```
In[1]:= $Assumptions = {Element[r3, Reals], r3 > 0, Element[s3, Reals], s3 > 0}
Out[1]= {r3 ∈ ℝ, r3 > 0, s3 ∈ ℝ, s3 > 0}

In[2]:= r = {r1, r2, r3[z]};

In[3]:= r$image = {r1, r2, -r3[z]};

In[4]:= s = {s1, s2, s3[z]};

In[5]:= G0 =
         1 / Sqrt[(r - s) . (r - s)]  - 1 / Sqrt[(r$image - s) . (r$image - s)] // FullSimplify
```

Out[5]= $$\frac{1}{\sqrt{(r1-s1)^2+(r2-s2)^2+(r3[z]-s3[z])^2}}-\frac{1}{\sqrt{(r1-s1)^2+(r2-s2)^2+(r3[z]+s3[z])^2}}$$

```
In[6]:= r3 /: D[r3[z], z] = 1;
        s3 /: D[s3[z], z] = 1;

In[12]:= G1 = D[G0, z] /. {r3′[z] → 1, s3′[z] → 1}
```

Out[12]= $$\frac{2\,(r3[z]+s3[z])}{\left((r1-s1)^2+(r2-s2)^2+(r3[z]+s3[z])^2\right)^{3/2}}$$

```
In[14]:= G2 = D[G0, {z, 2}] /. {r3′[z] → 1, s3′[z] → 1, r3″[z] → 0, s3″[z] → 0}
```

Out[14]= $$-\frac{12\,(r3[z]+s3[z])^2}{\left((r1-s1)^2+(r2-s2)^2+(r3[z]+s3[z])^2\right)^{5/2}}+\frac{4}{\left((r1-s1)^2+(r2-s2)^2+(r3[z]+s3[z])^2\right)^{3/2}}$$

```
In[33]:= $Assumptions = {Element[z1, Reals], z1 > 0, Element[z2, Reals],
           z2 > 0, Element[x, Reals], x > 0, Element[y, Reals], y > 0}
Out[33]= {z1 ∈ ℝ, z1 > 0, z2 ∈ ℝ, z2 > 0, x ∈ ℝ, x > 0, y ∈ ℝ, y > 0}
```

In[38]:= $$-\mathrm{Integrate}\left[\mathrm{BesselJ}\left[0, k\,\sqrt{x^2+y^2}\right]\ \mathrm{Exp}[-k\,(z1+z2)],\ \{k, 0, \infty\}\right]$$

Out[38]= $$-\frac{1}{\sqrt{x^2+y^2+(z1+z2)^2}}$$

In[41]:= $$\mathrm{Integrate}\left[k\ \mathrm{BesselJ}\left[0, k\,\sqrt{x^2+y^2}\right]\ \mathrm{Exp}[-k\,(z1+z2)],\ \{k, 0, \infty\}\right]$$

Out[41]= $$\frac{z1+z2}{\left(x^2+y^2+(z1+z2)^2\right)^{3/2}}$$

In[42]:= $$\mathrm{Integrate}\left[k^2\ \mathrm{BesselJ}\left[0, k\,\sqrt{x^2+y^2}\right]\ \mathrm{Exp}[-k\,(z1+z2)],\ \{k, 0, \infty\}\right]$$

Out[42]= $$\frac{-x^2-y^2+2\,(z1+z2)^2}{\left(x^2+y^2+(z1+z2)^2\right)^{5/2}}$$