

Secondary Math 3 Honors Rational Functions Test Review

Simplify each rational expression fully and state what the excluded values are.

1.
$$\frac{3 - 2r - r^2}{r^2 - 10r + 9}$$

$$= \frac{-(r^2 + 2r - 3)}{(r-9)(r-1)} = \frac{-(r+3)(r-1)}{(r-9)(r-1)}$$

exc. val: $r=9, 1$

$$\frac{-(r+3)}{r-9}$$

Add or subtract each rational expression. Fully simplify your answer.

3.
$$\frac{\frac{x+2}{x+2} \cdot 6x}{x+4} - \frac{3}{x+2} \cdot \frac{x+4}{x+4}$$

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

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

2.
$$\frac{5n^2 + 15n}{9n^2 + 27n} = \frac{5n(n+3)}{9n(n+3)} = \frac{5}{9}$$

exc. val: $n=0, -3$

4.
$$\frac{3}{6a} - \frac{a-2}{a+4} = \frac{3a+12 - (6a^2-12a)}{6a(a+4)} =$$

$$\frac{-6a^2 + 15a + 12}{6a(a+4)} = \frac{-3(2a^2 - 5a - 4)}{2 \cdot 6a(a+4)}$$

$$= \frac{-(2a^2 - 5a - 4)}{2a(a+4)}$$

Multiply or divide each rational expression. Fully simplify your answer.

5.
$$\frac{x^2 - 11x + 30}{x-5} \cdot \frac{6x}{8} =$$

$$\frac{(x-5)(x-6) \cdot 3x}{(x-5) \cdot 8} =$$

$$\frac{3x(x-6)}{8}$$

6.
$$\frac{1}{n-9} \div \frac{n-9}{n^2 - 17n + 72}$$

$$\frac{1 \cdot (n-8)(n-9)}{(n-9)(n-9)} = \frac{n-8}{n-9}$$

Solve each equation. Remember to check for extraneous solutions.

7. $\left(\frac{1}{3r} + \frac{r+3}{3r} = \frac{1}{r} \right) \cdot 3r$ $r \neq 0$

$1 + r + 3 - 3 = 0$
 $r = -1$

8. $\left(\frac{3}{k^2 - 5k} + \frac{6}{k} = \frac{1}{k-5} \right) \cdot k(k-5)$ $k \neq 5, 0$

$3 + 6(k-5) - k = 0$
 $3 + 6k - 30 - k = 0$
 $-27 + 5k = 0$

$5k = 27$
 $k = \frac{27}{5}$

Graph each rational function below. Write out or label any vertical, horizontal, or slant asymptotes; any x- and y-intercepts; holes. If there aren't any of what's asked for above, write "none."

9.

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

$eb \rightarrow -2$

$a = \frac{2}{x+3}$ $\frac{2}{3} \rightarrow \frac{2}{3}$
 $2x + 6 = 2$ $-\frac{2}{3}$
 $2x = -4$ $-\frac{4}{3}$
 $x = -2$

Horizontal Asymptote(s): $y = -2$

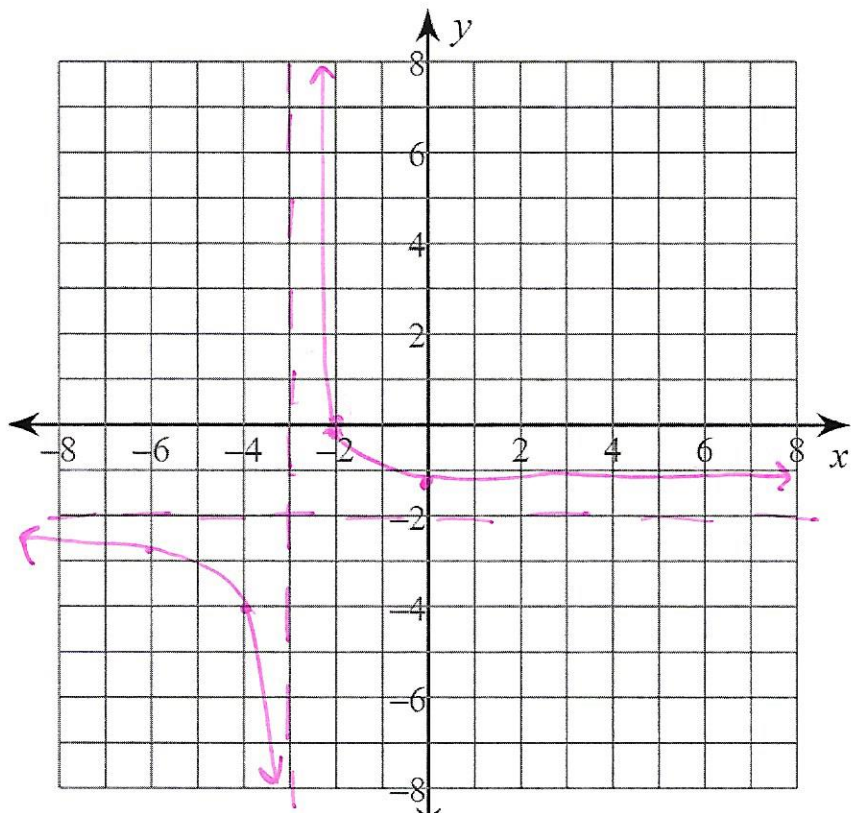
Vertical Asymptote(s): $x = -3$

Slant Asymptote(s): none

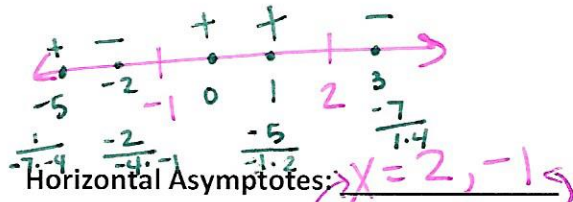
x-intercept(s): $(-2, 0)$

y-intercept(s): $(0, -\frac{4}{3})$

Hole(s): none



10. $f(x) = \frac{-x - 4}{x^2 - x - 2} = \frac{-(x+4)}{(x-2)(x+1)}$ proper - e.b $\rightarrow 0$



Horizontal Asymptotes: $x = 2, -1$

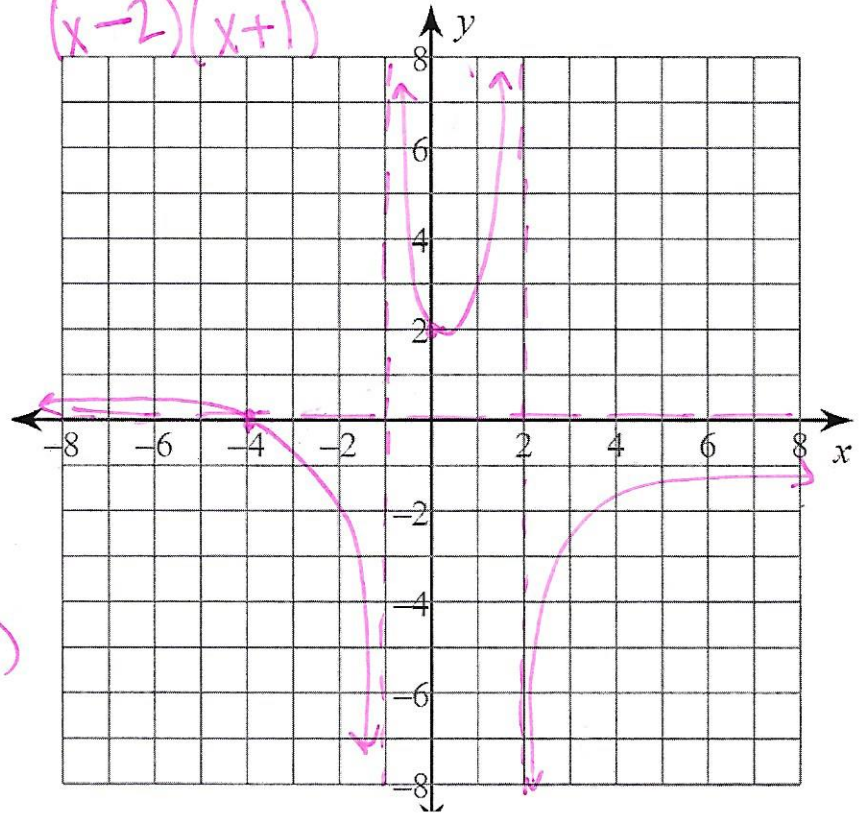
Vertical Asymptotes: $y = 0$

Slant Asymptotes: none

x-intercept: $x = -4$ $(-4, 0)$

y-intercept: $y = \frac{-4}{-2} = 2$ $(0, 2)$

Holes: none



11. $f(x) = \frac{x^2 - 16}{-2x^2 - 2x + 24} = \frac{(x-4)(x+4)}{-2(x^2+x-12)} = \frac{(x-4)(x+4)}{-2(x+4)(x-3)} = \frac{x-4}{2(x-3)}$

Horizontal Asymptote(s): $y = \frac{1}{2}$

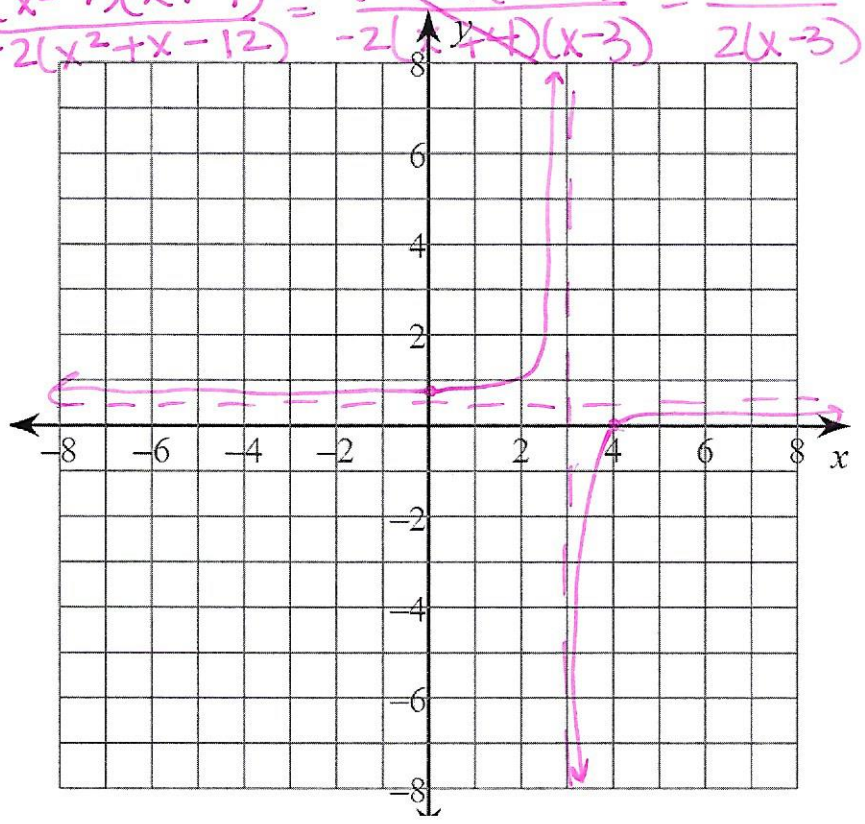
Vertical Asymptote(s): $x = 3$

Slant Asymptote(s): none

x-intercept(s): $x = 4$ $(4, 0)$

y-intercept(s): $y = \frac{-4}{-6} = \frac{2}{3}$ $(0, \frac{2}{3})$

Hole(s): $x = -4$



12.

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

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

Horizontal Asymptote(s): none

Vertical Asymptote(s): none

Slant Asymptote(s): $y = \frac{1}{3}x + \frac{4}{3}$

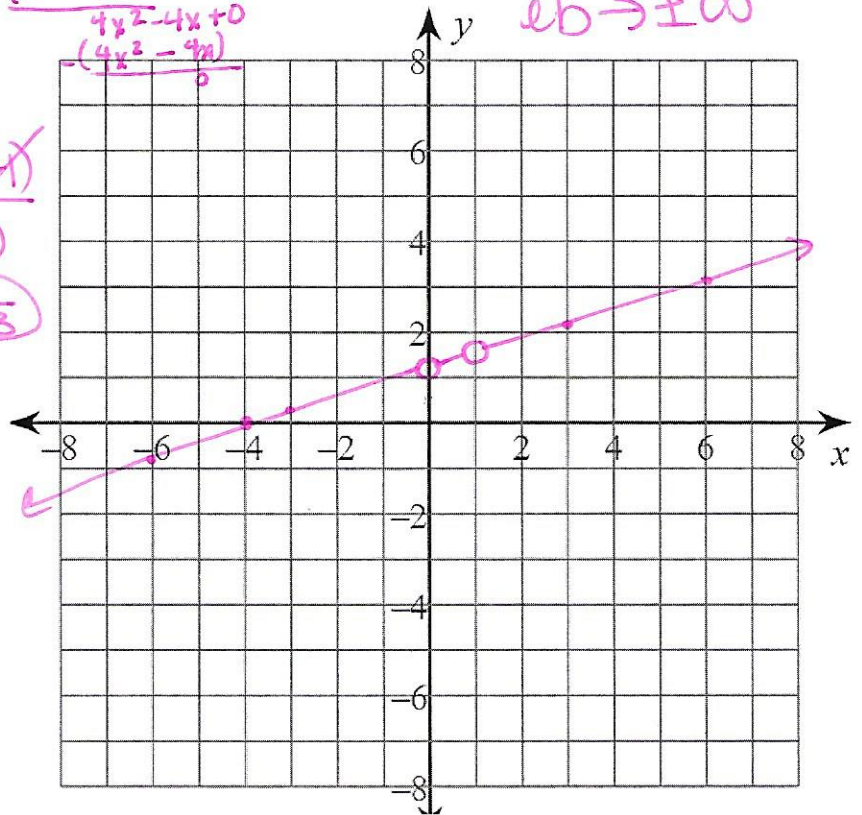
x-intercept(s): -4 (-4, 0)

y-intercept(s): $\frac{4}{3}$ (0, $\frac{4}{3}$)

Hole(s): x = 0, 1

$$\begin{array}{r} 12x + 43 \\ 3x^2 - 3x \\ \underline{-(x^3 - x^2)} \\ 4x^2 - 4x + 0 \\ \underline{-(4x^2 - 4x)} \\ 0 \end{array}$$

improper
 $eb \rightarrow \pm \infty$



**No calculator below. State the asymptotes, intercepts, and holes. Sketch a graph of the following.

$$f(x) = \frac{x^2 - 6x + 8}{4x - 12} = \frac{(x-4)(x-2)}{4(x-3)}$$

$$\begin{array}{r} \frac{1}{4}x - \frac{3}{4} \\ 4x - 12 \\ \underline{-(x^2 - 3x)} \\ -3x + 8 \\ \underline{-(-3x + 9)} \\ -1 \end{array}$$

Horizontal Asymptote(s): none

Vertical Asymptote(s): x = 3

Slant Asymptote(s): $y = \frac{1}{4}x - \frac{3}{4}$

x-intercept(s): x = 4, 2

y-intercept(s): $y = \frac{8}{-12} = -\frac{2}{3}$ (0, $-\frac{2}{3}$)

Hole(s): none

