VAGC_div_Exercise5.9a.wxm

A short development document for Geometric Algebra with wxMaxima
just to test some calculus functions within the GAwxM environment,
contains...
Initialization
Loading of functions (intrinsic and GA specific)
Pseudoscalar definition (specifies the space dimension) and
Calculation of the inverse pseudoscalar used to generate the dual of a multivector
Enumeration of the standard basis for the specified dimension

Exercise 5.9a, VAGC page 60 for the multivector divergence

Initialization

```
(%i36)  ext:["wxm"]$
        file_type_maxima:append(ext,file_type_maxima)$
        batchload("initialize_fns")$
```

the pseudoscalar and its inverse
the lowest useable dimension pseudoscalar should be {e1,e2} i.e. Plen = 2
e.g. for four dimensions edit Pseudos:{e1,e2,e3}$ to Pseudos:{e1,e2,e3,e4}$

```
(%i1)   Pseudos:{e1,e2,e3}$
        Pvar:listofvars(Pseudos)$
        Plen:length(Pvar)$
        I:Pseudos$
        ni:(Plen-1)*Plen/2$
        Ii:(-1)^ni*I$
        kill(ni)$
        ldisplay(Pvar)$
```

$(\%t8) \ Pvar = [e1, e2, e3]$

```
(%i9)   batchload("initialize_lsts")$
```

$(\%t9) \ lstblds = [[\{e1\}, \{e2\}, \{e3\}], [\{e1, e2\}, \{e1, e3\}, \{e2, e3\}], [\{e1, e2, e3\}]]$
$(\%t10) \ allblds = [\{e1\}, \{e2\}, \{e3\}, \{e1, e2\}, \{e1, e3\}, \{e2, e3\}, \{e1, e2, e3\}]$
$(\%t11) \ invblds = [\{e1\}, \{e2\}, \{e3\}, -\{e1, e2\}, -\{e1, e3\}, -\{e2, e3\}, -\{e1, e2, e3\}]$

end of Initialization

set derivabbrev:false$

```
(%i12)  derivabbrev:false$
```

Exercise 5.9a
VAGC page 60

```
(%i13)  Clst:[c1,c2,c3,0,0,0,0]$
```

```
(%i14)  eJ:allblds$
```

form the coordinate vector, c from the list of coefficients

```
(%i15)  lenlst:2^Plen-1$
        c:0$
        for j:1 thru lenlst do
        block(c:c+Clst[j]*eJ[j])$
```

form the function, F(x)=x in Exercise 5.9a

```
(%i18)  F(c):=c$
        F:ev(F(c))$
        ldisplay(c,F)$
```

$(\%t20) \ c = c3*\{e3\} + c2*\{e2\} + c1*\{e1\}$
$(\%t21) \ F = c3*\{e3\} + c2*\{e2\} + c1*\{e1\}$

```
(%i22)  Fstr:"F"$
        divF:mvdiv(Fstr,Clst)$
        ldisplay(divF)$
```

$(\%t24) \ divF = \{e3\} \&. \left(\frac{d}{d*c3}*F\right) + \{e2\} \&. \left(\frac{d}{d*c2}*F\right) + \{e1\} \&. \left(\frac{d}{d*c1}*F\right)$

```
(%i25)  lhs:ev(divF,diff);
```

$(\%o25)/R/ \ 3$

confirm that the evaluated divF is the same as the value given in the Exercise

```
(%i26)  n:Plen$
        rhs:n$
        is(equal(lhs,rhs));
```

$(\%o28) \ true$