ALGEBRA 2 HONORS: CHAPTER 9 EXAM

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Find any points of discontinuity for the rational function.
   \[ y = \frac{x - 1}{x^2 - 2x - 8} \]

   A. \( x = -4, x = 2 \)
   B. \( x = 4, x = -2 \)
   C. \( x = 4, x = 2 \)
   D. \( x = 1 \)

2. Describe the vertical asymptote(s) and hole(s) for the graph of
   \[ y = \frac{(x - 2)(x + 5)}{(x + 5)(x + 3)} \]

   A. asymptote: \( x = -3 \) and hole: \( x = -5 \)
   B. asymptotes: \( x = -3 \) and \( x = -5 \)
   C. asymptote: \( x = -2 \) and hole: \( x = -3 \)
   D. asymptote: \( x = 3 \) and hole: \( x = 5 \)

3. Find the horizontal asymptote of the graph of
   \[ y = \frac{-3x^2 + 6x + 6}{-7x^2 + x + 6} \]

   A. \( y = \frac{3}{7} \)
   B. \( y = 0 \)
   C. no horizontal asymptote
   D. \( y = 1 \)

4. Simplify the rational expression. State any restrictions on the variable.
   \[ \frac{y^2 - 9y + 14}{y - 7} \]

   A. \( y - 2; y \neq 7 \)
   B. \( -y + 2; y \neq 7 \)
   C. \( -y - 2; y \neq -7 \)
   D. \( y + 2; y \neq -7 \)
5. Simplify the rational expression. State any restrictions on the variable.
\[
\frac{x^4 + 3x^2 - 10}{x^4 - 7x^2 + 10}
\]

A) \(\frac{x^2 + 5}{x^2 - 5}; x \neq 2, x \neq 5\)

B) \(\frac{x^2 + 5}{x^2 - 5}; x \neq \pm\sqrt{2}, x \neq \pm\sqrt{5}\)

C) \(\frac{-x^2 + 5}{x^2 - 5}; x \neq \pm\sqrt{2}, x \neq \pm\sqrt{5}\)

D) \(\frac{x^2 + 5}{x^2 - 5}; x \neq 2, x \neq -5\)

6. Sketch the asymptotes and graph the function.
\[
y = \frac{-2x + 5}{x - 2}
\]
7. Multiply or divide. State any restrictions on the variables.
\[
\frac{2c^4}{7d^3} \cdot \frac{9d^2}{5c^3}
\]

\[
\text{A} \quad \frac{18c}{35d}, \ c \neq 0, \ d \neq 0
\]

\[
\text{B} \quad \frac{18c^7}{35d^5}, \ c \neq 0, \ d \neq 0
\]

\[
\text{C} \quad \frac{18c^7}{35d^5}, \ c \neq 0, \ d \neq 0
\]

\[
\text{D} \quad \frac{35d}{18c}, \ c \neq 0, \ d \neq 0
\]

8. Sketch the asymptotes and graph the function.
\[
y = \frac{x^2 - 8x + 15}{x^2 - 16}
\]
9. Multiply or divide. State any restrictions on the variables.
\[
\frac{d^2 + 8d + 12}{d + 6} \div \frac{d^2 + 2d}{d + 2}
\]
\begin{align*}
\text{A} & \quad \frac{d + 2}{d + 2}, \quad d \neq -6, 0, -2 \\
\text{B} & \quad \frac{d + 2}{d + 2}, \quad d \neq -6, -2
\end{align*}

10. Multiply or divide. State any restrictions on the variables.
\[
\frac{a - 6}{a - 3} \div \frac{a + 2}{a^2 - 8a + 15}
\]
\begin{align*}
\text{A} & \quad \frac{(a - 6)(a + 2)}{(a - 3)(a - 5)}, \quad a \neq 3, 5, -2 \\
\text{B} & \quad \frac{(a - 6)(a - 5)}{a + 2}, \quad a \neq 5, -2
\end{align*}

11. Add or subtract. Simplify if possible.
\[
\frac{6}{t - 7} + \frac{1}{t^2 - 49}
\]
\begin{align*}
\text{A} & \quad \frac{7}{(t - 7)(t + 7)} \\
\text{B} & \quad \frac{6t + 43}{(t - 7)(t + 7)}
\end{align*}
12. Add or subtract. Simplify if possible. 
\[
\frac{p^2 - 11p + 28}{p^2 - 4p - 21} - \frac{6}{p + 3}
\]

\[\text{A} \quad \frac{p - 4}{p + 3} \quad \text{B} \quad \frac{p - 10}{p + 3} \quad \text{C} \quad p - 10 \quad \text{D} \quad \frac{p^2 - 11p + 22}{p^2 - 4p - 21}\]

13. Add or subtract. Simplify if possible. 
\[
\frac{x^2 + 7x + 10}{x^2 + x - 2} + \frac{x^2 + 4x - 5}{x^2 + 9x + 20}
\]

\[\text{A} \quad \frac{2x^2 + 11x + 5}{2x^2 + 10x + 18} \quad \text{B} \quad \frac{2x^2 + 7x + 21}{(x - 1)(x + 4)} \quad \text{C} \quad \frac{x^2 + 7x + 21}{(x - 1)(x + 4)} \quad \text{D} \quad \frac{2x^2 + 11x + 5}{(x - 1)(x + 4)}\]

14. Simplify the complex fraction. 
\[
\frac{\frac{4}{2a} - \frac{3}{3a}}{\frac{1}{4a} + \frac{1}{a}}
\]

\[\text{A} \quad \frac{4}{5} \quad \text{B} \quad 2 \quad \text{C} \quad \frac{1}{2} \quad \text{D} \quad \frac{5}{4}\]

15. 
\[
\frac{\frac{d - 3}{d^2 - d - 20}}{\frac{d - 7}{d + 4}}
\]

\[\text{A} \quad \frac{d - 3}{(d - 7)(d - 5)} \quad \text{B} \quad \frac{(d - 3)(d - 7)}{(d + 4)(d - 5)} \quad \text{C} \quad \frac{(d - 3)(d - 7)}{(d + 4)^2 (d - 5)} \quad \text{D} \quad \frac{(d - 3)(d - 5)}{(d - 7)(d + 5)}\]
16. Solve the equation. Check the solution.
\[ \frac{-1}{x + 1} = \frac{5}{x + 2} \]

\[ \begin{array}{llll}
\text{A} & \frac{1}{2} & \text{B} & -7 \\
\text{C} & \frac{5}{6} & \text{D} & \frac{7}{6}
\end{array} \]

17. Solve the equation. Check the solution.
\[ \frac{a}{a^2 - 36} + \frac{2}{a - 6} = \frac{1}{a + 6} \]

\[ \begin{array}{llll}
\text{A} & -9 & \text{B} & -6 \\
\text{C} & -9 \text{ and } -6 & \text{D} & 6
\end{array} \]

18. Solve the equation. Check the solution.
\[ \frac{6}{x^2 - 9} - \frac{1}{x - 3} = 1 \]

\[ \begin{array}{llll}
\text{A} & -4 & \text{B} & 2 \\
\text{C} & -1 \pm \sqrt{73} & \text{D} & 3 \text{ or } -4
\end{array} \]

19. Solve the equation. Check the solution.
\[ \frac{1}{6y} + \frac{5}{2y} = -5 \]

\[ \begin{array}{llll}
\text{A} & \frac{4}{15} & \text{B} & \frac{8}{3} \\
\text{C} & \frac{8}{15} & \text{D} & \frac{3}{20}
\end{array} \]

Short Answer

20. Simplify the expression.
\[ \frac{(t^4 - 1)(t^2 - 9)(t - 9)^2}{(t^4 - 81)(t^2 + 1)(t + 1)^2} \]
21. Simplify
\[
\frac{7m^2 - 28n^2}{28n^2 - 7m^2}
\]

22. Simplify.
\[
\frac{x^2 - x + xy - y}{x^2 + 6x - 7} + \frac{x^2 + 2xy + y^2}{4x + 4y}
\]

23. Graph the function. Label any asymptotes, holes, or discontinuities.
\[
f(x) = \frac{x - 3}{x^2 - 5x + 6}
\]

24. Graph the function. Label any asymptotes, holes, or discontinuities.
\[
f(x) = \frac{9x^2 - 4}{3x^2 - 10x - 8}
\]
25. Graph the function. Label any asymptotes, holes, or discontinuities.

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

26. Given \( f(x) = \frac{p(x)}{q(x)} \), where \( q(x) \neq 0 \). How do you determine if the function has a horizontal asymptote? a vertical asymptote? a hole?

27. Simplify.

\[ \frac{1}{ay - 3a + 2xy - 6x} - \frac{xy + ay}{a^2 - 4x^2} \left( \frac{1}{y - 3} \right)^2 \]
MULTIPLE CHOICE

1. ANS: B    PTS: 1    DIF: L2
   REF: 9-3 Rational Functions and Their Graphs
   OBJ: 9-3.1 Properties of Rational Functions
   TOP: 9-3 Example 1
   KEY: rational function | point of discontinuity

2. ANS: A    PTS: 1    DIF: L2
   REF: 9-3 Rational Functions and Their Graphs
   OBJ: 9-3.1 Properties of Rational Functions
   TOP: 9-3 Example 2
   KEY: asymptote | vertical asymptote | rational function | graphing | hole in the graph of a function

3. ANS: A    PTS: 1    DIF: L2
   REF: 9-3 Rational Functions and Their Graphs
   OBJ: 9-3.1 Properties of Rational Functions
   TOP: 9-3 Example 3
   KEY: asymptote | graphing | rational function | horizontal asymptote

4. ANS: A    PTS: 1    DIF: L2
   REF: 9-4 Rational Expressions
   OBJ: 9-4.1 Simplifying Rational Expressions
   TOP: 9-4 Example 1
   KEY: rational expression | simplifying a rational expression | restrictions on a variable

5. ANS: B    PTS: 1    DIF: L3
   REF: 9-4 Rational Expressions
   OBJ: 9-4.1 Simplifying Rational Expressions
   TOP: 9-4 Example 1
   KEY: rational expression | simplifying a rational expression | restrictions on a variable

6. ANS: C    PTS: 1    DIF: L2
   REF: 9-3 Rational Functions and Their Graphs
   OBJ: 9-3.2 Graphing Rational Functions
   TOP: 9-3 Example 4
   KEY: graphing | rational function

7. ANS: A    PTS: 1    DIF: L2
   REF: 9-4 Rational Expressions
   OBJ: 9-4.2 Multiplying and Dividing Rational Expressions
   TOP: 9-4 Example 3
   KEY: simplifying a rational expression | restrictions on a variable | multiplying rational expressions

8. ANS: A    PTS: 1    DIF: L3
   REF: 9-3 Rational Functions and Their Graphs
   OBJ: 9-3.2 Graphing Rational Functions
   TOP: 9-3 Example 4
   KEY: graphing | rational function

9. ANS: D    PTS: 1    DIF: L2
   REF: 9-4 Rational Expressions
   OBJ: 9-4.2 Multiplying and Dividing Rational Expressions
   TOP: 9-4 Example 3
   KEY: simplifying a rational expression | restrictions on a variable | multiplying rational expressions

10. ANS: D   PTS: 1    DIF: L2
    REF: 9-4 Rational Expressions
    OBJ: 9-4.2 Multiplying and Dividing Rational Expressions
    TOP: 9-4 Example 4
    KEY: restrictions on a variable | dividing rational expressions
11. ANS: B   PTS: 1   DIF: L2
   REF: 9-5 Adding and Subtracting Rational Expressions
   OBJ: 9-5.1 Adding and Subtracting Rational Expressions   STA: CA A2 7.0
   TOP: 9-5 Example 3
   KEY: simplifying a rational expression | adding rational expressions

12. ANS: B   PTS: 1   DIF: L2
   REF: 9-5 Adding and Subtracting Rational Expressions
   OBJ: 9-5.1 Adding and Subtracting Rational Expressions   STA: CA A2 7.0
   TOP: 9-5 Example 4
   KEY: simplifying a rational expression | subtracting rational expressions

13. ANS: B   PTS: 1   DIF: L3
   REF: 9-5 Adding and Subtracting Rational Expressions
   OBJ: 9-5.1 Adding and Subtracting Rational Expressions   STA: CA A2 7.0
   TOP: 9-5 Example 3
   KEY: simplifying a rational expression | adding rational expressions

14. ANS: A   PTS: 1   DIF: L2
   REF: 9-5 Adding and Subtracting Rational Expressions
   OBJ: 9-5.2 Simplifying Complex Fractions   STA: CA A2 7.0
   TOP: 9-5 Example 5
   KEY: complex fraction | simplifying a rational expression | simplifying a complex fraction

15. ANS: A   PTS: 1   DIF: L2
   REF: 9-5 Adding and Subtracting Rational Expressions
   OBJ: 9-5.2 Simplifying Complex Fractions   STA: CA A2 7.0
   TOP: 9-5 Example 5
   KEY: dividing rational expressions | simplifying a complex fraction

16. ANS: D   PTS: 1   DIF: L2
   REF: 9-6 Solving Rational Equations
   OBJ: 9-6.1 Solving Rational Equations   STA: CA A2 7.0
   TOP: 9-6 Example 1
   KEY: rational equation

17. ANS: A   PTS: 1   DIF: L2
   REF: 9-6 Solving Rational Equations
   OBJ: 9-6.1 Solving Rational Equations   STA: CA A2 7.0
   TOP: 9-6 Example 2
   KEY: rational equation | no solutions

18. ANS: A   PTS: 1   DIF: L2
   REF: 9-6 Solving Rational Equations
   OBJ: 9-6.1 Solving Rational Equations   STA: CA A2 7.0
   TOP: 9-6 Example 2
   KEY: rational equation | no solutions

19. ANS: C   PTS: 1   DIF: L2
   REF: 9-6 Solving Rational Equations
   OBJ: 9-6.1 Solving Rational Equations   STA: CA A2 7.0
   TOP: 9-6 Example 2
   KEY: rational equation

SHORT ANSWER

20. ANS:
    \[
    \frac{(t - 1)(t - 9)^2}{(t^2 + 9)(t + 1)}
    \]
    PTS: 1
21. ANS: 
\[-1\]
PTS: 1

22. ANS: 
\[\frac{4}{x + y}\]
PTS: 1

23. ANS: 

![Graph of a rational function]

PTS: 1  DIF: Level B  REF: MAL21191
TOP: Lesson 8.3 Graph General Rational Functions  KEY: graph | rational function
MSC: Comprehension  NOT: 978-0-618-65615-8

24. ANS: 

![Graph of a rational function]

PTS: 1  DIF: Level B  REF: MAL21191
TOP: Lesson 8.3 Graph General Rational Functions  KEY: graph | rational function
MSC: Comprehension  NOT: 978-0-618-65615-8
25. ANS:

![Graph of a rational function.](image)

PTS: 1  DIF: Level B  REF: MAL21191
TOP: Lesson 8.3 Graph General Rational Functions  KEY: graph | rational function
MSC: Comprehension  NOT: 978-0-618-65615-8

26. ANS:

see notes

PTS: 1

27. ANS:

\[
\frac{-3(a + xy - 2x)}{(y - 3)^2(a - 2x)(a + 2x)}
\]

PTS: 1