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Asymptotes of Rational Functions

State the domain using interval notation. For any $x$-value excluded from the domain, state whether the graph has a vertical asymptote or a "hole" at that $x$-value. Use a graphing calculator to check your answer.

1. $f(x)=\frac{x+5}{x+1}$
2. $f(x)=\frac{x^{2}+2 x-3}{x^{2}-4 x+3}$

Find any holes, asymptotes, and intercepts and state the end behavior.
3.

$$
f(x)=\frac{x \quad 1}{x^{2}+x \quad 6}
$$

$$
\text { 7. } f(x)=\frac{x-1}{x+1}
$$

Sketch the graph of the given rational function. Also state the function's domain and range using interval notation. Find any $x$ and $y$ intercepts, state the end behavior, and behavior around the asymptotes.
8. $f(x)=\frac{x+1}{\left(\begin{array}{ll}x & 1\end{array}\right)^{2}(x+2)}$

Domain:
Range:
X - intercept:
Y - intercept:
V Asymptote:


Hole:
increasing:
decreasing:
End Behavior:
Asymptotes Behavior:
9. $f(x)=\frac{x^{2}+2 x \quad 3}{x^{2}+x \quad 2}$

Domain:
Range:
X - intercept:
Y - intercept:
V Asymptote:
Hole:

increasing:
decreasing:

End Behavior:
Asymptotes Behavior:
10. $f(x)=\frac{-3 x(x-2)}{(x-2)(x+2)}$

Domain:
Range:
X - intercept:
Y - intercept:
V Asymptote:
Hole:
Increasing:
Decreasing:
End Behavior:


Asymptotes Behavior:
11. $f(x)=\frac{x^{2} \quad 1}{x+2}$

Domain:
Range:
X - intercept:
Y - intercept:
V Asymptote:
Hole:
increasing:

decreasing:
End Behavior:

## Asymptotes Behavior:

18. Draw Conclusions For what value(s) of $a$ does the graph of $f(x)=\frac{x+a}{x^{2}+4 x+3}$ have a "hole"? Explain. Then, for each value of $a$, state the domain and the range of $f(x)$ using interval notation.
19. Critique Reasoning A student claims that the functions $f(x)=\frac{4 x^{2}-1}{4 x+2}$ and $g(x)=\frac{4 x+2}{4 x^{2}-1}$ have different domains but identical ranges. Which part of the student's claim is correct, and which is false? Explain.

## Review

Simplify the following rational expressions

1. $\frac{2}{x^{2}-x-2} \cdot \frac{10}{x^{2}+2 x-8}$
2. $\frac{x}{x^{2}-6 x+8} \cdot \frac{1}{x^{2}-x-12}$
