

Newton's Method

$$f(x) = x^3 + x^2 + x - 1$$

$$f'(x) = 3x^2 + 2x + 1$$

Start with $x_0 = 1$

L₀: Pt: $f(1) = 2 \Rightarrow (1, 2)$ Slope: $f'(1) = 6$	$y - 2 = 6(x - 1)$ $y = 2 + 6(x - 1)$	$y = f(1) + f'(1)(x - 1)$	
Intersect x-axis: Set $y=0$ and solve for x	$0 = 2 + 6(x - 1)$ $6(x - 1) = -2$ $x - 1 = -\frac{2}{6}$ $x = 1 - \frac{2}{6}$ $x = \frac{2}{3}$	$0 = f(1) + f'(1)(x - 1)$ $f'(1)(x - 1) = -f(1)$ $x - 1 = -\frac{f(1)}{f'(1)}$ $x = 1 - \frac{f(1)}{f'(1)}$ $x = 1 - \frac{2}{6}$ $x = \frac{2}{3}$	
Let x_1 be this new value	$x_1 = \frac{2}{3}$	$x_1 = \frac{2}{3}$	
Repeat Process			
L₁: Pt: $f(2/3) = 11/27 \Rightarrow (2/3, 11/27)$ Slope: $f'(2/3) = 11/3$	$y - \frac{11}{27} = \frac{11}{3}\left(x - \frac{2}{3}\right)$ $y = \frac{11}{27} + \frac{11}{3}\left(x - \frac{2}{3}\right)$		
Intersect x-axis: Set $y=0$ and solve for x	$0 = \frac{11}{27} + \frac{11}{3}\left(x - \frac{2}{3}\right)$ $\frac{11}{3}\left(x - \frac{2}{3}\right) = -\frac{11}{27}$ $x - \frac{2}{3} = -\frac{11/27}{11/3}$ $x = \frac{2}{3} - \frac{11/27}{11/3}$ $x = \frac{5}{9}$		
Let x_2 be this new value	$x_2 = \frac{5}{9}$		

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Repeat Process			
L₂: Pt: (5/9,f(5/9)) Slope: f'(5/9)			
Intersect x-axis: Set y=0 and solve for x			
Let x ₃ be this new value			