

# Quiz #1-3 Key

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7:19 PM

## Precalculus Quiz 1-3 Hungerford 3.3-3.4A

Name: Key Per: \_\_\_\_\_  
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In questions 1-4, write the equation that would result from performing the indicated transformations, *in the order given*, to the function  $f(x) = x^2 + \frac{1}{x+2}$ . You need not simplify your answers. (2 pts each)

1. Translate right 5 units and up 3 units.

$$x \rightarrow x-5 \quad y-3 = (x-5)^2 + \frac{1}{(x-5)+2}$$

$$y \rightarrow y-3$$

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

2. Dilate by a factor of 2 vertically and a factor of 1/3 horizontally.

$$x \rightarrow 3x \quad y \rightarrow \frac{y}{2}$$

$$\frac{y}{2} = (3x)^2 + \frac{1}{3x+2} \Rightarrow y = 2 \left( (3x)^2 + \frac{1}{3x+2} \right)$$

3. Dilate by a factor of 2 horizontally and then translate left 3.

$$x \rightarrow \frac{x}{2} : y = \left( \frac{x}{2} \right)^2 + \frac{1}{\frac{x}{2}+2}$$

$$x \rightarrow x+3 : y = \left( \frac{x+3}{2} \right)^2 + \frac{1}{\frac{x+3}{2}+2} \text{ or } y = \left( \frac{1}{2}(x+3) \right)^2 + \frac{1}{\frac{1}{2}(x+3)+2}$$

4. Reflect over the x-axis, translate left 2, and reflect over the y-axis.

$$y \rightarrow -y \quad -y = x^2 + \frac{1}{x+2} \Rightarrow y = -x^2 - \frac{1}{x+2}$$

$$x \rightarrow x+2 \Rightarrow y = -(x+2)^2 - \frac{1}{x+2}$$

$$x \rightarrow -x \Rightarrow y = -(-x+2)^2 - \frac{1}{-x+2}$$

5. What transformations, in what order, produce the graph of  $y = \sqrt{4x+9}$  from the graph of  $y = \sqrt{x+1}$ ? (4 pts)

$$y = \sqrt{x+1} \rightarrow y = \sqrt{4x+1} : x \rightarrow 4x : \text{Dilate H by factor of } \frac{1}{4}$$

$$y = \sqrt{4x+1} \rightarrow y = \sqrt{4x+9} : x \rightarrow x+2 : \text{Translate left +2}$$

$$(4(x+2)+1) = 4(x+2)+1$$

6. What kind of symmetry does the graph of  $y = \frac{x}{4x^2+1}$  have? Justify your answer algebraically. (4 pts)

$$\text{Odd: } -y = \frac{-x}{4(-x)^2+1} \Leftrightarrow -y = \frac{-x}{4x^2+1} \Leftrightarrow y = \frac{x}{4x^2+1}$$

7. Let  $f(x) = 2x^3 + 4x$ . Write a simplified expression for  $Df(x)$ , the difference quotient of  $f(x)$ . (4 pts)

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

$$= \frac{6x^2h + 6xh^2 + 2h^3 + 4h}{h} = 6x^2 + 6xh + 2h^2 + 4$$

In questions 1-4, write the equation that would result from performing the indicated transformations, *in the order given*, to the function  $f(x) = x^2 + \frac{1}{x+2}$ . You need not simplify your answers. (2 pts each)

1. Translate right 3 units and up 7 units.

$$\begin{aligned} x &\rightarrow x-3 \\ y &\rightarrow y-7 \end{aligned} \quad y-7 = (x-3)^2 + \frac{1}{(x-3)+2} \Rightarrow y = (x-3)^2 + \frac{1}{(x-3)+2} + 7$$

2. Dilate by a factor of 2 vertically and by a factor of 1/5 horizontally.

$$\begin{aligned} x &\rightarrow 5x \\ y &\rightarrow \frac{1}{2}y \end{aligned} \quad \frac{1}{2}y = (5x)^2 + \frac{1}{5x+2} \Rightarrow y = 2 \left( (5x)^2 + \frac{1}{5x+2} \right)$$

3. Dilate by a factor of 4 horizontally and then translate left 5.

$$\begin{aligned} x &\rightarrow \frac{1}{4}x \\ x &\rightarrow x+5 \end{aligned} \quad y = \left( \frac{1}{4}x \right)^2 + \frac{1}{\frac{1}{4}x+2} \Rightarrow y = \left( \frac{1}{4}(x+5) \right)^2 + \frac{1}{\frac{1}{4}(x+5)+2}$$

4. Reflect over the  $x$ -axis, translate left 2, and reflect over the  $y$ -axis.

$$\begin{aligned} y &\rightarrow -y \\ x &\rightarrow x+2 \\ x &\rightarrow -x \end{aligned} \quad \begin{aligned} \textcircled{1} & -y = x^2 + \frac{1}{x+2} \\ \textcircled{2} & -y = (x+2)^2 + \frac{1}{(x+2)+2} \\ \textcircled{3} & -y = (-x+2)^2 + \frac{1}{-x+2+2} \end{aligned}$$

5. What transformations, in what order, produce the graph of  $y = \sqrt{6x+19}$  from the graph of  $y = \sqrt{x+1}$ ? (4 pts)

$$\begin{aligned} \textcircled{1} \quad y &= \sqrt{x+1} \Rightarrow y = \sqrt{6x+1} & \textcircled{2} \quad y &= \sqrt{6x+1} \Rightarrow y = \sqrt{6x+19} \\ x &\rightarrow 6x & 6x+19 &= (6x+18)+1 \\ & & &= 6(x+3)+1 \quad \therefore x \rightarrow x+3 \end{aligned}$$

Dilate H by  $\frac{1}{6}$

6. What kind of symmetry does the graph of  $y = \frac{x^2}{4x^2+1}$  have? Justify your answer algebraically.  $\therefore$  Translate L 3.

$$\text{Even: } \frac{(-x)^2}{4(-x)^2+1} = \frac{x^2}{4x^2+1} = y$$

7. Let  $f(x) = 3x^3 + 2x$ . Write a simplified expression for  $Df(x)$ , the difference quotient of  $f(x)$ .

$$\begin{aligned} Df(x) &= \frac{[3(x+h)^3 + 2(x+h)] - [3x^3 + 2x]}{h} \\ &= \frac{9x^2h + 9xh^2 + h^3 + 2h}{h} = 9x^2 + 9xh + h^2 + 2 \end{aligned}$$