Solutions

MCR3U – Unit 2 Review: The Big Questions

1. Simplify and state restrictions. Be sure to identify asymptotes and holes.

FLIP

$$f(x) = \frac{-2x^2+2}{x^2-x-20} \div \frac{2x^2-x-3}{x^2+8x+16} \times \frac{6x^2-7x-3}{12x^2-6x}$$

$$= \frac{-2(x^2-1)}{(x-5)(x+4)} \times \frac{(x+4)(x+4)}{2x^2+2x-3x-3} \times \frac{6x^2-9x+2x-3}{6x(2x-1)}$$

$$= \frac{-2(x+1)(x-1)}{(x-5)(x+4)} \times \frac{(x+4)(x+4)}{2x(x+1)-3(x+1)} \times \frac{3x(2x-3)+1(2x-3)}{6x(2x-1)}$$

$$= \frac{-2(x+1)(x-1)}{(x-5)(x+4)} \times \frac{(x+4)(x+4)}{(x+1)(2x-3)} \times \frac{(2x-3)(3x+1)}{6x(2x-1)}$$

$x \neq 5, -4, -1, \frac{3}{2}, 0, \frac{1}{2}$

$$= \frac{-2\cancel{(x+1)}(x-1)\cancel{(x+4)}(x+4)\cancel{(2x-3)}(3x+1)}{6x(x-5)\cancel{(x+4)}\cancel{(x+1)}\cancel{(2x-3)}(2x-1)}$$

$$= \frac{-2(x-1)(x+4)(3x+1)}{6x(x-5)(2x-1)}$$

$$= \frac{-1(x-1)(x+4)(3x+1)}{3x(x-5)(2x-1)}; \quad x \neq 0, \frac{1}{2}, -1, \frac{3}{2}, -4, 5$$

holes

asymptotes

2. Given $f(x)$ above and $g(x)$ below,
   a. Is $g(x)$ equivalent to $f(x)$? Explain and show your work.
      Hint: you cannot factor $g(x)$!
   b. Strengthen/verify your claim by substituting two x-values into $f(x)$ and $g(x)$.

$$g(x) = \frac{-3x^3 - 10x^2 + 9x + 4}{6x^3 - 33x^2 + 15x}$$

a. I'll expand f(x) from #1

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

$$= \frac{(-x+1)(3x^2+x+12x+4)}{(3x^2-15x)(2x-1)}$$

$$= \frac{-x(3x^2+13x+4)+1(3x^2+13x+4)}{6x^3-3x^2-30x^2+15x}$$

$$= \frac{-3x^3-13x^2-4x+3x^2+13x+4}{6x^3-33x^2+15x}$$

$$= \frac{-3x^3-10x^2+9x+4}{6x^3-33x^2+15x}$$ *same as g(x)

$\boxed{\therefore f(x) = g(x)}$

b. ~~f(0)=~~ *Plug into original f(x) and g(x)

$$f(1) = \frac{-2(1)^2+2}{(1)^2-(1)-20} \div \frac{2(1)^2-(1)-3}{(1)^2+8(1)+16} \times \frac{6(1)^2-7(1)-3}{12(1)^2-6(1)}$$

$$= \frac{-2+2}{-20} \div \frac{-2}{26} \times \frac{-4}{6}$$

$$= 0 \times -13 \times -\frac{2}{3}$$

$\boxed{f(1) = 0}$

✓ same

$$g(1) = \frac{-3(1)^3-10(1)^2+9(1)+4}{6(1)^3-33(1)^2+15(1)}$$

$$= \frac{-3-10+9+4}{6-33+15}$$

$$= \frac{0}{-12}$$

$\boxed{g(1) = 0}$

3. Given the rational expression of $h(x)$ below,
   a. Simplify and state restrictions.
   b. Is $h(x)$ equivalent to $f(x)$ or $g(x)$?
   c. Strengthen/verify your claim by substituting the same 2 x-values into $h(x)$ that you substituted into $f(x)$ and $g(x)$ in question 2b.

$$h(x) = \frac{x^2+3x-4}{3x^2-15x} - \frac{-6x-2}{4x^2-22x+10}$$

a. $$h(x) = \frac{(x+4)(x-1)}{3x(x-5)} - \frac{-2(3x+1)}{2(2x^2-11x+5)}$$

$$= \frac{(x+4)(x-1)}{3x(x-5)} - \frac{-2(3x+1)}{2(2x^2-x-10x+5)}$$

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

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

$x \neq 0, 5, \frac{1}{2}$

$$= \frac{2(2x-1)}{2(2x-1)}\cdot\frac{(x+4)(x-1)}{3x(x-5)} - \frac{3x(-2)(3x+1)}{3x\,2(x-5)(2x-1)}$$

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

$$= \frac{(4x-2)(x^2+3x-4) - (-6x)(3x+1)}{(6x)\cancel{(2x^2-11x+5)}(x-5)(2x-1)}$$

$$= \frac{4x^3 + \cancel{12x^2} - 16x \cancel{-2x^2} - 6x + 8 + \cancel{18x^2} + 6x}{(6x)(x-5)(2x-1)}$$

$$= \frac{4x^3+28x^2-16x+8}{(6x)(x-5)(2x-1)}, \quad x \neq 0, 5, \frac{1}{2}$$

b. $\boxed{\text{not the same!}}$ because when simplified, the expressions are not equivalent

c. $$h(1) = \frac{(1)^2+3(1)-4}{3(1)^2-15(1)} - \frac{-6(1)-2}{4(1)^2-22(1)+10}$$

$$= \frac{0}{-12} - \frac{-8}{-8}$$

$$= 0 - 1$$

$$= -1$$

$h(1) = -1$ but $f(1) = g(1) = 0$

$\therefore h(1) \neq f(1)$ and $h(1) \neq g(1)$