Applications of Rational Function Test Review   Name: _____

(*problems are NON-Calculator)

Review is due on the day of your test.   As always, show ALL work and answers on a separate sheet of paper.   You will not receive any credit for work/answers written on this page.

#1-5: Multiply or divide. State any restrictions on the variables.

*1. $\dfrac{a^2}{8b^3} \cdot \dfrac{3b^5}{8a^3}$ $\dfrac{3b^2}{64a}$ $a \neq 0$ $b \neq 0$

*2. $\dfrac{a^2}{a+3} \cdot \dfrac{a^2-2a-15}{a^2-1a}$ $\dfrac{a^2-5a}{a-1}$ $a \neq -3, 0, \text{ or } 1$

*3. $\dfrac{x^2+x-2}{x+3} \cdot \dfrac{x^2-7x-30}{2x^2-x-1}$ $\dfrac{x^2-8x-20}{2x+1}$ $x \neq -3, -\tfrac{1}{2}, \text{ or } 1$

*4. $\dfrac{w+2}{w+1} \div \dfrac{w-5}{w^2+3w+2}$ $\dfrac{w^2+4w+4}{w-5}$ $w \neq -2, -1 \text{ or } 5$

*5. $\dfrac{x^2-9}{x^2+5x+6} \div \dfrac{x^2+2x-15}{x^2+x-20}$ $\dfrac{x-4}{x+2}$ $x \neq -5, -3, -2, 3 \text{ or } 4$

#6-7: Find the least common denominator.

*6. $\dfrac{3}{x^2+x-12}$ and $\dfrac{x}{x^2+2x-15}$ $(x-3)(x+4)(x+5)$

*7. $\dfrac{3x}{x^2-11x+30}$ and $\dfrac{-2}{x^2-10x+24}$ $(x-5)(x-6)(x-4)$

#8-10: Add or subtract. Simplify if possible.

*8. $\dfrac{7}{c+4} + \dfrac{1}{c^2-16}$ $\dfrac{7c-27}{c^2-16}$

*9. $\dfrac{w^2-11w+24}{w^2-7w+12} - \dfrac{3}{w-4}$ $\dfrac{w-11}{w-4}$

*10. $\dfrac{x}{9} + \dfrac{3y}{3} - \dfrac{2x}{6}$ $\dfrac{-2x+9y}{9}$

*#11-12: Simplify the complex fraction.

*11. $\dfrac{\frac{1}{x+2}}{\frac{2}{x}-5}$ $\dfrac{x}{-5x^2-8x+4}$

*12. $\dfrac{\frac{d+5}{d^2+11d+24}}{\frac{d+2}{d+3}}$ $\dfrac{d+5}{d^2+10d+16}$

*#13-16: Solve the equation. Check the solution.

*13. $\dfrac{x+2}{x+1} = \dfrac{x+5}{x+3}$ $x=1$

*14. $\dfrac{2}{x+2} = \dfrac{-3}{x+3}$ $x=-\dfrac{12}{5}$

*15. $\dfrac{x}{x^2-25} + \dfrac{4}{x-5} = \dfrac{1}{x+5}$ $-\dfrac{25}{4}$

*16. $\dfrac{1}{x-3} = \dfrac{3}{x^2+2x-9}$ $x=0 \text{ or } 1$

17. If R is the total resistance for a parallel circuit with two resistors of resistances r_1 and r_2, then $\dfrac{1}{R} = \dfrac{1}{r_1} + \dfrac{1}{r_2}$. Find the resistance r_1 if the total resistance R is 65 ohms and r_2 is 90 ohms. Round your answer to the nearest ohm if necessary.   **38 ohms**

18. A school club bought a bunch of tables from IKEA, but they have to put them together.   Working alone, James can put together a table in 3 hours. Stewart can put together a table in 7 hours. Write an equation that can be used to find how long it will take them working together to build a table. How many hours will it take them to put together a table? If necessary, round your answer to the nearest hundredth.   **2.1 hours**

19. You and your brother work together cleaning the house for your mom.   Usually you work together, and it takes three and a half hours to clean the entire house.   Your brother has done it by himself before, and it takes him 5 hours to do by himself.   How long would it take you to clean the whole house by yourself?   **$11\tfrac{2}{3}$ hours**

20. Joseph can row 7 miles downstream in the same time it takes him to row 3 miles upstream. He rows downstream 5 miles/hour faster than he rows upstream. Find Joseph's rowing rate each way. Round your answers to the nearest tenth, if necessary. *(Hint: You will need to make a table and use $d = rt$.)*

DS: 8.75   US: 3.75

21. You can bike 8 miles in the same time it takes your friend to walk 2 miles. You ride your bike 15 miles per hour faster than your friend can walk. How fast are you and your friend going? *(Hint: You will need to make a table and use $d = rt$.)*

You: 20   Your friend: 5

22. If a rectangle has a fixed area, and the length of the rectangle varies inversely with the width. What is the equation that would represent this situation for the area of 42 square feet?

$$l = \frac{42}{w}$$

Intro to Rational Functions Review:

#23-24: Write a rational function using the parent function $f(x) = \frac{1}{x}$, from the graph, table, or description provided. Explain your reasoning.

$\frac{2x}{x+6}$

*23. Vertical asymptote at $x = -6$ and horizontal asymptote at $y = 2$.

*24. The domain is all real numbers except 5 ($x \neq 5$), the range is all real numbers except 0 ($y \neq 0$). $\frac{1}{x-5}$

#25: Find any points of discontinuity for the rational function.

*25. $y = \dfrac{x - 8}{x^2 - x - 30}$ $x \neq 6 \text{ or } -5$ ← both VA

#26-27: Use algebra to determine the vertical asymptotes and/or removable discontinuities (holes) of each function. Explain your reasoning.

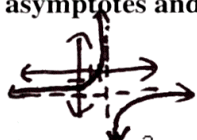*26. $y = \dfrac{(x - 4)(x + 5)}{(x + 5)(x - 5)}$ VA: x=5 RD: $(-5, \frac{9}{10})$

*27. $y = \dfrac{x^2 + 2x + 1}{x^2 + x - 6}$ VA: x= -3 x= 2

#28-29: Sketch the asymptotes and graph the function. Identify the domain and range. Identify the y-intercept (if any).
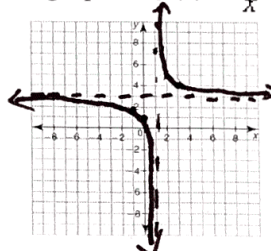
*28. $y = \dfrac{-2}{(x-3)^2} - 3$

*29. $y = \dfrac{3}{x - 1} - 1$

*30. Consider the function $g(x) = \dfrac{2}{x - 1} + 3$.

a. Describe how you would obtain the graph of $g(x)$ from the graph of $f(x) = \frac{1}{x}$. →1 ↑3 VS x2

b. Determine the vertical asymptotes of g(x) x=1

c. Determine the horizontal asymptotes of g(x). y=3

d. Determine the domain and range of g(x). x≠1 y≠3

e. Determine the y-intercept of g(x) (0,1)

f. Sketch the graph of g(x).

Polynomial Unit review:
#31-35: These are review problems from the Polynomials Unit.

31. Find the zeroes of $(x) = (x + 2)^4(x - 9)^3$ and state the multiplicity. -2 (m:4), 9 (m:3)

32. Describe the end behavior of the function: $f(x) = x^5 - x^3 + x - 4$ ↓ ↑

33. Factor the expression completely and solve: $x^4 - 25x^2 + 144 = 0$ $(x+3)(x-3)(x+4)(x-4)=0$ x= ±3 or ±4

34. Divide using synthetic division. Determine whether the binomial is a factor of the polynomial.
$x^4 - 2x^3 - x^2 - 4x - 6$ by $(x + 2)$ $x^3-4x^2+7x-18 +30/x+2$ Not a factor

35. A function and one of its factors is given. Use synthetic division to determine the other 2 factors.
$f(x) = x^3 + 5x^2 + 11x + 10; x + 2$ $(x+2)(x^2+3x+5)$