PreCalculus UNIT 7
RATIONAL FUNCTIONS (<mark>MHF</mark>) – journal questions
Summarize everything you need to know about these topics. Use examples and concise (not long – but with enough detail) explanations. Include definitions and diagrams if necessary

1. REVIEW Simplifying Rational Expressions
    Read over UNIT A part 2 before you begin

NOTES TO MAKE	EXAMPLES TO SHOW, state restrictions at the end
a. Make notes • Talk about a common error students make in cancelling terms. Explain how/when you are allowed to cancel and when you cannot • Stress the importance of factoring first. How does factoring first make this example easier?	$\dfrac{k^2+k}{k^2-k} \times \dfrac{3k-21}{2k^2-11k-21}$
b. Make notes • The only time you EXPAND is in Add/Subtract type of questions, and even then ONLY in the NUMERATOR to clear brackets within brackets. Otherwise always factor. • Be careful to distribute the negative throughout the second fraction when subtracting. • Stress the importance of factoring first. Talk about what type of computations you'd have to do on the given example if you tried to find LCD without factoring first.	$\dfrac{x-6}{x^2-3x+2} - \dfrac{3x+2}{x^2-x-2}$
c. Make a note to remember to state restrictions before AND after the flip in division questions. Which restriction in the given example would be missed if the flip is done before factoring?	$\dfrac{6x-6}{x^2} \div \dfrac{3x-3}{x^2+2x}$

2.
    a. Copy/Paste the following

ALGORITHM for Sketching RATIONAL Functions	**Finding Asymptotes**
• Factor if possible, factors that _____ create "Holes" (removable discontinuities), make a note of how to find the y-value of where the open circle is to be drawn: _____ _____ • Find HA/OA (the end behavior of the graph) • Find VAs (essential discontinuities) • Find Intercepts (both x and y) • Test intervals to finish off the graph OR Look at multiplicities of Zeros (cut, bounce, or bend?) Look at multiplicities of VA's (graph going to same infinity or opposite infinity on either side?)	Suppose $f(x)=\dfrac{P(x)}{Q(x)}$ is a rational function with the degree of $Q(x)$ at least 1. **For HA/OA look at degrees** • If degree of $Q(x)$ is bigger than degree of $P(x)$ then HA is y = 0 • If degrees are equal then HA is $y = \dfrac{a}{b}$ where a and b are leading coefficients of $P(x)$ and $Q(x)$ respectively • If degree of $Q(x)$ is smaller by ONE than degree of $P(x)$ then OA is y = quotient **For VA** Find restrictions that do not cancel

    Sketch using the algorithm:

    b. $y = \dfrac{x^3-8}{x^2-3x-4}$ c. $f(x) = \dfrac{2x^2+3x+1}{x^3-5x^2-x+5}$ d. $f(x) = \dfrac{-2(x-1)^2(x+3)^5}{(x-2)^3(x+1)^2(x-5)^2}$

3. Other NOTES
    a. Which asymptotes can be crossed by the graph?
    b. A rational of the form $\dfrac{1}{polynomial}$ can be drawn using "reciprocal of polynomial" method done in UNIT 6 Polynomial Journal #9b.

        Show a sketch of $y=\dfrac{1}{(x+3)(x-5)}$ using this method. Explain.

    c. A rational of the form $\dfrac{linear}{linear}$ can be written as a transformed parent rational $\dfrac{a}{k(x-d)} + c$ after long division and then drawn by using

        transformations learned in UNIT F Functions journal. Show $y = \dfrac{x+4}{-2x-6}$ example by converting it into transformed form and sketching

        (ensure shifts and reflections are shown, stretch/compress can be ignored if you do not label points or scale).

    d. Sketch the full graph of and talk about finding an x-intercept of $y = \dfrac{2x}{x^2+1} + 1$, and make it clear that x-int is found by setting y=0,

        not just by looking at the factors of the numerator (that method only works if there is no 'c')

4. Solving rational and radical EQUATIONS
    a. Explain and show how to solve a RATIONAL equation

    $$2(2x+1) = \frac{3x^2 - 12x - 5}{x - 4}$$

    b. Explain and show how to solve an IRRATIONAL equation (AP)

    $$x + 1 = \sqrt{3x + 7}.$$

    c. Explain how to solve question 4b GRAPHICALLY ie. Graphs of the two functions (one from each side of equals sign) on the same grid and looking at POIs

5. Solving rational and radical INEQUALITIES
    a. Explain and show how to solve a RATIONAL inequality
        - Make a note why cross multiplying is wrong
        - Make a note to watch what endpoint of the interval to include or not based on whether it is a zero or a VA

    $$7x + 11 \le \frac{x - 3}{2x + 1}$$

    b. Explain and show how to solve an IRRATIONAL inequality (AP)

    $$x + 1 > \sqrt{x^2 - 2x}.$$

6. Solve WORD PROBLEMS
    a. Solve and include explanation of set ups of equations for:
        - **Motion/Rate problem**
          A boat travels 40 km upstream and then returns to its starting point. If the entire trip, both ways, take 1.8 hours and the speed of the current is 5km per hour, determine the speed of the boat in still water. Note one direction the speed, against the current, will be 5 km/h less than that in still water, while the other direction, with the current, the speed will be 5 km/h more than that in still water.

        - **Work problem**
          A painter works on a job for 10 days and is then joined by her helper. Together they finish the job in 6 more days. Her helper could have done the job alone in 30 days. How long would it have taken the painter to do the job alone?

        - **% problem**
          Todd has answered 11 of his last 20 daily quiz questions correctly. His baseball coach told him that he must bring his average up to at least 70% if he wants to play in the season opener. Todd vows to study diligently and answer all of the daily quiz questions correctly in the future. How many consecutive daily quiz questions must he answer correctly to bring his average up to 70%?