LAGA_chapter06.02.wxm (LAGA examples)

A test document for Geometric Algebra with wxMaxima
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

Blades, Norms and Reversion in the geometric algebra, G4, i.e. using Plen=4

Reference book...Linear and Geometric Algebra (LAGA)
by Alan Macdonald

Initialization

```
(%i28) 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,e4}$
      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, e4]

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

(%t9) lstblds = [[{e1}, {e2}, {e3}, {e4}], [{e1, e2}, {e1, e3}, {e1, e4}, {e2, e3}, {e2, e4}, {e3, e4}], [{e1, e2, e3}, {e1, e2, e4}, {e1, e3, e4}, {e2, e3, e4}], [{e1, e2, e3, e4}]]
(%t10) allblds = [{e1}, {e2}, {e3}, {e4}, {e1, e2}, {e1, e3}, {e1, e4}, {e2, e3}, {e2, e4}, {e3, e4}, {e1, e2, e3}, {e1, e2, e4}, {e1, e3, e4}, {e2, e3, e4}, {e1, e2, e3, e4}]
(%t11) invblds = [{e1}, {e2}, {e3}, {e4}, -{e1, e2}, -{e1, e3}, -{e1, e4}, -{e2, e3}, -{e2, e4}, -{e3, e4}, -{e1, e2, e3}, -{e1, e2, e4}, -{e1, e3, e4}, -{e2, e3, e4}, {e1, e2, e3, e4}]

end of Initialization

G4

Exercise 6.6
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Show that if B is a 4-blade, then it has an inverse of the given form, using
the blade (tilda) product

```
(%i12) b1:s1*{e1}$
       b2:s2*{e2}$
       b3:s3*{e3}$
       b4:s4*{e4}$
       B:b1~*b2~*b3~*b4$
       ldisplay(B)$
```

(%t17) B = {e1, e2, e3, e4} * s1 * s2 * s3 * s4

```
(%i18) Binv:(b4~*b3~*b2~*b1)/normod(B)^2$
       ldisplay(Binv)$
```

(%t19) Binv = $\frac{\{e1,e2,e3,e4\}}{s1*s2*s3*s4}$

```
(%i20) BBinv:B~*Binv$
       ldisplay(BBinv)$
```

(%t21) BBinv = 1

Exercise 6.7
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Show that if B is a 4-blade, then it has an inverse of the given form

```
(%i22) Bm1:(-1)^(4*(4-1)/2)*B/normod(B)^2$
       ldisplay(Bm1)$
```

(%t23) Bm1 = $\frac{\{e1,e2,e3,e4\}}{s1*s2*s3*s4}$

```
(%i24) BBm1:B~*Bm1$
       ldisplay(BBm1)$
```

(%t25) BBm1 = 1

Problem 6.2.5
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6.2.5a e.g. for a 4-blade, A using the blade (tilda) outer product

```
(%i26) a1:s1*{e1}$
       a2:s2*{e2}$
       a3:s3*{e3}$
       a4:s4*{e4}$
       A:a1~^a2~^a3~^a4$
       Arev:a4~^a3~^a2~^a1$
       ldisplay(A,Arev)$
```

(%t32) A = {e1, e2, e3, e4} * s1 * s2 * s3 * s4
(%t33) Arev = {e1, e2, e3, e4} * s1 * s2 * s3 * s4

6.2.5b e.g. for a 3-blade, A3, using the multivector reverse function, mvrev()

```
(%i34) A3:a1~*a2~*a4$
       A3rev:mvrev(A3)$
       A3revrev:mvrev(A3rev)$
       ldisplay(A3,A3rev,A3revrev)$
```

(%t37) A3 = {e1, e2, e4} * s1 * s2 * s4
(%t38)/R/ A3rev = -{e1, e2, e4} * s1 * s2 * s4
(%t39)/R/ A3revrev = {e1, e2, e4} * s1 * s2 * s4