Unit 6 Assignment Calendar

Date	Day	Assignment
---------	----------	**6.0 Factoring Review** HW: 6.0 Practice **(Optional)**
1/9/24 1/10/24	Tuesday Wednesday	**6.1: Graphing Rational Functions in Graphing Form** HW: 6.1 Practice
1/11/24 1/12/24	Thursday Friday	**6.2: Graphing Rational Functions in General Form** HW: 6.2 Practice
1/16/24 1/17/24	Tuesday Wednesday	**6.3: Graphing Rational Functions with Holes** HW: 6.3 Practice
1/18/24 1/19/24	Thursday Friday	**6.4: Simplifying, Multiplying, and Dividing Rational Expressions** HW: 6.4 Practice
1/22/24 1/22/24	Monday Tuesday	**6.5: Adding and Subtracting Rational Expressions** HW: 6.5 Practice
1/24/24 1/25/24	Wednesday Thursday	**6.6: Solving Rational Equations and Systems** **HW:** 6.6 Practice
1/26/24 1/29/24	Friday Monday	**6.7: Slant Asymptotes and Graphing Review** HW: 6.7 Practice
1/30/24 1/31/24 2/1/24 2/2/24	Tuesday Wednesday Thursday Friday	**Unit 6 Practice Test** HW: Unit Practice Test (and study!)
2/5/23 2/6/23	Monday Tuesday	**Unit 6 Test**

- **Need help? Try** www.khanacademy.org , www.purplemath.com , or www.mathguy.us
- www.washoeschools.net/DRHSmath has the link to YouTube lesson videos, all notes, all worksheets
- Students who complete all assignments this semester will earn a 2% bonus.
- All late assignments must be turned in prior to the Unit 6 Test in order to earn credit.

6.0 Factoring Practice (Optional – only do this if you think you need extra practice)

For #1 – 13, factor each expression completely.

1) $b^2 + 3b - 40$
2) $x^2 + 9$
3) $c^4 + c^2 - 12$
4) $m^2 - 16h^8$
5) $k^3 + 27$
6) $2x^2 + 5x + 3$
7) $16g^2 + 8g + 1$
8) $4r^2 - 25$
9) $3x(x + 2y)^2 - 4(x + 2y)^3$
10) $-12y^2 + 36y - 27$
11) $2x^3 - 7x^2 + 3x$
12) $4x^3 - 32$
13) Explain how to add/subtract fractions with like denominators.
14) $\frac{4}{16} + \frac{5}{16}$
15) $\frac{4}{12} - \frac{13}{12}$
16) Explain how to add/subtract fractions with unlike denominators.
17) $\frac{9}{16} + \frac{3}{4}$
18) $\frac{1}{15} - \frac{1}{6}$
19) Explain how to multiply fractions.
20) $\frac{10}{3} \cdot \frac{9}{4}$
21) $\frac{9x}{10} \cdot \frac{12}{5x}$
22) Explain how to divide fractions.
23) $\frac{1}{2} \div \frac{5}{8}$
24) $\frac{6}{35x} \div \frac{3}{7x}$

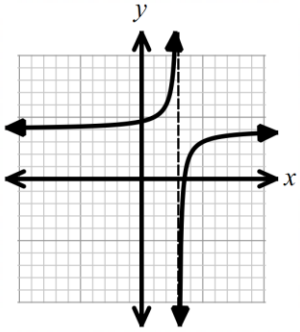
6.1 Practice Problems

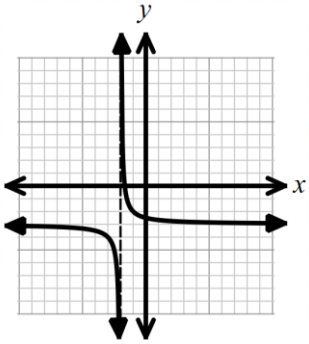
For #1 – 8, graph each rational function. Identify the domain, range, and equations of the horizontal and vertical asymptotes.

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

5) $y = \frac{4}{x-1} - 2$ 6) $g(x) = \frac{2}{x} - 4$ 7) $y = \frac{-1}{x+5} + 1$ 8) $y = \frac{5}{x}$

For #9 – 12, describe the end behavior for each rational function.

9) 

10) 

11) $y = \frac{5}{x+6} - 11$ 12) $g(x) = -\frac{3}{x}$

13) A rational function has a vertical asymptote at $x = 4$, a horizontal asymptote at $y = -2$, a vertical stretch by a factor of 3, and is vertically reflected compared to the parent function. Write the equation of the rational function, and describe its domain and range.

14) A rational function has the following domain and range. $D = \{x|x \neq -3\}$ and $R = \{y|y \neq 5\}$. Write the equations of the vertical and horizontal asymptotes.

15) Graph $f(x) = -\frac{1}{2}(x-2)^2 + 3$. Find domain and range. 16) Find all of the zeros of $f(x) = x^3 - 3x^2 + 4x - 2$

17) Write the simplest polynomial function with the zeros $3i, \sqrt{2}, -4$.

18) The parent function $y = \frac{1}{x}$ is shifted horizontally to the left 3 and vertically up 2. It is also vertically stretched by a factor of 5. Write the equation of the rational function after these transformations.

6.2 Practice Problems

For #1 – 4, write the equations of any asymptotes.

1) $g(x) = \frac{x^2+2x-15}{x^2-36}$ 2) $h(x) = \frac{3x^2-3}{x+2}$ 3) $y = \frac{5x-3}{x^2-25}$ 4) $y = \frac{3x^2-6x}{x^2+4x-5}$

For #5 – 10, graph the vertical and horizontal asymptotes. Then test a point on each side of the vertical asymptote(s) and sketch the graph. Identify the domain and range.

5) $y = \frac{x-2}{x+4}$ 6) $y = \frac{4}{(x-1)^2}$ 7) $f(x) = \frac{2x-6}{x+5}$

8) $g(x) = \frac{3x^2}{x^2-2x-8}$ 9) $y = \frac{x+3}{x^2+4x}$ 10) $y = \frac{2x^2+5x-12}{3x^2+5x-2}$

For #11 – 12, find the *x*- and *y*-intercepts, as well as the equations of the horizontal and vertical asymptote(s).

11) $f(x) = \frac{2x^2+3x-20}{x^2-6x-27}$ 12) $y = \frac{2x}{x^2-64}$

For #13 – 14, graph each rational function completely. Write the equations of all asymptotes, identify all intercepts, describe the domain and range (in set notation), and describe the end behavior.

13) $y = \frac{2x+6}{x-1}$ 14) $f(x) = \frac{4x-2x^2}{x^2+5x-6}$

15) Multiple Choice: Which rational functions have the following end behavior: **as $x \to \infty, y \to -3$; and as $x \to -\infty, y \to -3$** Select **all that apply.**

A) $y = -\frac{3}{x-2}$ B) $y = \frac{4-3x}{x+2}$ C) $g(x) = \frac{2}{x+5} - 3$ D) $\frac{3-6x^2}{2x^2-1}$

16) Factor $125x^3 - 343$

6.3 Practice Problems

For #1 – 4: For each rational function, write the coordinates for any holes in the graph.

1) $y = \frac{(x-2)}{x^2-4}$ 2) $h(x) = \frac{5x-15}{x^2-7x+12}$ 3) $g(x) = \frac{2x}{7x-3x^2}$ 4) $y = \frac{x^2-1}{2x^2+x-3}$

For #5 – 8: Graph each rational function. Include all asymptotes, intercepts, and holes. Write the domain and range.

5) $f(x) = \frac{x+2}{x^2+5x+6}$ 6) $y = \frac{3x^2-12}{x^2+2x}$ 7) $g(x) = \frac{x^2-2x+1}{x^2-1}$ 8) $y = \frac{x^2+7x+10}{x^2-4x-12}$

9) Describe the end behavior for the function in #6.

10) Describe the end behavior for the function in #8.

11) Given the function, $f(x) = -2x^2 + 4x - 11$, determine the maximum or minimum value.

12) State the domain and range of the function: $y = \frac{x+7}{3x-15}$ in set notation.

13) Simplify, assume all variables are positive: $\sqrt[4]{625x^{48}y^{36}z^{72}}$

14) Find $g(h(x))$ and $h(g(x))$ for $g(x) = 5x$ *and* $h(x) = 3x + 8$.

6.4 Practice Problems

For #1 – 14, simplify each expression. Identify the restrictions on the domain, if any, for #1 – 9.

1) $\frac{n^2+2n-24}{n^2-11n+28}$ 2) $\frac{x^2-2x-3}{x^2-1}$ 3) $\frac{x^2-x-12}{x^2+x-20}$ 4) $\frac{x^2-36}{x+5} \div (x+6)$ 5) $\frac{3x^3}{6y^3} \cdot \frac{y^5}{x^5}$

6) $\frac{x^2+4x}{x^2-6x+8} \cdot \frac{x^2-x-2}{3x^3+12x^2}$ 7) $\frac{x^2+8x-20}{5x^3+50x^2} \div \frac{x^2+9x}{x^2+7x-18}$ 8) $\frac{(x+2)^2}{x-5} \cdot \frac{x^2-2x}{x^2-4}$

9) $\dfrac{\frac{x^2-4x+4}{15x}}{\frac{x-2}{5x}}$ 10) $\frac{x^2y^3}{3x^4} \cdot \frac{(xy)^2}{x^3y} \div \frac{x^2y^4}{6y^3}$ 11) $\frac{x+2}{x+9} \cdot \left[\frac{x^2+9x}{x^2-4} \div \frac{3x^2+6x}{x^2+2x}\right]$

12) $\frac{x^2+4x}{x^2-4x-12} \cdot \frac{x^2-9x+18}{2x}$ 13) $\frac{x-4}{x^3+1} \cdot (x^2 - x + 1)$ 14) $\frac{x-2}{2x^2-x-3} \div \dfrac{\frac{x^2-4x-5}{x^2-36}}{\frac{x^2-6x+5}{x^2+7x+6}}$

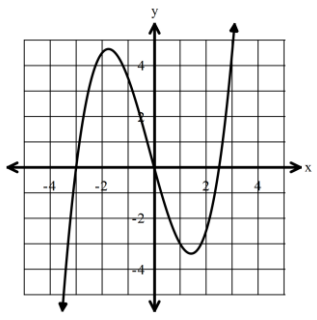
15) Solve the system: $\begin{cases} 3x - 2y = 7 \\ 4y = 2x + 6 \end{cases}$

16) Multiple Choice. Simplify: $\dfrac{\frac{x^2-9x+14}{x^2-6x+5}}{\frac{x^2-8x+7}{x^2-7x+10}}$

A) $\frac{(x-7)^2}{(x-5)^2}$ B) $\frac{(x-2)^2}{(x-1)^2}$ C) $\frac{(x-5)(x-7)}{2(x-1)}$ D) $\frac{(x-7)}{2(x-1)}$

17) The function $f(x) = \frac{1}{2}x^3 + \frac{1}{4}x^2 - \frac{15}{4}x$ is graphed to the right. Over which intervals of x is $f(x)$ positive?

For #17:



6.5 Practice Problems

For #1 – 8, simplify each expression. Identify the restrictions on the domain, if any

1) $\frac{-2x+3}{15x}+\frac{-x-3}{15x}$

2) $\frac{9}{x+3}+\frac{2}{x-3}$

3) $\frac{3x+4}{x^2-16}-\frac{2}{x-4}$

4) $\frac{4x}{x^2-9}+\frac{2}{x+3}-\frac{2}{x-3}$

5) $\dfrac{\frac{2}{x-6}}{\frac{3}{x}+5}$

6) $\dfrac{\frac{2}{x+2}-\frac{3}{x}}{\frac{3}{x+2}+\frac{2}{x}}$

7) $\dfrac{\frac{x^2+14x+49}{32x}}{\frac{x+7}{8x}}$

8) $\frac{x+1}{x^2+6x+9}+\frac{6}{x^2-9}$

9) Rewrite the function in vertex form:

$f(x)=2x^2+16x+18$

10) Simplify $\frac{3}{5-\sqrt{7}}$

11) Simplify $\frac{2i(6-4i)}{3+3i}$

12) Simplify $5i^{37}\sqrt{-18}\sqrt{6}$

13) Perform the indicated operation: $\frac{x+2}{x+5}\cdot\frac{\frac{x^2}{x+2}}{\frac{x+1}{x+5}}$

A. $\frac{x^2(x+1)}{(x+5)^2}$ B. $\frac{(x+2)^2}{x^2(x+1)}$

C. $\frac{(x+5)^2}{x^2(x+1)}$ D. $\frac{x^2}{x+1}$

14) Simplify: $\frac{1}{1-x}+\frac{x}{x-1}$

A. 1 C. $\frac{x+1}{1-x}$

B. $\frac{x+1}{x-1}$ D. $\frac{x+1}{(x-1)^2}$

15) If you want to show that the polynomial identity $\frac{x+y}{xy}=\frac{1}{x}+\frac{1}{y}$ (where x and y ≠ 0) is true, what should be your first step on the right-hand side of the equal sign?

6.6 Practice Problems

For #1 – 13, solve each equation. If needed, simplify radical answers.

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

2) $\frac{3}{k^2-1}=\frac{3}{k+1}$

3) $\frac{x+2}{4x}-\frac{3}{2x}=\frac{1}{8}$

4) $\frac{4}{j-1}-\frac{1}{j-3}=0$

5) $\frac{x-7}{x+9}=\frac{x+1}{x-4}$

6) $\frac{k}{k+1}+\frac{1}{k-1}=\frac{4k-3}{(k+1)(k-1)}$

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

8) $\frac{3x}{x-3}+\frac{5x}{x+1}=\frac{8x^2-8x-12}{x^2-2x-3}$

9) $\frac{2x}{x-4}+\frac{3x}{x+5}=\frac{4x^2-x+6}{x^2+x-20}$

10) $\frac{10}{x+4}+2=\frac{15}{x+1}$

11) $\frac{x}{x-2}+\frac{1}{x-4}=\frac{2}{x^2-6x+8}$

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

13) $\frac{5}{a-5}-1=\frac{a}{a-5}$

14) Graph the following rational function. Identify any holes or asymptotes, and the domain and range. $y=\frac{3x}{x^2-4}$

6.6 Practice Continued on the next page…

15) Which statement describes the end behavior of the function $f(x) = \frac{-5x+4}{2x-3}$?

A. as $x \to -\infty, f(x) \to +\frac{3}{2}$ and as $x \to +\infty, f(x) \to -\frac{5}{2}$

B. as $x \to -\infty, f(x) \to -\infty$ and as $x \to +\infty, f(x) \to +\frac{3}{2}$

C. as $x \to -\infty, f(x) \to -\frac{5}{2}$ and as $x \to +\infty, f(x) \to -\frac{5}{2}$

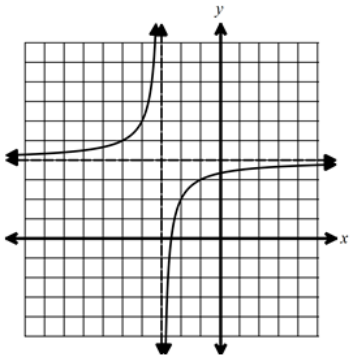
D. as $x \to -\infty, f(x) \to -\infty$ and as $x \to +\infty, f(x) \to -\frac{5}{2}$

16) Multiple Choice: Perform the indicated operation: $\frac{\frac{x-3}{2}}{\frac{-4}{x+1}+\frac{x}{3}}$

A. $\frac{3x+3}{2(x+4)}$ C. $\frac{3x^2-6x-9}{-8x}$

B. $\frac{x^3-x^2-15x+36}{6(x+1)}$ D. $\frac{3x^2-6x-9}{2(-4+x)}$

17) Let $f(x) = -\frac{2}{x+3} + 4$ and $g(x) = -x$.
Use the graph of $f(x)$ to the right to help determine the values of x for which $f(x) = g(x)$.



18) Graph the function $f(x) = \frac{2x^2+6x}{x^2-9}$ and $g(x) = 3x - 10$. Find the x-coordinates of the solutions.

19) Let $f(x) = \frac{x^2-3x-10}{x^2+5x+6}$ and $g(x) = -\frac{1}{4}x + \frac{5}{4}$. Find the solutions when $f(x) = g(x)$.

20) Write a linear equation $f(x)$ that has solutions with $g(x) = \frac{3x+4}{x-4}$ of (8, 7) and (0, -1).

21) Find the values for x for which $f(x) = g(x)$ if $f(x) = \frac{1}{x-4} - 3$ and $g(x) = x - 7$.

6.7 Practice Problems

For #1 – 6, graph each rational function. Identify the domain, range, asymptotes, holes, and end behavior.

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

4) $f(x) = \frac{x^2+3x-4}{x-2}$ 5) $y = \frac{x^2+2x-15}{x^2-36}$ 6) $y = \frac{6x^2-24}{2x^2-4x}$

For #7 – 8: write the equation of the slant asymptote for each rational function.

7) $f(x) = \frac{3x^2-4x+7}{x-3}$ 8) $y = \frac{-2x^2+5}{x+1}$

6.7 Practice Continued on the next page…

9) Multiple Choice: Perform the indicated operation: $\frac{4x+5}{x^2-25}+\frac{7}{x-5}$

A. $\frac{11x+40}{x^2-25}$ B. $\frac{4x+12}{x^2-25}$
C. $\frac{11x+40}{x-5}$ D. $\frac{4x+12}{x-5}$

10) Simplify, and identify the domain restrictions:

$$\frac{3x^2-27}{x^2+5x+6}$$

11) Write the function, $g(x)=\frac{3x-1}{x+4}$ in graphing form.

12) Write the function, $f(x)=\frac{4x-14}{x-6}$ in graphing form.

13) Translate the graph of $g(x)=\frac{3x-6}{x-1}$ two units up and three units left. Write the answer in graphing form.

14) Translate the graph of $f(x)=\frac{6x+7}{x+1}$ one unit down and four units left. Which of the following is the function after the translations?

A. $f(x)=\frac{1}{x-4}-1$ C. $f(x)=\frac{6}{x-4}-1$

B. $f(x)=\frac{1}{x-3}+5$ D. $f(x)=\frac{1}{x+5}+5$

15) Write the end behavior of the function $h(x)=\frac{2}{x-3}+4$

16) Translate the graph f(x) = $\frac{4x+1}{x+3}$ 6 units left and 2 units down. Write the equation after the translations.

17) State the domain and range for the function $f(x)=\frac{1}{x-4}+3$

18) Solve for x: $\frac{3}{x-2}+4=\frac{5x}{x^2-4}$

Unit 6 Practice Test (Continued on the next page)

For # 1 – 4, graph each function without a calculator*. Identify the domain, range, and any asymptotes or holes. Describe the end behavior.

1) $y=\frac{5}{x-1}-2$ 2) $y=\frac{4x+19}{x+3}$ 3) $f(x)=\frac{6x^2}{x-2}$ 4) $y=\frac{x^2-9}{x^2+2x-15}$

***For 3, can use a calc to find the range.**

For # 5 – 19, simplify the rational expression, and state any restrictions on the domain.

5) $\frac{x^2-x-20}{x^2-2x-15}$ 6) $\frac{x^2-36}{x^2+12x+36}$ 7) $\frac{80x^4}{y^3}\cdot\frac{xy}{5x^2}$ 8) $\frac{x-3}{2x-8}\cdot\frac{6x^2-96}{x^2-9}$

9) $\frac{x-3}{x-5}\cdot\frac{x^2-4x+3}{4x^2-9}\div\frac{x^2-9}{2x^2-x-3}$ 10) $\frac{x^2-13x+40}{x^2-2x-15}\div\frac{1}{x^2-5x-24}$ 11) $\frac{7}{5x}-\frac{4}{3x}$

12) $\frac{5x^2y^3}{x^7}\div\frac{30xy^4}{y^2}$ 13) $\frac{x^2-x-2}{x^2+4x-5}\div\frac{x-2}{5x+25}$ 14) $\frac{x}{x-2}+\frac{7}{x-1}$ 15) $\frac{2}{x^2+4x-21}+\frac{x}{x+7}-\frac{5}{2(x-3)}$

16) $\frac{\frac{4x-8}{9x}}{\frac{3x^2-12}{12x^3}}$ 17) $\frac{x-5}{2x^2-3x-5}\div\frac{\frac{x^2-6x+5}{x^2-1}}{\frac{x^2+9x+14}{x^2+8x+7}}$ 18) $\frac{5x^{-1}+2x^{-2}}{3x^{-2}-2x^{-1}}$ 19) $\frac{\frac{1}{x}-1}{\frac{1}{x}+1}$

For #20 – 25, solve each equation. Simplify radical answers.

20) $\frac{2}{x+2}=\frac{6}{2x+5}$ 21) $\frac{x+12}{3}=\frac{2x+3}{x+2}$ 22) $\frac{3x}{x+1}=\frac{12}{x^2-1}+2$ 23) $\frac{2(x+7)}{x+4}-2=\frac{2x+20}{2x+8}$

24) $\frac{4x}{x+2}+\frac{5x}{x+4}=\frac{9x^2-3x-7}{x^2+6x+8}$ 25) $\frac{9}{x+2}+1=\frac{4}{x-3}$

26) The function $y=\frac{1}{x}$ is translated one unit to the right and up four units. Write a simplified rational expression for this function.

27) Identify any holes and/or **vertical** asymptotes for the following function: $f(x)=\frac{6x^3-24x}{x^2+2x-8}$.

28) Describe the transformations of $g(x)$ from the parent function $y=\frac{1}{x}$ if $g(x)=\frac{1}{x-3}+2$.

29) If each of the following expressions is defined, which is equivalent to $x-1$?

A. $\frac{(x+1)(x-1)}{(x-1)}$ C. $\frac{(x+1)(x+2)}{x-2}\div\frac{x+2}{x-2}$

B. $\frac{(x-1)(x+2)}{x+1}\cdot\frac{x+1}{x+2}$ D. $\frac{x+1}{x+2}+\frac{x-1}{x+2}$

30) Write the function in graphing form: $f(x)=\frac{2x-10}{x-4}$ 31) Write the equations of all asymptotes for $y=\frac{3x^2+x+7}{x+4}$

32) Translate the graph of $f(x)=\frac{5x+1}{x-2}$ three units up and 4 units to the left. Write the function in graphing form.

6.0 Factoring ANSWERS

1) $(b+8)(b-5)$ 2) $(x+3i)(x-3i)$ 3) $(c+2i)(c-2i)\left(c+\sqrt{3}\right)(c-\sqrt{3})$ 4) $(m+4h^4)(m-4h^4)$

5) $(k+3)(k^2-3k+9)$ 6) $(2x+3)(x+1)$ 7) $(4g+1)^2$ 8) $(2r+5)(2r-5)$

9) $-(x+2y)^2(x+8y)$ 10) $-3(2y-3)^2$ 11) $x(2x-1)(x-3)$ 12) $4(x-2)(x^2+2x+4)$

13) Add the numerator, keep denominator the same. 14) $\frac{9}{16}$ 15) $-\frac{3}{4}$

16) Multiply by the appropriate number(s) to get a common denominator. Then proceed as in #14 above. 17) $\frac{21}{16}$ 18) $-\frac{1}{10}$

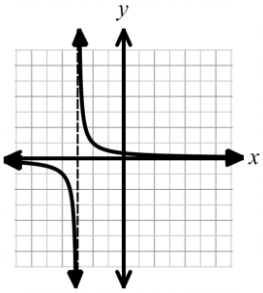
19) Multiply numerator and denominator straight across. Reduce if possible. 20) $\frac{15}{2}$ 21) $\frac{54}{25}$

22) Multiply by the reciprocal of the fraction after the division sign. 23) $\frac{4}{5}$ 24) $\frac{2}{5}$

6.1 Practice Problems ANSWERS

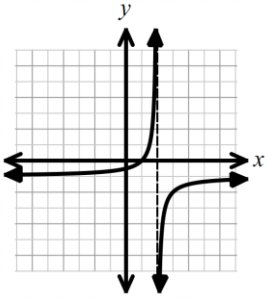
For #1 – 8, graph each rational function. Identify the domain, range, and equations of the horizontal and vertical asymptotes.

1)



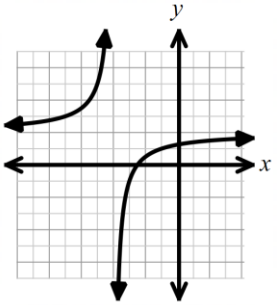
D: $\{x\|x\neq -3\}$
R: $\{y\|y\neq 0\}$
HA: $y=0$
VA: $x=-3$

2)



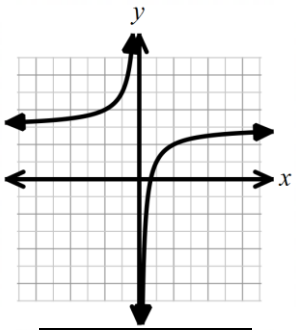
D: $\{x\|x\neq 2\}$
R: $\{y\|y\neq -1\}$
HA: $y=-1$
VA: $x=2$

3)

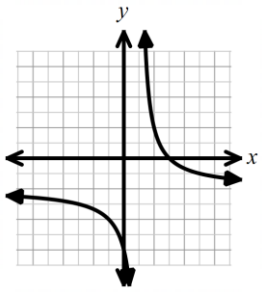


D: $\{x\|x\neq -4\}$
R: $\{y\|y\neq 2\}$
HA: $y=2$
VA: $x=-4$

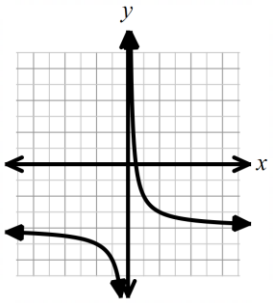
4)



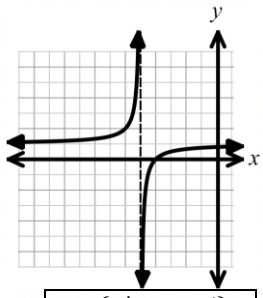
D: $\{x\|x\neq 0\}$
R: $\{y\|y\neq 3\}$
HA: $y=3$
VA: $x=0$

5) 

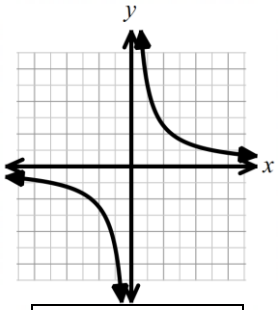
D: $\{x\|x \neq 1\}$
R: $\{y\|y \neq -2\}$
HA: $y = -2$
VA: $x = 1$

6) 

D: $\{x\|x \neq 0\}$
R: $\{y\|y \neq -4\}$
HA: $y = -4$
VA: $x = 0$

7) 

D: $\{x\|x \neq -5\}$
R: $\{y\|y \neq 1\}$
HA: $y = 1$
VA: $x = -5$

8) 

D: $\{x\|x \neq 0\}$
R: $\{y\|y \neq 0\}$
HA: $y = 0$
VA: $x = 0$

9) as $x \to \infty, y \to 4$; and as $x \to -\infty, y \to 4$

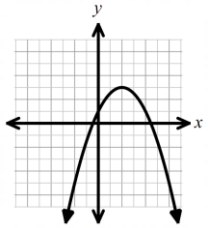
10) as $x \to \infty, y \to -3$; and as $x \to -\infty, y \to -3$

11) as $x \to \infty, y \to -11$; and as $x \to -\infty, y \to -11$

12) as $x \to \infty, y \to 0$; and as $x \to -\infty, y \to 0$

13) $y = -\frac{3}{x-4} - 2$; D: $\{x|x \neq 4\}$; R: $\{y|y \neq -2\}$

14) VA: $x = -3$; HA: $y = 5$

15) 

D: $(-\infty, \infty)$; R: $(-\infty, 3]$

16) $1 + i, 1 - i, 1$

17) $f(x) = x^5 + 4x^4 + 7x^3 + 28x^2 - 18x - 72$

18) $y = \frac{5}{x+3} + 2$

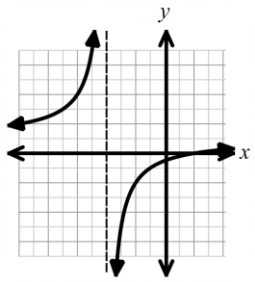
6.2 Practice Problems ANSWERS

1) VA: $x = 6$ and $x = -6$; HA: $y = 1$

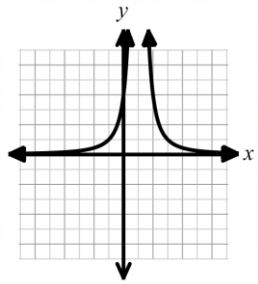
2) VA: $x = -2$; HA: none

3) VA: $x = 5$ and $x = -5$; HA: $y = 0$

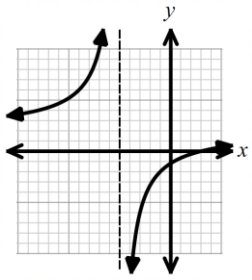
4) VA: $x = -5$ and $x = 1$; HA: $y = 3$

5) 

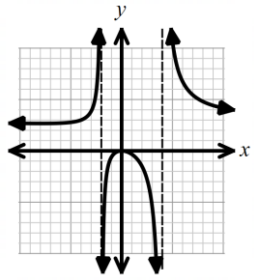
D: $\{x\|x \neq -4\}$
R: $\{y\|y \neq 1\}$
VA: $x = -4$
HA: $y = 1$

6) 

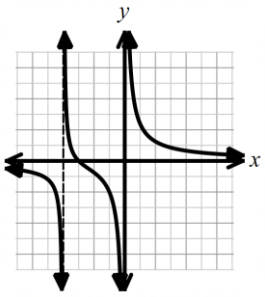
D: $\{x\|x \neq 1\}$
R: $\{y\|y \neq 0\}$
VA: $x = 1$
HA: $y = 0$

7) 

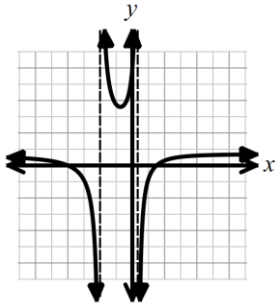
D: $\{x\|x \neq -5\}$
R: $\{y\|y \neq 2\}$
VA: $x = -5$
HA: $y = 2$

8) 

D: $\{x\|x \neq -2, 4\}$
R: $\{y\|y \neq 3\}$
VA: $x = -2, x = 4$
HA: $y = 3$

9) 

D: $\{x\|x \neq 0, -4\}$
R: $\{y\|y \neq 0\}$
VA: $x = 0; x = -4$
HA: $y = 0$

10) 

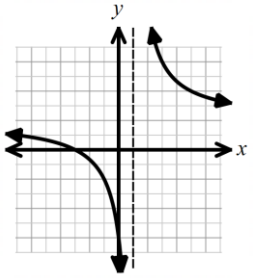
D: $\left\{x \middle\| x \neq -2, \frac{1}{3}\right\}$
R: $\left\{y \middle\| y \neq \frac{2}{3}\right\}$
VA: $x = -2; x = \frac{1}{3}$
HA: $y = \frac{2}{3}$

11)

x-int: $(-4, 0)\left(\frac{5}{2}, 0\right)$
y-int: $\left(0, \frac{20}{27}\right)$
VA: $x = 9; x = -3$
HA: $y = 2$

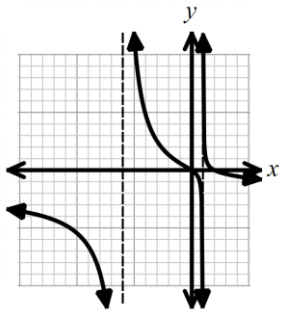
12)

x-int: $(0, 0)$
y-int: $(0,0)$
VA: $x = -8; x = 8$
HA: $y = 0$

13) 

x-int: $(-3, 0)$
y-int: $(0, -6)$
VA: $x = 1$
HA: $y = 2$
D: $\{x\|x \neq 1\}$
R: $\{y\|y \neq 2\}$
as $x \to \infty, y \to 2$; as $x \to -\infty, y \to 2$

14)



x-int: $(0,0)$ $(2,0)$
y-int: $(0,0)$
VA: $x=-6; x=1$
HA: $y=-2$
D: $\{x\|x\neq -6,1\}$
R: all real numbers
as $x\to\infty, y\to -2$; as $x\to -\infty, y\to -2$

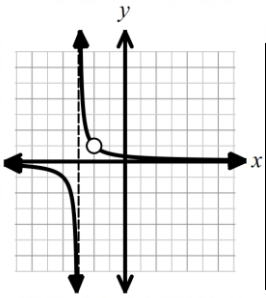
15) B, C, and D

16) $(5x-7)(25x^2+35x+49)$

6.3 Practice Problems ANSWERS

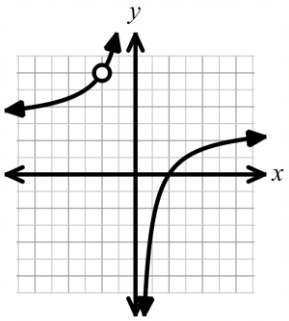
1) $\left(2,\frac{1}{4}\right)$ 2) $(3,-5)$ 3) $\left(0,\frac{2}{7}\right)$ 4) $\left(1,\frac{2}{5}\right)$

5)



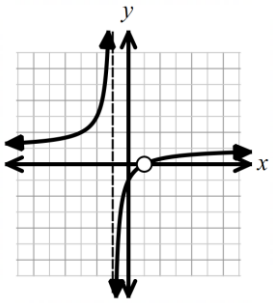
x-int: none
y-int: $\left(0,\frac{1}{3}\right)$
VA: $x=-3$
HA: $y=0$
D: $\{x\|x\neq -3,-2\}$
R: $\{y\|y\neq 0,1\}$
hole: $(-2,1)$

6)



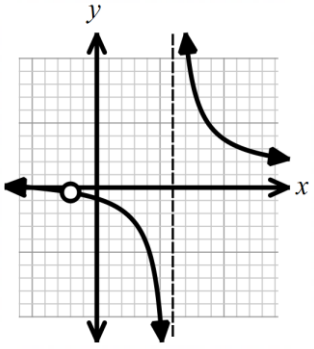
x-int: $(2,0)$
y-int: none
VA: $x=0$
HA: $y=3$
D: $\{x\|x\neq -2,0\}$
R: $\{y\|y\neq 3,6\}$
hole: $(-2,6)$

7)



x-int: none
y-int: $(0,-1)$
VA: $x=-1$
HA: $y=1$
D: $\{x\|x\neq -1,1\}$
R: $\{y\|y\neq 1,0\}$
hole: $(1,0)$

8)



x-int: (-5, 0)
y-int: $\left(0,-\frac{5}{6}\right)$
VA: $x=6$
HA: $y=1$
D: $\{x\|x\neq -2,6\}$
R: $\left\{y\middle\|y\neq 1,-\frac{3}{8}\right\}$
hole: $\left(-2,-\frac{3}{8}\right)$

9) as $x\to\infty, y\to 3$; as $x\to -\infty, y\to 3$ 10) as $x\to$ c

11) max value is -9 12) D: $\{x\|x\neq 5\}$; R: $\left\{y\middle\|y\neq \frac{1}{3}\right\}$ 13) $5x^{12}y^9z^{18}$

14) $g(h(x))=\ 15x+40;\ h(g(x))=15x+8$

6.4 Practice ANSWERS

1) $\frac{n+6}{n-7}; n\neq 4\ or\ 7$ 2) $\frac{x-3}{x-1}; x\neq \pm 1$ 3) $\frac{x+3}{x+5}; x\neq -5\ or\ 4$ 4) $\frac{x-6}{x+5}; x\neq -5\ or\ -6$

5) $\frac{y^2}{2x^2}; x\neq 0; y\neq 0$ 6) $\frac{x+1}{3x(x-4)}; x\neq 0,\pm 4, or\ 2$ 7) $\frac{(x-2)^2}{5x^3}; x\neq -10,-9,0, or\ 2$ 8) $\frac{x(x+2)}{x-5}; x\neq \pm 2,5$

9) $\frac{x-2}{3}; x\neq 0\ or\ 2$ 10) $\frac{2y^3}{x^5}$ 11) $\frac{x}{3(x-2)}$ 12) $\frac{(x+4)(x-3)}{2(x+2)}$ 13) $\frac{x-4}{x+1}$

14) $\frac{(x-2)(x-1)(x-6)}{(2x-3)(x+1)^3}$ 15) (5, 4) 16) B 17) $(-3,0)\cap(2.5,\infty)$

6.5 Practice ANSWERS

1) $-\frac{1}{5}; x \neq 0$ 2) $\frac{11x-21}{(x+3)(x-3)}; x \neq \pm 3$ 3) $\frac{1}{x+4}; x \neq \pm 4$ 4) $\frac{4}{x+3}; x \neq \pm 3$

5) $\frac{2x}{(x-6)(3+5x)}; x \neq \frac{-3}{5}, 0, or\ 6$ 6) $\frac{-1(x+6)}{5x+4}; x \neq \frac{-4}{5}, 0, or -2$ 7) $\frac{x+7}{4}; x \neq 0\ or -7$ 8) $\frac{x^2+4x+15}{(x-3)(x+3)^2}; x \neq \pm 3$

9) $2(x+4)^2 - 14$ 10) $\frac{5+\sqrt{7}}{6}$ 11) $\frac{10+2i}{3}$

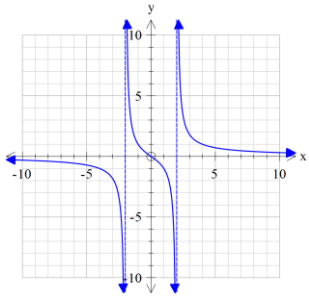
12) $-30\sqrt{3}$ 13) D 14) A 15) Find a common denominator for the fractions so they can add

6.6 Practice ANSWERS

1) 2 2) 2 3) 8 4) $\frac{11}{3}$ 5) $\frac{19}{21}$ 6) 2 7) $\frac{4}{11}$

8) no solution 9) -2, 3 10) -6 or $\frac{7}{2}$ 11) -1 12) $-\frac{1}{2}$ 13) no solution

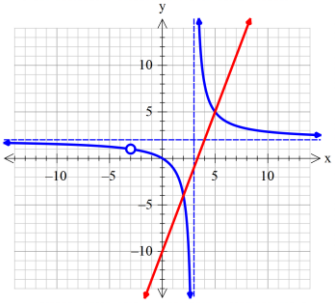
14)



No holes
Asymptotes: $x = \pm 2,\ y = 0$
Domain: $(-\infty, -2) \cap (-2, 2) \cap (2, \infty)$
Range: $(-\infty, \infty)$

15) C

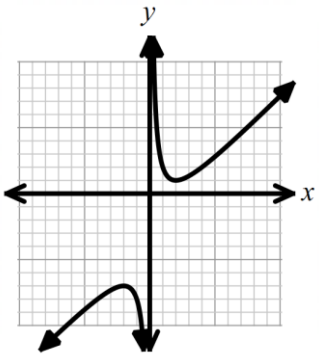
16) A



17) -2 & -5 18) 2 & 5 19) (-7, 3) & 5, 0) 20) y = x – 1 21)3 & 5

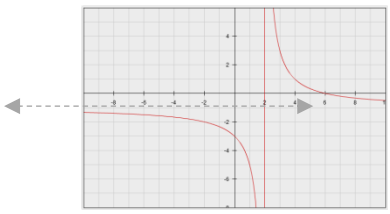
6.7 Practice ANSWERS

1) D: $\{x \mid x \neq 0\}$
R: $\{y \mid y \leq -7 \text{ and } y \geq 1\}$
VA: $x = 0$; HA: *none*
Slant asymptote: $y = x - 3$
As $x \to \infty, f(x) \to \infty$
As $x \to -\infty, f(x) \to -\infty$



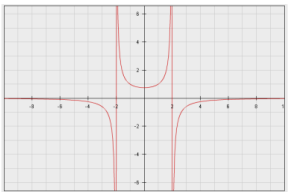
2) D: $\{x \mid x \neq 2\}$
R: $\{y \mid y \neq -1\}$
VA: $x = 2$; HA: $y = -1$

As $x \to \infty, f(x) \to -1$
As $x \to -\infty, f(x) \to -1$



3) D: $\{x \mid x \neq \pm 2\}$
R: $\{y \mid y \neq 0\}$
VA: $x = 2$ and $x = -2$; HA: $y = 0$

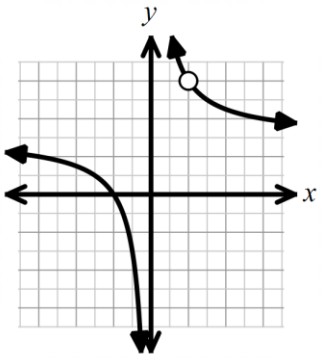
As $x \to \infty, f(x) \to 0$
As $x \to -\infty, f(x) \to 0$



4) D: $\{x \mid x \neq 2\}$
R: $y \leq 2.1$ and $y \geq 11.9$
VA: $x = 2$; HA: *none*
Hole: none Slant asym: $y = x + 5$
As $x \to \infty, f(x) \to \infty$
As $x \to -\infty, f(x) \to -\infty$

5) D: $\{x \mid x \neq \pm 6\}$
R: $\{y \mid y \neq 1\}$
VA: $x = 6$ and $x = -6$; HA: $y = 1$
Hole: none
As $x \to \infty, f(x) \to 1$
As $x \to -\infty, f(x) \to 1$

6) D: $\{x \mid x \neq 0, 2\}$
R: $\{y \mid y \neq 3, 6\}$
VA: $x = 0$; HA: $y = 3$
Hole at (2, 6)
As $x \to \infty, f(x) \to 3$
As $x \to -\infty, f(x) \to 3$



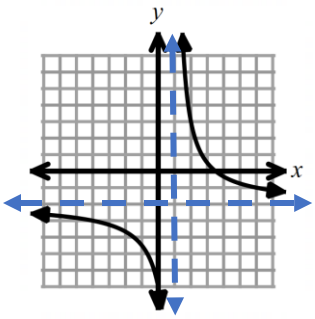
7) $y = 3x + 5$ 8) $y = -2x + 2$ 9) A 10) $\frac{3(x-3)}{x+2}$; $x \neq -3, -2$ 11) $y = \frac{-13}{x+4} + 3$

12) $f(x) = \frac{10}{x-6} + 4$ 13) $g(x) = \frac{-3}{x+2} + 5$ 14) D 15) As $x \to \pm\infty, f(x) \to 4$

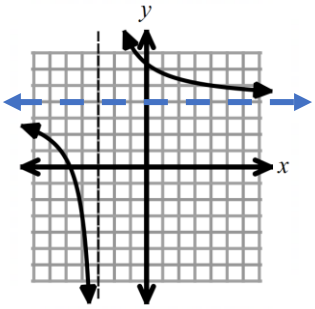
16) $f(x) = \frac{2x+7}{x+9}$ or $f(x) = -\frac{11}{x+9} + 2$ 17) D: $\{x \mid x \neq 4\}$R: $\{y \mid y \neq 3\}$ 18) $x = \frac{1 \pm \sqrt{41}}{4}$

Unit 6 Practice Test ANSWERS

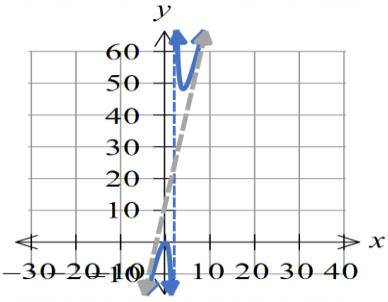
1) D: $\{x \mid x \neq 1\}$
R: $\{y \mid y \neq -2\}$
VA: $x = 1$; HA: $y = -2$
As $x \to \infty, f(x) \to -2$
As $x \to -\infty, f(x) \to -2$



2) D: $\{x \mid x \neq -3\}$
R: $\{y \mid y \neq 4\}$
VA: $x = -3$; HA: $y = 4$
As $x \to \infty, f(x) \to 4$
As $x \to -\infty, f(x) \to 4$



3) D: $\{x \mid x \neq 2\}$
R: $(-\infty, 0] \cup [48, \infty)$
VA: $x = 2$; HA: none slant: $y = 6x + 12$
As $x \to \infty, f(x) \to \infty$
As $x \to -\infty, f(x) \to -\infty$



4) D: $\{x \mid x \neq -5, 3\}$
R: $\left\{y \mid y \neq \frac{3}{4}, 1\right\}$
VA: $x = -5$; HA: $y = 1$
Hole: (3, ¾)
As $x \to \infty, f(x) \to 1$
As $x \to -\infty, f(x) \to 1$

5) $\frac{x+4}{x+3}; x \neq 5, -3$ 6) $\frac{x-6}{x+6}; x \neq -6$ 7) $\frac{16x^3}{y^2}; x \neq 0, y \neq 0$

8) $\frac{3(x+4)}{x+3}; x \neq 4 \text{ or } \pm 3$ 9) $\frac{(x-3)(x-1)(x+1)}{(x-5)(2x+3)(x+3)}; x \neq -1, \pm\frac{3}{2}, 5, \pm 3$

10) $(x-8)^2; x \neq -3, 5, \text{or } 8$ 11) $\frac{1}{15x}; x \neq 0$ 12) $\frac{y}{6x^6}; x \neq 0; y \neq 0$

13) $\frac{5(x+1)}{(x-1)}; x \neq -5,\ 2, \text{or } 1$ 14) $\frac{x^2+6x-14}{(x-2)(x-1)}; x \neq 1 \text{ or } 2$

15) $\frac{2x^2-11x-31}{2(x+7)(x-3)}; x \neq -7 \text{ or } 3$ 16) $\frac{16x^2}{9(x+2)}; x \neq 0, \pm 2$

17) $\frac{(x+2)}{(2x-5)(x+1)}; x \neq \frac{5}{2}, \pm 1, -2, -7, 5$ 18) $\frac{5x+2}{3-2x}; x \neq 0,\ \frac{3}{2}$

19) $\frac{1-x}{1+x}; x \neq 0, -1$ 20) -1 21) -5, -3 22) -2, 5 23) no solution 24) $-\frac{7}{29}$

25) $-2 \pm 3\sqrt{5}$ 26) $y = \frac{4x-3}{x-1}$ 27) VA: $x = -4$; hole at (2, 8)

28) Shift to the right 3 units and up 2 units. 29) B

30) $f(x) = \frac{-2}{x-4} + 2$ 31) VA at $x = -4$; slant asymptote at $y = 3x - 11$ 32) $f(x) = \frac{11}{x+2} + 8$