

## □ 1 Expansions

```
(%i1) kill(all);
(%o0) done
```

```
(%i1) taylor((1+x)^-3,x,0,3);
(%o1)/T/ 1-3 x+6 x^2-10 x^3+...
```

```
(%i2) p: powerseries((1+x)^-3,x,1);
(%o2) 
$$\sum_{i1=0}^{\infty} (i1+1)(i1+2) 2^{-i1-4} (-1)^{i1} (x-1)^{i1}$$

```

```
(%i3) expandwrt_denom: true;
(%o3) true
```

```
(%i4) expandwrt((1+x)^(-3),x);
(%o4) 
$$\frac{1}{x^3+3 x^2+3 x+1}$$

```

```
(%i5) taylor((1+x)^(-5/2),x,0,3);
(%o5)/T/ 1 - \frac{5 x}{2} + \frac{35 x^2}{8} - \frac{105 x^3}{16} + ...
```

```
(%i6) beta_expand: true;
(%o6) true
```

```
(%i7) p: powerseries((1+x)^(-3/2),x,0);
WARNING: DEFUN/DEFMACRO: redefining function SIMP-UNIT-STEP in
C:\maxima-5.38.1\share\maxima\5.38.1_5_gdf93b7b_dirty\share\orthopo
was defined in top-level
WARNING: DEFUN/DEFMACRO: redefining function SIMP-POCHHAMMER in
C:\maxima-5.38.1\share\maxima\5.38.1_5_gdf93b7b_dirty\share\orthopo
was defined in top-level
(%o7) 
$$\left( \sum_{i2=1}^{\infty} \frac{x^{i2}}{\text{beta}\left(-i2-\frac{1}{2}, i2\right) i2} \right) + 1$$

```

## □ 2 Dipole field calculation

```
(%i8) kill(all);
(%o0) done
```

```
(%i1) grad(psi) := [diff(psi,X), diff(psi,Y), diff(psi,Z)];
(%o1) grad( $\Psi$ ):= [ \frac{d}{d X} \Psi, \frac{d}{d Y} \Psi, \frac{d}{d Z} \Psi ]
```

```

(%i3)  r: [X,Y,Z];
        dr: [dX,dY,dZ];
(%o2)  [X, Y, Z]
(%o3)  [dX, dY, dZ]

(%i4)  r1: sqrt(r.r);
(%o4)   $\sqrt{Z^2+Y^2+X^2}$ 

(%i5)  p: [p_X,p_Y,p_Z];
(%o5)  [p_X, p_Y, p_Z]

(%i6)  phi_0: 1/(4*pi*epsilon_0*r1^3)*r.p;
(%o6)  
$$\frac{Z p_Z + Y p_Y + X p_X}{4 \pi (Z^2 + Y^2 + X^2)^{3/2} \epsilon_0}$$


(%i7)  E_0: -grad(phi_0);
(%o7)  
$$\left[ \frac{3 X (Z p_Z + Y p_Y + X p_X)}{4 \pi (Z^2 + Y^2 + X^2)^{5/2} \epsilon_0} - \frac{p_X}{4 \pi (Z^2 + Y^2 + X^2)^{3/2} \epsilon_0}, \frac{3 Y (Z p_Z + Y p_Y + X p_X)}{4 \pi (Z^2 + Y^2 + X^2)^{5/2} \epsilon_0} - \frac{p_Y}{4 \pi (Z^2 + Y^2 + X^2)^{3/2} \epsilon_0}, \frac{3 Z (Z p_Z + Y p_Y + X p_X)}{4 \pi (Z^2 + Y^2 + X^2)^{5/2} \epsilon_0} - \frac{p_Z}{4 \pi (Z^2 + Y^2 + X^2)^{3/2} \epsilon_0} \right]$$


□ 3 Ensemble average

□ 3.1 393 (5), Eq. (5)

(%i8)  (r+dr)*(2*r.dr+dr.dr);
(%o8)  
$$\left[ (dX+X) \left( dZ^2 + 2 (Z dZ + Y dY + X dX) + dY^2 + dX^2 \right), (dY+Y) \left( dZ^2 + 2 (Z dZ + Y dY + X dX) + dY^2 + dX^2 \right), (dZ+Z) \left( dZ^2 + 2 (Z dZ + Y dY + X dX) + dY^2 + dX^2 \right) \right]$$


(%i9)  ratsimp(first(%));
(%o9)  
$$(dX+X) dZ^2 + (2 Z dX + 2 X Z) dZ + (dX+X) dY^2 + (2 Y dX + 2 X Y) dY + dX^3 + 3 X dX^2 + 2 X^2 dX$$


(%i10) expand(%);
(%o10) 
$$dX dZ^2 + X dZ^2 + 2 Z dX dZ + 2 X Z dZ + dX dY^2 + X dY^2 + 2 Y dX dY + 2 X Y dY + dX^3 + 3 X dX^2 + 2 X^2 dX$$


```