(i) d is an anti-derivation of degree 1;

L_V is a derivation of degree 0;

$V\rfloor$ is an anti-derivation of degree - 1;

(ii) Either argue by induction or computation.

Induction: The step from p to $p+1$ can be done by noticing that it is enough to consider the effect on a single $(p+1)$-form, and this is a product of a 1-form and a p-form. For both of these it is true that $D_1 = D_2$.

Computation: You can write the effect of D on a p-form as the sum of p terms where in each one it acts on a 1-form. On these, it is true that $D_1 = D_2$.

(iii) Compute $D(\alpha \wedge \beta)$, where α is a p-form. When you meet terms like $D_1(D_2\alpha \wedge \beta)$ remember that $D_2\alpha$ is a (k_2+p)-form. Because the k's are odd you will find that the terms you don't want occur in cancelling pairs.

(iv) You can show that D_V is a derivative by calculation. But the better answer is to observe that (by (i)) $V\rfloor$ and d can be taken as D_1 and D_2 as in (iii).

To show that $D_V = L_V$ it is now enough to show that they agree on functions (trivial) and on 1-forms. This is not entirely trivial, but any 1-form is a sum of expressions like fdw, so it is enough to check it on them, and that is a simple calculation of functions. On 1-forms, it is enough, by linearity, to work with fdx, where $x = x^1$.

$$D_V(fdx) = \underline{V}\rfloor d(fdx) + d(\underline{V}\rfloor fdx) = \underline{V}\rfloor df \wedge dx + d\left(f\langle V, dx\rangle\right) = \underline{V}\rfloor df \wedge dx + V_1 df + f dV_1$$

where $V = \sum_i V_i dx^i$. So

$$D_v fdx(W) = df \wedge dx(V,W) + V_1\langle df, W\rangle + f\langle dV_1, W\rangle =$$
$$\langle df, V\rangle\langle dx, W\rangle - \langle df, W\rangle\langle dx, V\rangle + V_1\langle df, W\rangle + f\langle dV_1, W\rangle =$$
$$\langle df, V\rangle\langle dx, W\rangle + f\langle dV_1, W\rangle$$

On the other side, $L_V(fdx)W = L_V f\langle dx, W\rangle + f(L_V dx)W =$

$$Vf\langle dx, W\rangle + f\left(V\langle dx, W\rangle - dx([V,W])\right).$$

So it is enough to show that $\langle dV_1, W\rangle = \left(V\langle dx, W\rangle - dx([V,W])\right)$ which it does (write V and W in components).