Bellwork

• Find the following:

1. Degree 3
2. # Solutions 3
3. Max Turns 2
4. Y-INT +3
5. LC: 1

\[ f(x) = 3x^3 + x^2 - 5x + 3 \]
Homework Answers

#1  y-int: 0  x-int: 0  VA: x = 3/2  HA: y = 2
f(x) = \frac{4x}{2x-3}

#2  y-int: -7/4  x-int: -7  VA: x = 4  HA: y = 1
f(x) = \frac{x+7}{x-4}

#3  y-int: 2.5  x-int: none  VA: x = 2  HA: y = 0
f(x) = \frac{-5}{x-2}

See whiteboard for graphs
Polynomials

Find all zeros

\[ f(x) = x^3 + x^2 - 5x + 3 \]
Unit 2:
Polynomial and Rational Functions

Section 2.5 (Day 2):
Rational Functions

Objective: SWBAT graph rational functions.
Graphs of Rational Functions

**Y-intercept:**
Sub 0 for $x$, get $y$.

**X-intercept(s):**
Set **Numerator** = 0 and solve for $x$

**Vertical Asymptote(s):**
Set **Denominator** = 0 and solve for $x$
Graphs of Rational Functions

Horizontal Asymptote(s):

If \text{degree of num.} = \text{degree of denom.} \quad y = \text{ratio of leading coefficients}

If \text{degree of num.} < \text{degree of denom.} \quad y = 0

If \text{degree of num.} > \text{degree of denom.} \quad \text{no horizontal asymptote exists}

Slant Asymptote:

- If \text{degree of num.} \text{ is EXACTLY 1 greater than degree of denom.}
- To find the slant asymptote divide the \textbf{numerator} by the \textbf{denominator}.
- Use \textbf{long division}, ignore remainders.
Graphs of Rational Functions

Holes:
- When the **numerator** and the **denominator** have common factors.
- Point of **DISCONTINUITY**
  - Not an asymptote
  - Just a point
  - Mark with open circle

\[
f(x) = \frac{(x-2)(x-3)}{(x-3)(x+5)}
\]

hole at \( x = 3 \)
Graph Rational Functions in Graphing Calculator

- Go to y = menu.
- Put **numerator** in parenthesis.
- Divide.
- Put **denominator** in parenthesis.
- Graph.

\[
\frac{(\text{Numerator})}{(\text{Denominator})}
\]

**You must have PARENTHESES!**
Find any intercepts, asymptotes, and holes for the function. Then sketch a graph.

Ex. 1: \[ f(x) = \frac{3x^2 + 1}{x^1} \]

- **y-intercept:** none
  - Let \( x = 0 \)
- **x-intercept:** none
  - \( \text{num} = 0 \)
- **Vertical Asymptote:** \( x = 0 \)
  - \( \text{denum} = 0 \)
- **Horizontal Asymptote:** none
  - \( \frac{3}{1} = 3 \)
- **Slant asymptote:** \( y = 3x \)

\[ x = \sqrt{3x^2 + 1} \]

\[ x = \sqrt{3} \]

\[ x = \sqrt{-1} \]

\[ x = \sqrt{-1} \text{ imaginary} \]

Graph on next slide…
Mark asymptotes, intercepts and holes. Then check graph with a graphing calculator…

Ex. 1: \[ f(x) = \frac{3x^2 + 1}{x} \]
Find any intercepts, asymptotes, and holes for the function. Then sketch a graph.

Ex. 2:  \( f(x) = \frac{x^3}{x^2 - 4} \)

- **y-intercept**: \( y = \frac{0}{4} = 0 \)
- **x-intercept**: \( x = 0 \)

**Vertical Asymptotes**: \( x^2 - 4 = 0 \) \( x^2 = 4 \) \( x = \pm 2 \)

**Horizontal Asymptotes**: None

**Slant Asymptote**: \( y = x \)

Graph on next slide…
Mark asymptotes, intercepts and holes. Then check graph with a graphing calculator…

Ex. 2: 

\[ f(x) = \frac{x^3}{x^2 - 4} \]

Slant: 

\[ y = x + 0 \]

\[ y = mx + b \]
Find any intercepts, asymptotes, and holes for the function. Then sketch a graph.

Ex. 3:

\[ f(x) = \frac{x^2 - 5x + 6}{x^2 - 4} \]

\[ \frac{(x - 2)(x - 3)}{(x + 2)(x - 2)} \]

hole: \( x = 2 \) \( (x - 2 = 0) \)

y-inter: \( -\frac{3}{2}, -1.5 \)

x-inter: \( 3 \) \( (x - 3 = 0) \)

VA: \( x = 2 \) \( (x + 2 = 0) \)

HA: \( \frac{1}{2} \) \( y = 1 \)

Slant HA: No

Graph on next slide…
Mark asymptotes, intercepts and holes. Then check graph with a graphing calculator…

Ex. 3: \[ f(x) = \frac{x^2 - 5x + 6}{x^2 - 4} \]
Summary:

Write one COMPLETE sentence telling how you create a “hole” in your graph.

Guided Practice

Fan – n – Pick
Homework

Homework: Find any intercepts, asymptotes, and holes for the function, then graph.

\[ f(x) = \frac{x^2 - 4}{x^2 - 2x - 8} = \frac{(x+2)(x-2)}{(x-4)(x+2)} \]

\[ f(x) = \frac{x^2 + 3x - 3}{x + 4} \quad \text{hole at } x = -2 \]

\[ f(x) = \frac{x^3}{x^2 - 9} \]

\[ x + 2 = 0 \]

\[ X = -2 \]