p3LaguerrePlots

March 26, 2021

```python
[1]: # P3 plotting
     import numpy as np
     import matplotlib.pyplot as plt
     %matplotlib inline
     from numpy.polynomial.polynomial import Polynomial
```

```python
[2]: # generate polynomials
     coef0 = [1]
     coef1 = [-1, 1]
     coef2 = [2, -4, 1]
     coef3 = [-6, 18, -9, 1]
     L0 = Polynomial(coef0)
     L1 = Polynomial(coef1)
     L2 = Polynomial(coef2)
     L3 = Polynomial(coef3)
```

```python
[5]: # find zeros
     L0.roots() # has no zeros
```

```
[5]: array([], dtype=float64)
```

```python
[6]: L1.roots()
```

```
[6]: array([1.])
```
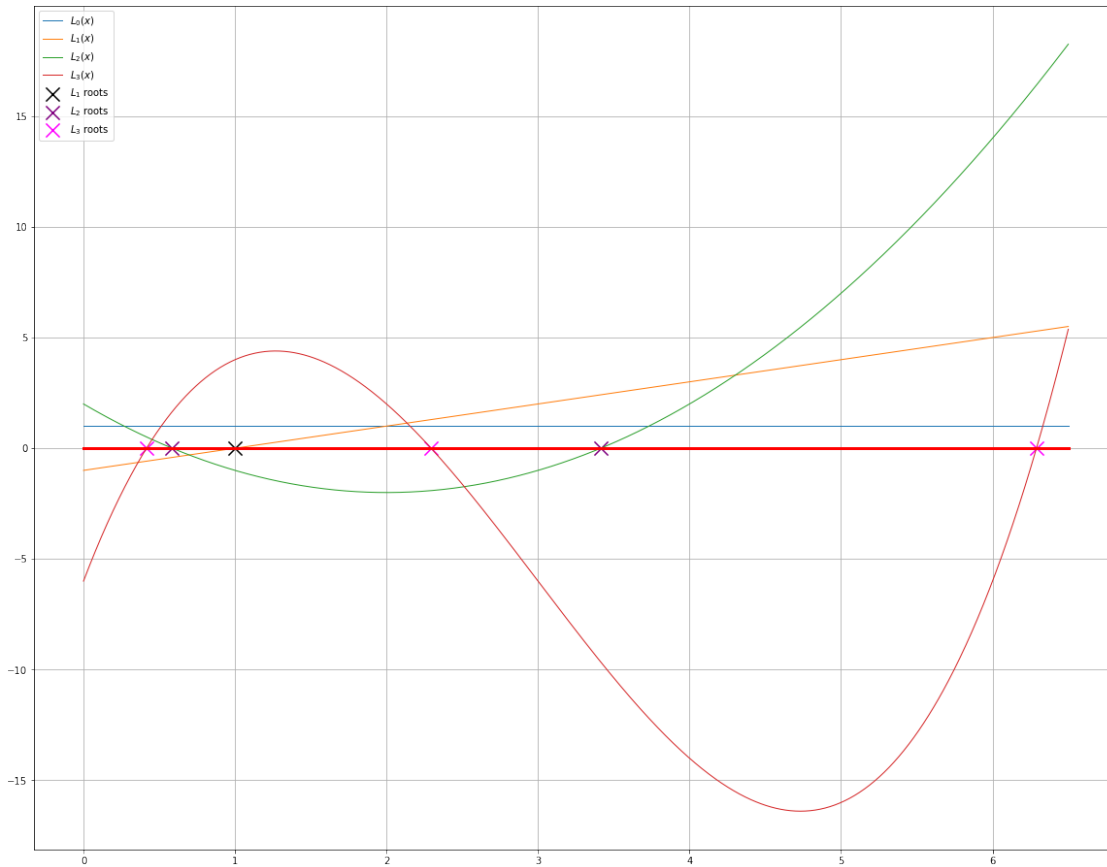
```python
[7]: L2.roots()
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[7]: array([0.58578644, 3.41421356])
```

```python
[8]: L3.roots()
```

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[8]: array([0.41577456, 2.29428036, 6.28994508])
```

```python
[25]: # save roots
      r1 = L1.roots(); r2 = L2.roots(); r3 = L3.roots();
```

```
[47]:  # plot
       X = np.linspace(0, 6.5, 1001)
       plt.figure(1, figsize=(20,16));
       plt.plot(X, L0(X), lw=1, label="$L_0(x)$");
       plt.scatter(r1, [0], marker="x", s=200, color='black', label="$L_1$ roots");
       plt.plot(X, L1(X), lw=1, label="$L_1(x)$");
       plt.scatter(r2, [0]*len(r2), marker="x", s=200, color='purple', label="$L_2$⌴
        ↪roots");
       plt.plot(X, L2(X), lw=1, label="$L_2(x)$");
       plt.scatter(r3, [0]*len(r3), marker="x", s=200, color='magenta', label="$L_3$⌴
        ↪roots");
       plt.plot(X, L3(X), lw=1, label="$L_3(x)$");
       plt.plot(X, [0]*len(X), lw=3, color='red');
       plt.grid(); plt.legend();
```


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