```mathematica
zeroCoupon[interest_,
   timeToMaturity_] =
  e^-interest timeToMaturity
```

$$e^{-\text{interest}\ \text{timeToMaturity}}$$

```mathematica
durZeroCoupon[interest_,
   timeToMaturity_] =
  D[zeroCoupon[interest,
    timeToMaturity], interest]
```

$$-e^{-\text{interest}\ \text{timeToMaturity}}\ \text{timeToMaturity}$$

```mathematica
convZeroCoupon[interest_,
   timeToMaturity_] =
  D[durZeroCoupon[interest,
    timeToMaturity], interest]
```

$$e^{-\text{interest}\ \text{timeToMaturity}}\ \text{timeToMaturity}^2$$

```
matchingMix =
  Solve[
    {a zeroCoupon[r, s] +
        b zeroCoupon[r, l] ==
      zeroCoupon[r, m],
     a durZeroCoupon[r, s] +
        b durZeroCoupon[r, l] ==
      durZeroCoupon[r, m]},
    {a, b}]
```

$$\left\{\left\{a \to -\frac{\mathbb{e}^{-m\,r+r\,s}\,(l-m)}{-l+s}\,,\right.\right.$$
$$\left.\left. b \to -\frac{\mathbb{e}^{l\,r-m\,r}\,(-m+s)}{l-s}\right\}\right\}$$

```
kortVekt = a /. matchingMix[[1]]
langVekt = b /. matchingMix[[1]]
```

$$-\frac{\mathbb{e}^{-m\,r+r\,s}\,(l-m)}{-l+s}$$

$$-\frac{\mathbb{e}^{l\,r-m\,r}\,(-m+s)}{l-s}$$

```
Simplify[
  kortVekt convZeroCoupon[r, s] +
    langVekt convZeroCoupon[r,
      l] - convZeroCoupon[r, m]]
```

$$\mathbb{e}^{-m\,r}\ (l-m)\ (m-s)$$

```
s = 5
m = 10
l = 15
r = Log[1.03]
kortVekt
langVekt
```

5

10

15

0.0295588

0.431304

0.579637

```
Plot[
  kortVekt * zeroCoupon[rVar,
    s] + langVekt *
    zeroCoupon[rVar, l] -
   zeroCoupon[rVar, m],
  {rVar, Log[1.01], Log[1.05]}];
```