

Quiz # 6

Name: \_\_\_\_\_

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Math 124: Spring 2022

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## Gradient-Based Optimisation (10 Points)

Consider the problem of minimising the function  $f(x) = x^2(x - 1)(x + 2)$  using gradient descent.

### Problem 1 - 3 Points

Given a guess of the minimum of  $f(x)$  at iteration  $k$  denoted  $x_k$ , state the formula for the next guess  $x_{k+1}$  using gradient descent with a fixed rate of  $\alpha$ . (No need to differentiate the function explicitly you can just leave it as  $f'(x)$ )

### Problem 2 - 4 Points

Sketch the function.

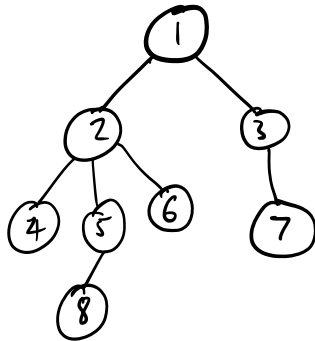
### Problem 3 - 4 Points

Let  $x_0 = 0.5, \alpha = 0.1$ . Do you expect gradient descent to converge to the absolute minimum of the function? Include a diagram in your explanation.

## Short Answer Questions (10 Points)

### Problem 3 - 3 Points

State a possible ordering for depth-first search on the following graph:



### Problem 6 - 2 Points

Write some mathematica code to plot the function  $f(x) = x^2(x - 1)(x + 2)$  between  $[-2, 2]$ .

### Problem 7 - 2 Points

Write some mathematica code to plot the derivative of the function  $f(x) = x^2(x - 1)(x + 2)$  between  $[-2, 2]$ .

### Problem 8 - 3 Points

What is your favourite and least favourite topics of this course? No wrong answers!