

HW2: Polynomial Graphing Calculator

Problem 0: Write pseudocode algorithms for polynomial operations

Problem 1: Answer questions about RatNum

Problem 2: Implement RatTerm

Problem 3: Implement RatPoly

Problem 4: Implement RatPolyStack

Problem 5: Try out the calculator



RatThings

RatNum

- ADT for a Rational Number
- Has NaN

RatTerm

- Single polynomial term
- Coefficient (RatNum) & degree

RatPoly

- Sum of RatTerms

RatPolyStack

- Ordered collection of RatPolys



Polynomial Addition

$$(5x^4 + 4x^3 - x^2 + 5) + (3x^5 - 2x^3 + x - 5)$$

Polynomial Addition

$$(5x^4 + 4x^3 - x^2 + 5) + (3x^5 - 2x^3 + x - 5)$$

$$\begin{array}{r} 5x^4 + 4x^3 - x^2 + 5 \\ + 3x^5 - 2x^3 + x - 5 \end{array}$$

Polynomial Addition

$$(5x^4 + 4x^3 - x^2 + 5) + (3x^5 - 2x^3 + x - 5)$$

$$\begin{array}{r} 5x^4 + 4x^3 - x^2 + 0x + 5 \\ + 3x^5 + 0x^4 - 2x^3 + 0x^2 + x - 5 \end{array}$$

Polynomial Addition

$$(5x^4 + 4x^3 - x^2 + 5) + (3x^5 - 2x^3 + x - 5)$$

$$\begin{array}{r} \\ \\ + \\ \hline 3x^5 + 5x^4 + 2x^3 - x^2 + x + 0 \end{array}$$

Polynomial Subtraction

$$(5x^4 + 4x^3 - x^2 + 5) - (3x^5 - 2x^3 + x - 5)$$

$$\begin{array}{r} 5x^4 + 4x^3 - x^2 + 5 \\ - 3x^5 - 2x^3 + x - 5 \end{array}$$

Polynomial Subtraction

$$(5x^4 + 4x^3 - x^2 + 5) - (3x^5 - 2x^3 + x - 5)$$

$$\begin{array}{r} 5x^4 + 4x^3 - x^2 + 0x + 5 \\ - 3x^5 + 0x^4 - 2x^3 + 0x^2 + x - 5 \end{array}$$

Polynomial Subtraction

$$(5x^4 + 4x^3 - x^2 + 5) - (3x^5 - 2x^3 + x - 5)$$

$$\begin{array}{r} 5x^4 + 4x^3 - x^2 + 0x + 5 \\ - 3x^5 + 0x^4 - 2x^3 + 0x^2 + x - 5 \\ \hline -3x^5 + 5x^4 + 6x^3 - x^2 - x + 10 \end{array}$$

Polynomial Multiplication

$$(4x^3 - x^2 + 5) * (x - 5)$$

Polynomial Multiplication

$$(4x^3 - x^2 + 5) * (x - 5)$$

$$4x^3 - x^2 + 5$$

*

$$x - 5$$

Polynomial Multiplication

$$(4x^3 - x^2 + 5) * (x - 5)$$

$$4x^3 - x^2 + 5$$

*

$$x - 5$$

$$-20x^3 + 5x^2 - 25$$

Polynomial Multiplication

$$(4x^3 - x^2 + 5) * (x - 5)$$

$$4x^3 - x^2 + 5$$

*

$$x - 5$$

$$\begin{array}{r} 4x^4 - 20x^3 + 5x^2 - 25 \\ -x^3 + 5x \end{array}$$

Polynomial Multiplication

$$(4x^3 - x^2 + 5) * (x - 5)$$

$$4x^3 - x^2 + 5$$

*

$$x - 5$$

$$-20x^3 + 5x^2 - 25$$

$$+ 4x^4 - x^3 + 5x$$

$$4x^4 - 21x^3 + 5x^2 + 5x - 25$$

Poly Division

$$(5x^6 + 4x^4 - x^3 + 5) / (x^3 - 2x - 5)$$

Poly Division

$$(5x^6 + 4x^4 - x^3 + 5) / (x^3 - 2x - 5)$$

$$x^3 - 2x - 5$$

$$5x^6 + 4x^4 - x^3 + 5$$

Poly Division

1 0 -2 -5

5 0 4 -1 0 0 5

Poly Division

5

1	0	-2	-5		5	0	4	-1	0	0	5
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Poly Division

5

1 0 -2 -5

5 0 4 -1 0 0 5

5 0 -10 -25

Poly Division

5

1 0 -2 -5

5 0 4 -1 0 0 5

5 0 -10 -25

0 0 14 24

Poly Division

5

1 0 -2 -5

5 0 4 -1 0 0 5

5 0 -10 -25

0 0 14 24

14 24 0

Poly Division

5 0

1 0 -2 -5

5 0 4 -1 0 0 5

5 0 -10 -25

0 0 14 24

14 24 0

Poly Division

5 0

1 0 -2 -5

5 0 4 -1 0 0 5

5 0 -10 -25

0 0 14 24

14 24 0

14 24 0 0

Poly Division

$$\begin{array}{r} \\ \\ \hline 1 -2 -5 \\ \\ \hline 5 4 -1 5 \\ \\ \hline 5 -10 -25 \\ \\ \hline 14 24 \\ \\ 24 \\ \\ \end{array}$$

Poly Division

5 0 14

1 0 -2 -5

5 0 4 -1 0 0 5

5 0 -10 -25

0 0 14 24

14 24 0

14 24 0 0

14 0 -28 -70

Poly Division

$$\begin{array}{r}
 \\
 \hline
 1 -2 -5 \\
 \\
 \hline
 5 \\
 5 -10 -25 \\
 \hline
 14 \\
 \\
 \\
 14 -28 -70 \\
 \hline
 24
 \end{array}$$

Poly Division

$$\begin{array}{r}
 \\
 \hline
 1 -2 -5 \\
 \\
 \hline
 5 \\
 5 -10 -25 \\
 \hline
 14 \\
 \phantom{} 14 \\
 \phantom{\phantom{}} 14 \\
 \phantom{\phantom{\phantom{}}} 14 -28 -70 \\
 \hline
 \\
 \phantom{} 24
 \end{array}$$

Poly Division

$$\begin{array}{cccc|cccc} & & & & 5 & 0 & 14 & 24 \\ 1 & 0 & -2 & -5 & 5 & 0 & 4 & -1 & 0 & 0 & 5 \\ & & & & 5 & 0 & -10 & -25 & & & \\ \hline & & & & 0 & 0 & 14 & 24 & & & \\ & & & & & & 14 & 24 & 0 & & \\ & & & & & & 14 & 24 & 0 & 0 & \\ & & & & & & 14 & 0 & -28 & -70 & \\ \hline & & & & & & 0 & 24 & 28 & 70 & \\ & & & & & & & 24 & 28 & 70 & 5 \\ & & & & & & & 24 & 0 & -48 & -120 \end{array}$$

Poly Division

$$\begin{array}{r|rrrrrrr} & & & & 5 & 0 & 14 & 24 \\ \hline 1 & 0 & -2 & -5 & 5 & 0 & 4 & -1 & 0 & 0 & 5 \\ & & & & 5 & 0 & -10 & -25 & & & \\ \hline & & & & 0 & 0 & 14 & 24 & & & \\ & & & & & & 14 & 24 & 0 & & \\ & & & & & & 14 & 24 & 0 & 0 & \\ & & & & & & 14 & 0 & -28 & -70 & \\ \hline & & & & & & 0 & 24 & 28 & 70 & \\ & & & & & & & 24 & 28 & 70 & 5 \\ & & & & & & & 24 & 0 & -48 & -120 \\ \hline & & & & & & & 0 & 28 & 118 & 125 \end{array}$$

Poly Division

$$(5x^6 + 4x^4 - x^3 + 5) / (x^3 - 2x - 5)$$

$$5x^3 + 14x + 24$$

Poly Division

$$(5x^6 + 4x^4 - x^3 + 5) / (x^3 - 2x - 5)$$

$$5x^3 + 14x + 24 + \frac{28x^2 + 118x + 125}{x^3 - 2x - 5}$$