

1. Write a procedure to evaluate radial Coulomb wave functions.

```

hyp := proc(a,b,x)
local f,k,top,bot;
top := 1;
bot := 1;
f := 1;
if a > 0 then 0
elif a = 0 then 1
else
for k from 1 to -a do
top := top*(a+k-1);
bot := bot*(b+k-1);
f := f + (top*x**k)/(bot*k!);
od;
fi;
end;

P := proc(Z,n,l,r)
if n > 1 then
sqrt(Z*(n+1)!/(n-1-1)!/(n*(2*1+1)!)) *
(2*Z*r/n)**(l+1) * exp(-Z*r/n) * hyp(-n+1+1,2*1+2,2*Z*r/n);
else 0
fi;
end;

```

2. Evaluate norm and scalar product.

```

assume(Z>0);
p[3,1] := P(Z,3,1,r);
p[2,1] := P(Z,2,1,r);
norm := int(p[3,1]*p[3,1],r=0..infinity);
scpr := int(p[3,1]*p[2,1],r=0..infinity);

```

3. Plot all  $n=5$  wave functions.

```

plot({P(1,5,0,r),P(1,5,1,r),P(1,5,2,r),P(1,5,3,r),
P(1,5,4,r)},r=0..90);

```

