Question of the Day

If you had to swap your legs with the legs of any other animal, which animal would you choose?

On the Docket

Check in.
Concept Review – Approximation and Optimization
Function Shapes
Harmonic Constiuents?
Chain rule practice.

Approximation

First Order Approximation

$$f(x + dx) \approx f(x) + f'(x) \cdot dx$$

Second Order Approximation

$$f(x + dx) \approx f(x) + f'(x) \cdot dx + \frac{1}{2} f''(x) \cdot (dx)^2$$

- What is f?
- What is $\approx$?
- What is x?
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To approximate $\sqrt[3]{127}$

- What is f?
- What is f'?
- What is f''?
- What is x?
- What is dx?

Optimization

Goal and Constraint

An optimization problem consists of a goal and a restriction

$$g(x, y) \qquad\qquad r(x, y) = C$$

Using the restriction, rewrite the goal in terms of one variable.
With the derivative, optimize the goal (e.g. maximize, minimize).

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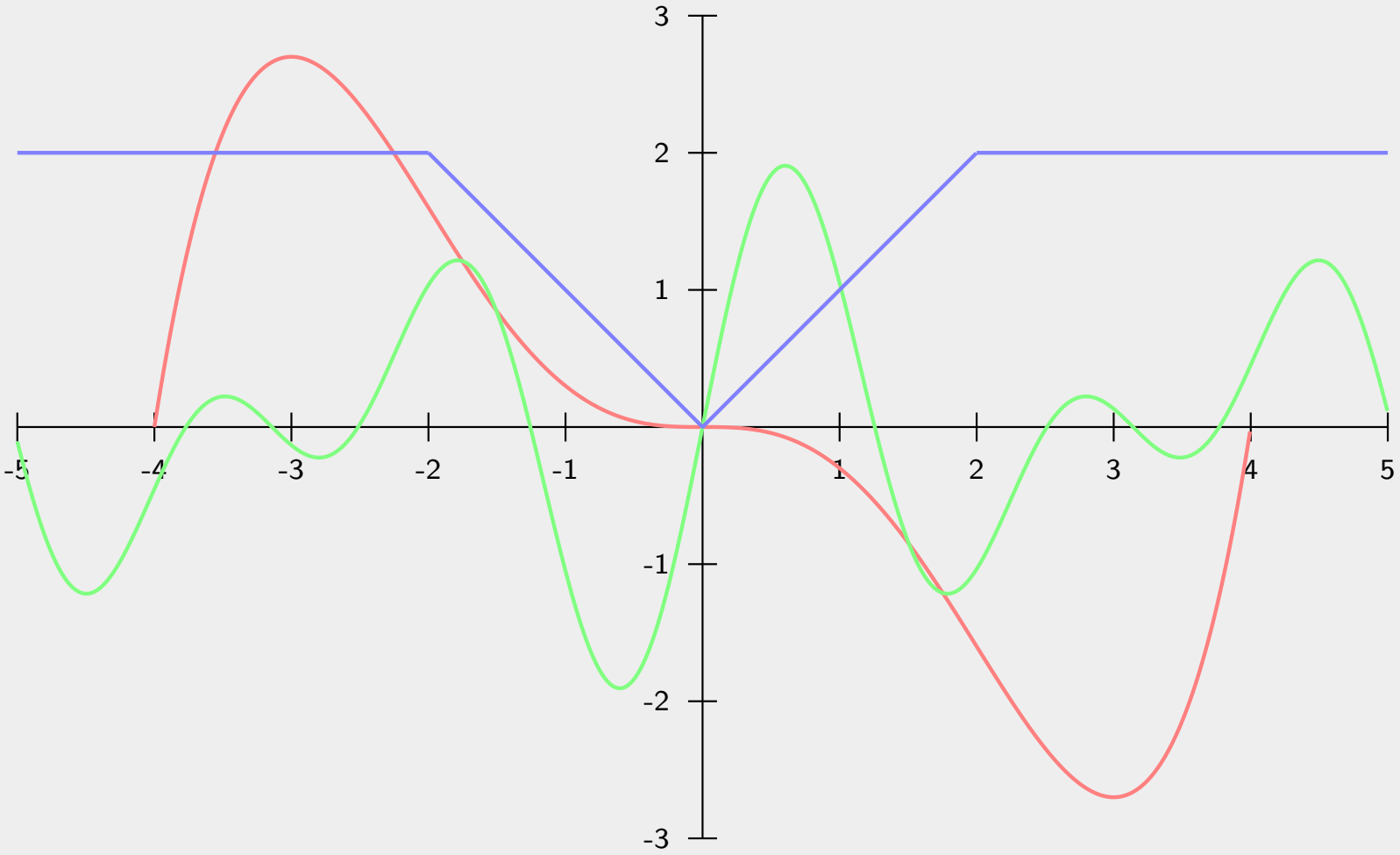
Exercise

If 1200 cm^2 of material is available to make a box with a square base and an open top, find the largest possible volume of the box.

- What is the goal function?
- What is the constraint?
- What is the restriction?

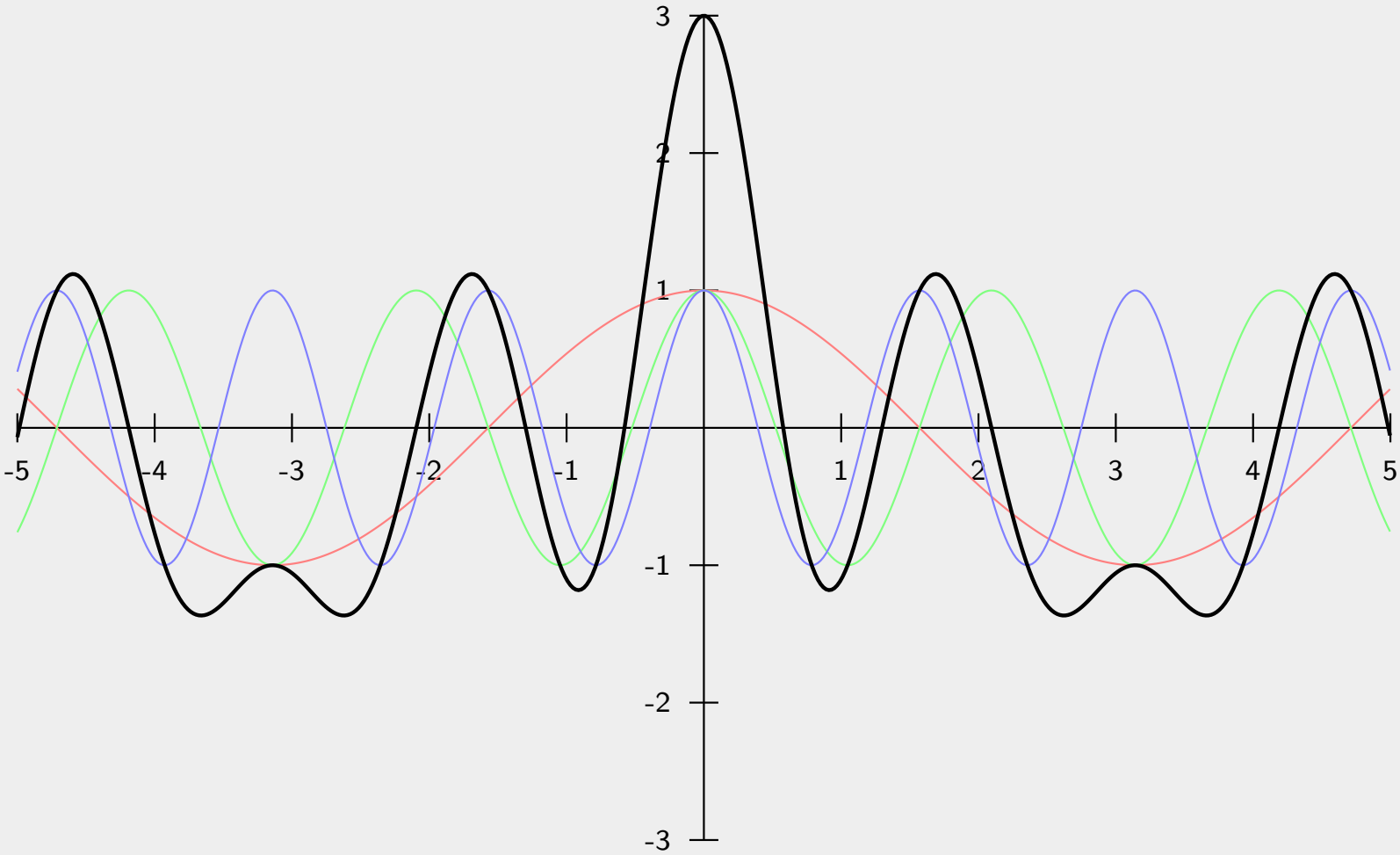
Function Shapes

At the points $x \in \{-3, -2, -1, 0, 1, 2, 3\}$ below



What can you say about the functions red, green and blue?
(Think slope, first derivative, second derivative, etc.)

Harmonic Constituents



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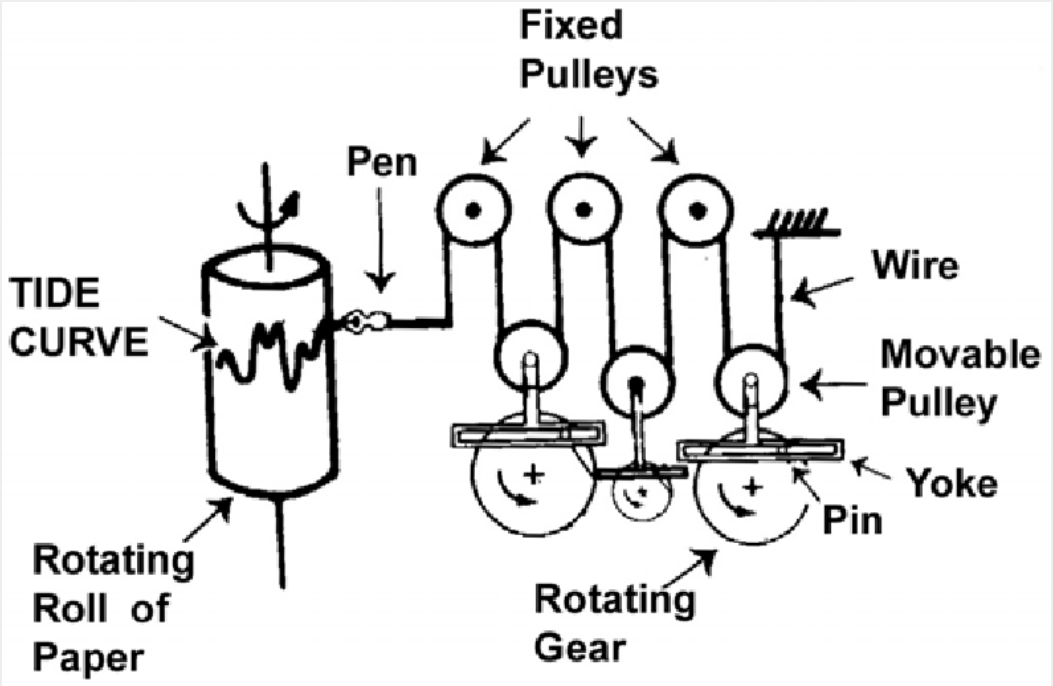

Chain Rule Practice

Differentiate the following functions:

- $f(x) = (6x^2 + 7x)^4$
- $g(t) = (4t^2 - 3t + 2)^{-2}$
- $H(z) = 2^{1-6z}$
- $h(z) = \sin(z^6) + \sin^6(z)$
- $f(x) = \ln(\sin(x)) - (x^4 - 3x)^{10}$
- $f(x) = (\sqrt[3]{12x} + \sin^2(3x))^{-1}$