Outline

I. Aim & rationale

A. Title: How transformations of the reciprocal function are related to their inverses: a graphical and algebraic exploration

B. Rationale:

1. one of the main parent functions, common

2. its translations are relatively easy to work with, but

2. tricky because fractions are difficult

3. also interesting because of asymptotic behavior (graph for interest?)

C: Aim: To investigate how the reciprocal function and its translations in the horizontal and vertical directions are related to their functional inverses, determining general rules and patterns.

D. Organization of paper

II. Method

A. Reciprocal parent function and its translations

1. Graphical representation (Desmos screenshots)

2. Algebraic equivalents: slide right in the denominator, add term for vertical slides

B. General form

3. Generalized horizontal and vertical translations (use Desmos slider?)

4. Potential extension: horizontal (and vertical) dilation. (leave for later right now)

C. Derive functional inverse

1. Graphically, reflect over *y*=*x*. Follow example point: (1,1)?

2. Algebraically, switch *x* and *y*.

3. Do the numbers always follow a general pattern?

III. Results

A. Focus on explaining general case, use variables instead of specific values.

B. How do we know our solution includes all possible examples?

C. How are patterns in the graphs connected to the algebra, and vice-a-versa

D. What is interesting or important? (Is this cool? Are we there yet?)

IV. Discussion

A. Focus on general case

B. Carefully explain the patterns in detail

C. Why does it work like this? What is connected to what, how?

D. How is this limited?

E. Extensions, further work: dynamic graphs? 3 dimensions?

V. Conclusion

A. Brief summary of each important step

1. Translations

2. Inverses

3. Patterns or rules

B. Connect back to aim. Successfully accomplished aim.

C. Relevance, limitations, extensions (rehash briefly)

D. Final personal note about engagement

VI. Works cited

A. Textbook: Buchanan, Laurie, et al. *Mathematics Standard Level: Course Companion*. Oxford, 2012, pp. 140-157.