Three points in meiosis

We seek here to determine the joint probabilities for the haplotype on a meiotic product from the cross AAA x BBB. We assume that the two intervals have common recombination fraction, r, and let c denote the three-point coincidence---that is, Pr(double recombinant) / r^2.

```
Clear[r, r13, c, pAAA, pAAB, pABA];
r13 = 2 r (1 - c r);
```

```
eqns = {pAAA + pAAB == (1 - r) / 2, pAAA + pABA == (1 - r13) / 2,
   pAAB + pABA == r / 2};
```

```
Solve[eqns, {pAAA, pAAB, pABA}];
```

```
p = {pAAA, pAAB, pABA} /. %[[1]]
```

$$\left\{-\frac{1}{2}\,(-1+2\,r-c\,r^2),\ -\frac{1}{2}\,(-r+c\,r^2),\ \frac{c\,r^2}{2}\right\}$$

We should have that p[1] + 2 p[2] + p[3] = 1/2.

```
Simplify[p[[1]] + 2 p[[2]] + p[[3]]]
```

$$\frac{1}{2}$$