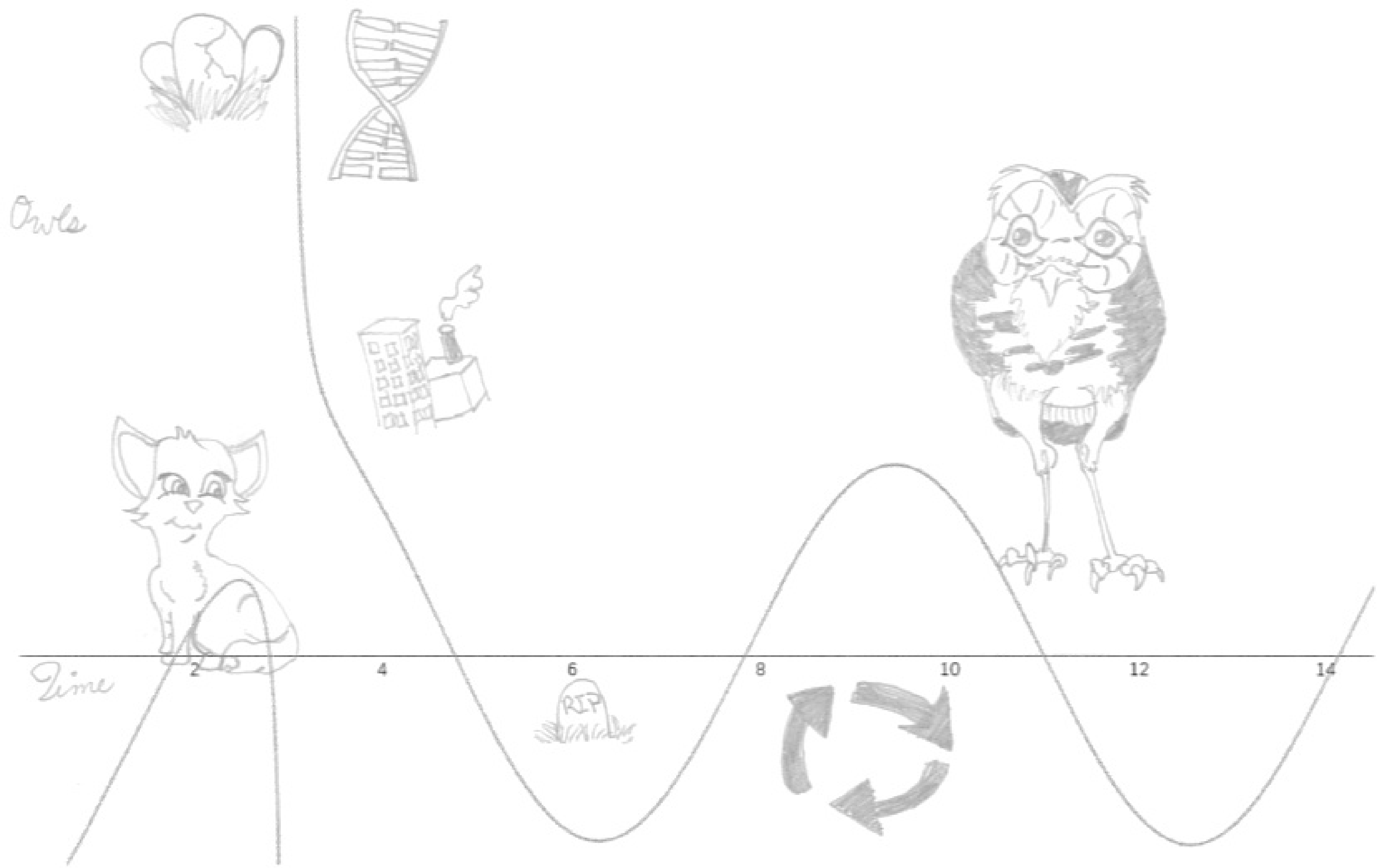
THE EVOLUTION OF BURROWING OWLS

Mikayla Kricfalusi



(WARNING: Not historically or scientifically accurate whatsoever)

What animal can be majestic, cute, slightly creepy, and mildly ironic all at the same time? Burrowing owls. Burrowing owls are long legged little creatures who hunt on the ground and live in burrows they steal from prairie dogs, ground squirrels, and tortoises. Once, a long long time ago, these burrowing owls began to evolve from the dinosaurs. On a graph, we can see this as owls over time increasing from negative infinity, where they might have been zero, as animals started to look and act more and more like burrowing owls. Then, these owls hit a point where there were too many of them for the ecosystem to support and they began to decrease again, especially as predators who liked to eat burrowing owls began to evolve, such as kittens. Burrowing owls began to speciate, dispersing into infinitely small pieces. Then, in pure Jurassic Park style, scientists brought back the burrowing owl, and had the potential to create infinite amounts of owls. But the owls escaped, and slowly began to die off in the unfamiliar environment. In a desperate bid for survival, they ate all the other animals, resulting in a burrowing owl apocalypse. Since they were one of only a few species left, the population continued to fluctuate until the end of planet Earth.

Equation: $y = \frac{1}{x^2-3x} - 2\cos(x)$

Quotient Rule

$$\frac{f(x)}{g(x)} = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$$

First Derivative: Slope

(1) split into $\frac{1}{x^2-3x}$ + $-2\cos(x)$

$$\frac{1}{x^2-3x} = \frac{(x^2-3x)(0) - 1(2x-3)}{(x^2-3x)(x^2-3x)}$$

$$= \frac{-2x+3}{x^4-6x^3+9x^2}$$

$$-2\cos(x) = +2\sin(x)$$

$$f'(x) = \frac{-2x+3}{x^4-6x^3+9x^2} + 2\sin(x)$$

$\Rightarrow$

Set = to 0 + Solve: Extremas

$$0 = \frac{-2x+3}{x^4-6x^3+9x^2} + 2\sin(x)$$

$$= \frac{-2x+3+2\sin(x)(x^4-6x^3+9x^2)}{x^4-6x^3+9x^2}$$

$$= \frac{-2x+(x^4-6x^3+9x^2)2\sin(x)+3}{x^4-6x^3+9x^2}$$

$$= \frac{2(-x+(x^4-6x^3+9x^2)\sin(x))+3}{x^4-6x^3+9x^2}$$

$$= \frac{2(-x+x^2(x-3)^2\sin(x))+3}{x^2(x-3)^2}$$

(Unable to continue solving)

Wolfram Alpha:

$x = 2.487753$
$x = 6.294336$
$x = 9.422615$
$x = 12.567136$

Just Sin(x):
(wave after $x = 3\pi$)
min @ $x = 2k\pi$ $k \in [2, \infty)$
max @ $x = \pi + 2k\pi$ $k \in [1, \infty)$

Second Derivative: Min/Max

(1) Split into $\frac{-2x+3}{x^4-6x^3+9x^2}$ + $2\sin(x)$

$$\frac{-2x+3}{x^4-6x^3+9x^2} = \frac{(x^4-6x^3+9x^2)(-2) - (-2x+3)(4x^3-18x^2+18x)}{(x^4-6x^3+9x^2)(x^4-6x^3+9x^2)}$$

$$= \frac{-2x^4+12x^3-18x^2-(-8x^4+36x^3-36x^2+12x^3-54x^2+54x)}{x^8-6x^7+9x^6-6x^7+36x^6-54x^5+9x^6-54x^5+81x^4}$$

$$= \frac{-2x^4+12x^3-18x^2+8x^4-36x^3+36x^2-12x^3+54x^2-54x}{x^8-6x^7+9x^6-6x^7+36x^6-54x^5+9x^6-54x^5+81x^4}$$

$$= \frac{6x^4+12x^3+72x^2-54x}{x^8-12x^7+54x^6-108x^5+81x^4}$$

$$= \frac{6x(x^3+2x^2+9x-54)}{x^4(x^4-12x^3+54x^2-108x+81)}$$

$$\frac{6x(x^3+2x^2+9x-54)}{x^4(x^4-12x^3+54x^2-108x+81)} + 2\cos(x)$$

Plug in X values:

(work not included)

domain $(0, \infty)$

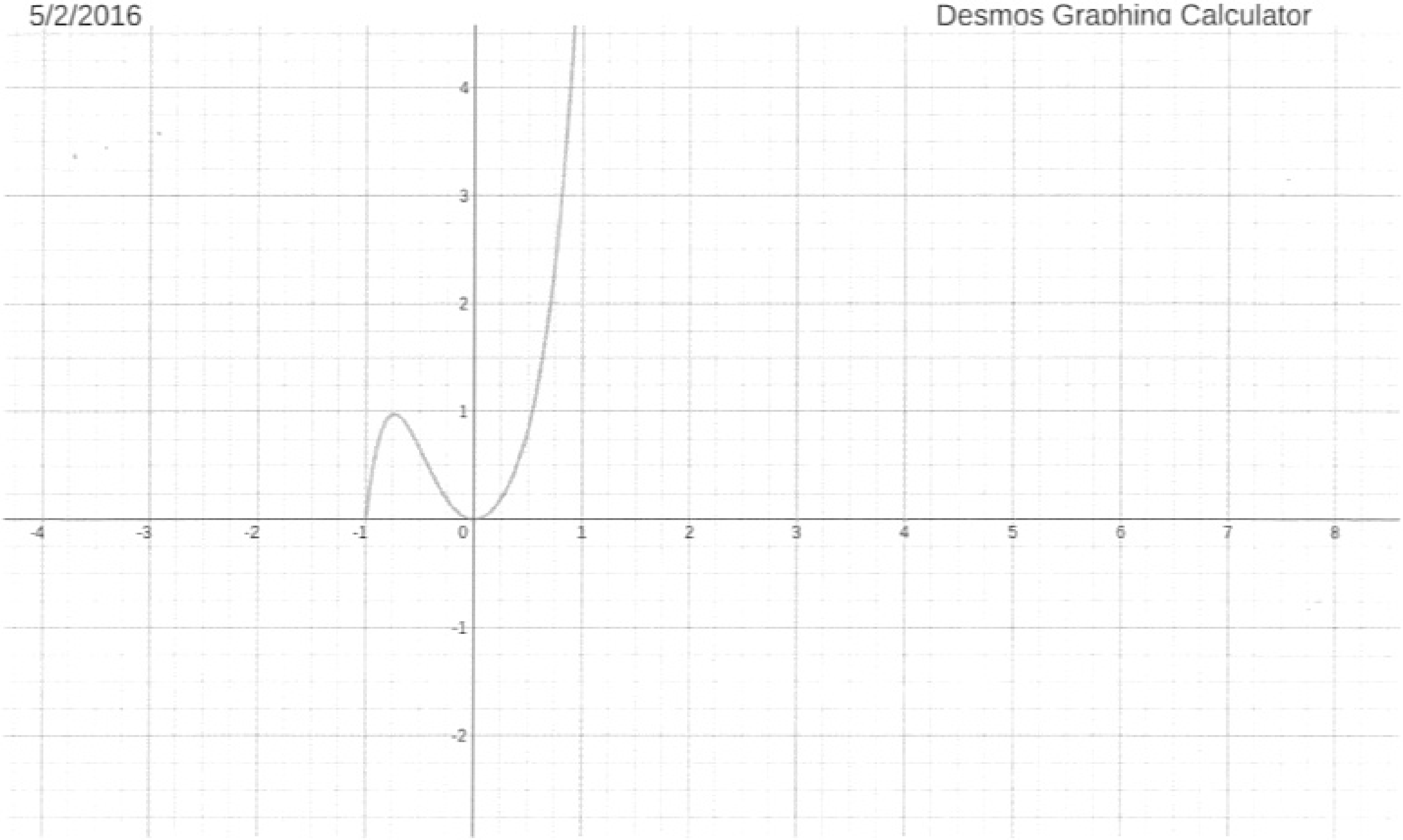
Maximums:
@ $x = 2.487753$
$x = 3k\pi$ $k \in [1, \infty)$

Minimums:
@ $x = 6.294336$
$x = 2k\pi$ $k \in [2, \infty)$

Alexis Miranda

The Raptors

Raptors, that's the name of a very special baseball team coming straight from San Marcos, California. This is a very special team, filled with energetic players waiting for that win. But this isn't just any ordinary baseball team, they don't realize what they attain as a team. The team has returning players and the rest of the team are new players. Last year, the Raptors were having trouble in the beginning, but as time went by they were adjusting to the game, since it was the first year HTHNC created a baseball team. This year the team growed in players, suddenly a lot of kids wanted to join. The majority of the team was filled with new players and the rest were returning players. During this time it became a lot harder to organize and adjust the players into positions. Once the games started, the returning players started off, they were doing a great job getting hits. Eventually, some of the new players got a chance to get game time, but once that happened the team wasn't doing good as before. The coach noticed this and started to take action during the practice sessions. The team started to lose more games and everybody started to panic. But little did they know, that every player has potential to make a great play. It all involved motivation, confidence, and the most important of all, teamwork. Once the Raptors opened up more and supported each other, that's when they started getting those wins and became champions.



$y = 3x^5 + 3x^2$ $15x^4 + 6x^1$ (-0.7837, 0.9562)

x y

$3 \cdot 5 \cdot x^{5-1}$ $15 \cdot 4 \cdot x$ (0,0)

$60x^3 + 6$

$3 \cdot 2 \cdot x^{2-1}$

$15x^4 + 6x^1$

$15(-0.7837)^4 + 6(0.7837)^1$

$15(0.3772) + 6(0.7837)$

$5.658 + 4.7022$

$x = 10.3602$

min

Alexis Miranda

Calculations

$y = 3x^5 + 3y^2$

$f'(x) = 15x^4 + 6x^1$

$f''(x) = 60x^3 + 6$

Once I got my second derivative, I plugged it in desmos with my first derivative. Then I found two points that intersected each other

First point = (-0.7837, 0.9562)
Second point = (0, 0)

After that, I then plugged them in for x into my second derivative.

$15(-0.7837)^4 + 6(0.7837)^1$

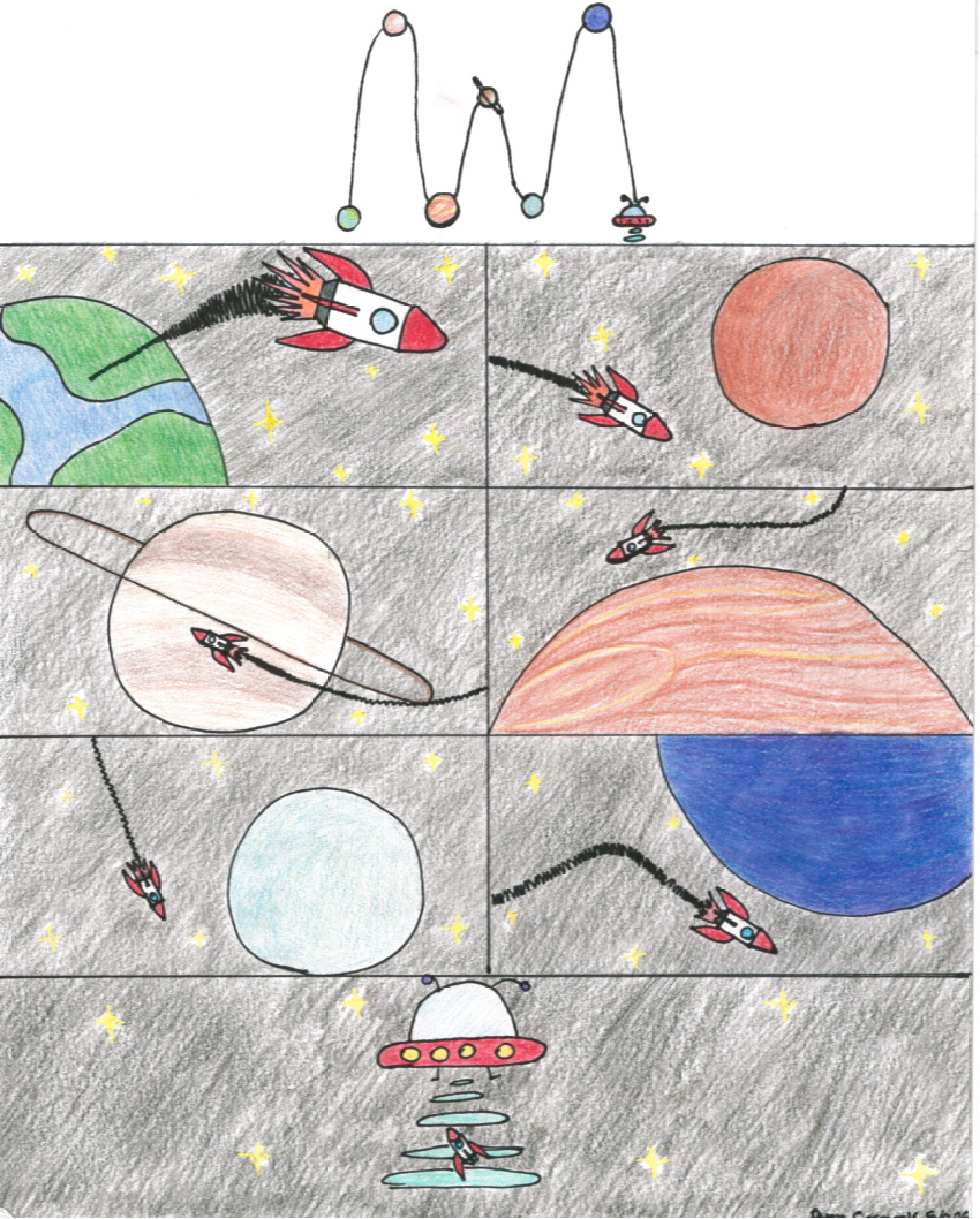
$15(0.3772) + 6(0.7837)$

$5.658 + 4.7022$

$x = 10.3602$ = min
My result was a positive number which means that it is a minimum for the Extrema.


HT·H NC
RAPTORS
RETURNING
PLAYERS
NEW
PLAYERS
0
RAPTORS
12
GOMPERS
TEAMWORK
CHAMPIONS!

$$\left[\left(-3(x-1.27)^2+2\right)^3+\left(2(x-1.27)^2+2\right)^2\right]-8 \quad \{.031 < x < 2.509\}$$



Ryan Cormack
5/2/16

1^{st} Derivative

$[(-3(x-1.27)^2+2)^3 + (2(x-1.27)^2+2)^2] - 8 \quad \{.031 < x < 2.509\}$

(1) $(-3(x-1.27)(x-1.27)$ — Expand

$x^2 - 1.27x - 1.27x + 1.27^2$

$(-3(x^2 - 2.54x + 1.27^2)+2)^3$ — Distribute and combine terms

$(-3x^2 + 7.62x + 6.8387)^3$

$3(-3x^2+7.62x+6.8387)^2 \cdot (-6x+7.62)$ — chain rule

$(-18x+22.86)(-3x^2+7.62x+6.8387)^2$ — Distribute 3

(2) $(2(x-1.27)^2+2)^2$

$(2(x-1.27)(x-1.27)+2)^2$ — Expand

$(2(x^2-2.54x+1.27^2)+2)^2$

$(2x^2-5.08x+5.2258)^2$ — Distribute and combine terms

$2(2x^2-5.08x+5.2258) \cdot (4x-5.08)$ — Chain Rule

$(2x^2-5.08x+5.2258)(8x-10.16)$ — Distribute 2

$(-18x+22.86)(-3x^2+7.62x+6.8387)^2 + (8x-10.16)(2x^2-5.08x+5.2258)$

- Graph 2nd Derivative
- Plug 3 values
- min or max

Extrema's

1st $\overset{u}{(-18x+22.86)}\overset{①\ v}{(-3x^2+7.62x+6.8387)^2}+\overset{②\ u}{(8x-10.16)}\overset{v}{(2x^2-5.08x+5.2258)}$

$UV' + VU'$

① ~~$(-18x+22.86)(-6x+7.62$~~

~~$(-18x+22.86)$~~

VU'

$(-3x^2+7.62x+6.8387)^2 \cdot (18)$

$2(-3x^2+7.62x+6.8387)\cdot(-6x+7.62)$ Chain rule

$(-3x^2+7.62x+6.8387)(-12x+15.24)$ Distribute 2

UV' $(-18x+22.86)(-3x^2+7.62x+6.8387)(-12x+15.24)$

② $(8x-10.16)(2x^2-5.08x+5.2258)$

$(8)(2x^2-5.08x+5.2258)$ Derive $8x-10.16$

~~$(-18x+22.86)(-3x^2+7.62x+6.8387)(-12x+15.24)+(8)(2x^2-5.08x+5.2258)$~~

$+(8x-10.16)(4x-5.08)$

2nd $(-18x+22.86)(-3x^2+7.62x+6.8387)(-12x+15.24)+(-3x^2+7.62x+6.8387)^2(-18)$
$+(8x-10.16)(4x-5.08)+(8)(2x^2-5.08x+5.2258)$

1.27
3.071
3.424

Max @ 1.27 -2438.5101

Min @ 3.071 1467.3071

Max @ 3.424 -2098.3834

Equation ↝ $[(-3(x-1.27)^2+2)^3 + (2(x-1.27)^2+2)^2] - 8 \quad \{.031 < x < 2.509\}$

Expand $(x-1.27)$ ↗ $(-3(x-1.27)(x-1.27)$

$x^2 - 1.27x - 1.27x$

FOIL ⟶ $x^2 - 1.27x - 1.27x + 1.27^2$

Distribute -3 → $(-3(x^2 - 2.54x + 1.27^2) + 2)^3$ ← oh no.

$((-3x^2 + 7.62x + 4.8387) + 2)^3$

FOIL ↘ $((-3x^2 + 7.62x + 4.8387) + 2)((-3x^2 + 7.62x + 4.8387) + 2)$

$9x^4 - 22.86x^3 - 14.5161 - 22.86x^3 + 58.0644x^2 + 36.870894x$

$-14.5161x^2 + 36.870894x + 23.4136177 - 6x^2 + 15.24x + 9.6774$

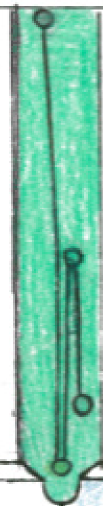
$-6x^2 + 15.24x + 9.6774 + 4$

↑ Distribute into

0.031
2509

$y = 3x^3 - \frac{2}{x^2}$

We follow the story of James.



Who travels through time

This is the story of James. He traveled through time using a machine in the year 2068. With his time machine he traveled back in time, to our present day, and then back to the Wild West. Sadly, James couldn't leave the Wild West.

$$-3x^3 - \frac{2}{x^2} - 10$$

Chris B

①	$-9x^2 - \frac{4}{x^3} = 0$	After getting the first derivative we set it equal to 0 then add $9x^2$ to both sides in order to find the solution
②	$-\frac{4}{x^3} = 9x^2$ $\cdot x^3 \quad \cdot x^3$	Because we are left with ② we have to multiply both sides by x^3
③	$\frac{-4}{4} = \frac{9x^5}{4}$	After we are left with ③, we have to devide both sides by 5 so that it is equal to 1
④	$1 = -\frac{9x^5}{5}$	Now that the value is equal to 1, we can solve for the final answer
⑤	$-\left(\sqrt[5]{\frac{4}{9}}\right)$	BaZinga!!!!