Using Chauvenet's notations:

- h': apparent height of the center of the Moon
- H': apparent height of the center of the Sun
- d': apparent distance between the centers of the Moon and the Sun

and adapting these notations in the following way to be used here:
- [delta]h -> dh
- [delta]H -> dH
- [delta]d -> dd

Assuming dH = 0, the equation (g) on page 404 become:

```
dd*sin(d' + dd/2) = dh*sin(h' + dh/2)*cos d'/cos h' - dh*sin(2*H')/2/cos h'/cos H'
sin(2*H') = 2*sin H'*cos H' =>
dd*sin(d' + dd/2) = dh*sin(h' + dh/2)*cos d'/cos h' - dh*sin H'/cos h'
```

The angles dd and dh are small. Let's put S = sin 1' = 0.00029 if they are expressed in minutes (S = sin 1" if they are expressed in seconds). The equation can be written:

```
dd*(sin d' + S*dd*cos d'/2) = dh*(sin h' + S*dh*cos h'/2)*cos d'/cos h' - dh*sin H'/cos h'
```

By developing and then reorganizing:

```
dd*sin d' + S*dd²*cos d'/2 = dh*sin h'*cos d'/cos h' + S*dh²*cos d'/2 - dh*sin H'/cos h'
dd*sin d' + S*dd²*cos d'/2 = dh*(sin h'*cos d' - sin H')/cos h' + S*dh²*cos d'/2
```

```
dh = HP*cos h' =>
dd*sin d' + S*dd²*cos d'/2 = HP*(sin h'*cos d' - sin H') + S*HP²*(cos h')²*cos d'/2
```

Dividing by sin d':

```
dd + S*dd²*cot d'/2 = HP*(sin h'*cos d' - sin H')/sin d' + S*HP²*(cos h')²*cot d'/2
```

By setting y = (sin h'*cos d' - sin H')/sin d':

```
dd + S*dd²*cot d'/2 = HP*y + S*HP²*(cos h')²*cot d'/2
```

To the first order we have (see page 408): dd = HP*y => dd² = HP²*y² =>

```
dd = HP*y + S*HP²*(cos h')²*cot d'/2 - S*HP²*y²*cot d'/2
```

By factoring:

```
dd = HP*y + S*HP²*[(cos h')² - y²]*cot d'/2
dd = HP*{y + S*HP*[(cos h')² - y²]*cot d'/2}
```

Finally, since HP and dd are expressed in minutes:

```
dd = HP*{y + 0.000145*HP*[(cos h')² - y²]*cot d'}
```