC^T = (6\times10)\cdot(10\times2) = 6\times2$

$x^TB = (1\times6)(6\times10) = 1\times10$ row

$By = (6\times10)(10\times1) = 6\times1$ col

$ADz = (3\times5)(5\times5)(5\times1) = 3\times1$ col

$x^TBy = (1\times6)\cdot(6\times10)\cdot(10\times1) = 1\times1$ Scalar

2) $x - y = \begin{pmatrix}1\\2\end{pmatrix} - \begin{pmatrix}3\\-1\end{pmatrix} = \begin{pmatrix}1-3\\2+1\end{pmatrix} = \boxed{\begin{pmatrix}-2\\3\end{pmatrix}}$

$x + 2y = \begin{pmatrix}1\\2\end{pmatrix} + 2\begin{pmatrix}3\\-1\end{pmatrix} = \begin{pmatrix}1\\2\end{pmatrix} + \begin{pmatrix}6\\-2\end{pmatrix} = \boxed{\begin{pmatrix}7\\0\end{pmatrix}}$

$x^Ty = (1\times2)(2\times1) = 1\times1$ Scalar

$\begin{pmatrix}1 & 2\end{pmatrix}\begin{pmatrix}3\\-1\end{pmatrix} = 1(3) + 2(-1) = \boxed{1}$

$y^Tx = (1\times2)(2\times1) = $ Scalar

$\begin{pmatrix}3 & -1\end{pmatrix}\begin{pmatrix}1\\2\end{pmatrix} = 3(1) + 1(-2) = \boxed{1}$

3) $A^T = \begin{pmatrix} -3 & 0 & 1 \\ 1 & 4 & -2 \end{pmatrix}$

$Ax = (3\times 2)(2\times 1) = 3\times 1$ col vector

OK

$= \begin{pmatrix} -3 & 1 \\ 0 & 4 \\ 1 & -2 \end{pmatrix}\begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} -3(2)+(1)(1) \\ 0(2)+4(1) \\ 1(2)+(-2)(1) \end{pmatrix} = \boxed{\begin{pmatrix} -5 \\ 4 \\ 0 \end{pmatrix}}$

$A^Tx = (2\times 3)(2\times 1)$

DNE

$y^TA = (1\times 3)(3\times 2) = 1\times 2$ row vector

OK

$(1 \quad -1 \quad -2)\left(\begin{array}{c|c} -3 & 1 \\ 0 & 4 \\ 1 & -2 \end{array}\right) = \boxed{(-5 \quad 1)}$

$(1 \quad -1 \quad -2)\begin{pmatrix} -3 \\ 0 \\ 1 \end{pmatrix} = 1(-3)+(-1)(0)+(-2)(1) = -5$

$(1 \quad -1 \quad -2)\begin{pmatrix} 1 \\ 4 \\ -2 \end{pmatrix} = 1(1)+(-1)(4)+(-2)(-2) = 0$

$y^Tx = (1\times 2)(2\times 1) =$ scalar

$(3 \quad -1)\begin{pmatrix} 1 \\ 2 \end{pmatrix} = 3(1)+(-1)(2) = \boxed{1}$