**/45**

## *Part A) Knowledge and Understanding*

**Multiple Choice**

*Identify the choice that best completes the statement or answers the question.*

1. Which of the following is the reciprocal of a quadratic function?

   a. $f(x) = \frac{1}{4x+1}$
   c. $f(x) = \frac{x}{x+1}$
   b. $f(x) = \frac{1}{x^2+1}$
   d. none of the above

2. Which of the reciprocal functions has a vertical asymptote at $x = \frac{5}{2}$?

   a. $f(x) = \frac{1}{x+\frac{5}{2}}$
   c. $f(x) = \frac{5}{x+2}$
   b. $f(x) = \frac{1}{2x+5}$
   d. $f(x) = \frac{1}{2x-5}$

3. Which of the following is true?

   a. $f(x) = \frac{1}{2-x}$ has two vertical asymptotes.
   b. $f(x) = \frac{1}{x}$ decreases over its entire domain.
   c. $f(x) = -\frac{1}{x}$ is always negative.
   d. $f(x) = -\frac{1}{2x}$ never increases.

4. For what interval is the slope of the function $f(x) = \frac{1}{3x+6}$ increasing?

   a. $x < -2$
   c. $x > -2$
   b. $x > 2$
   d. $x \in \mathbb{R}, x \neq -2$

5. Which function has a domain consisting of all real numbers?

   a. $f(x) = \frac{1}{x-25}$
   c. $f(x) = \frac{1}{x^2-25}$
   b. $f(x) = \frac{1}{x+25}$
   d. $f(x) = \frac{1}{x^2+25}$

6. Which function has a y-intercept of $\frac{1}{2}$?

   a. $f(x) = \frac{2}{(2x-1)(x+1)}$
   c. $f(x) = -\frac{4}{x^2-7x-8}$
   b. $f(x) = \frac{2}{2x^2+5x-3}$
   d. all of the above

7. What is true about the function $f(x) = \frac{3}{x^2 - 6x + 5}$, as $x \to -\infty$?

a. f(x) → 0 from below

b. f(x) → 0 from above

c. $f(x) \to \infty$

d. $f(x) \to -\infty$

8. What is the value of k in the function if its graph passes through the point (2, 4.2)?

$f(x) = \frac{2x + k}{x + 3}$

a. 21.2

b. 6

c. 17

d. none of the above

9. Solve the equation $\frac{3}{x - 2} = \frac{7}{4x - 8}$

a. $x = 2$

b. $x = \frac{4}{5}$

c. $x = -2$

d. No solution

10. Which of the following functions has exactly one vertical asymptote when graphed?

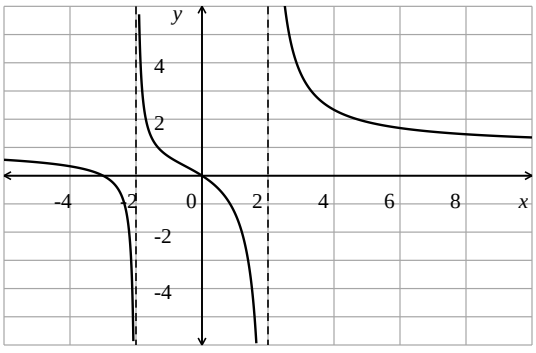
a. $f(x) = \frac{6}{x^2 - 3x}$

b. $f(x) = \frac{6x}{x^2 - 3x}$

c. $f(x) = \frac{6x^2 - 18x}{x}$

d. B and C

11. Use the graph of the function to solve the inequality $f(x) = \frac{x}{x - 2} + \frac{x}{x^2 - 4} \leq 0$.




a. $-3 < x < -2,\ 0 < x < 2$

b. $x \neq -2,\ x \neq 2,\ x \in \mathbb{R}$

c. $x \leq -3,\ -2 < x \leq 0,\ x > 2$

d. $-3 \leq x < -2,\ 0 \leq x < 2$

**Part B) Applications**

1. Consider the function $f(x) = \frac{3}{x^2 - x - 6}$

a) Determine the key features of the function:

i) vertical asymptote(s) and tests /3

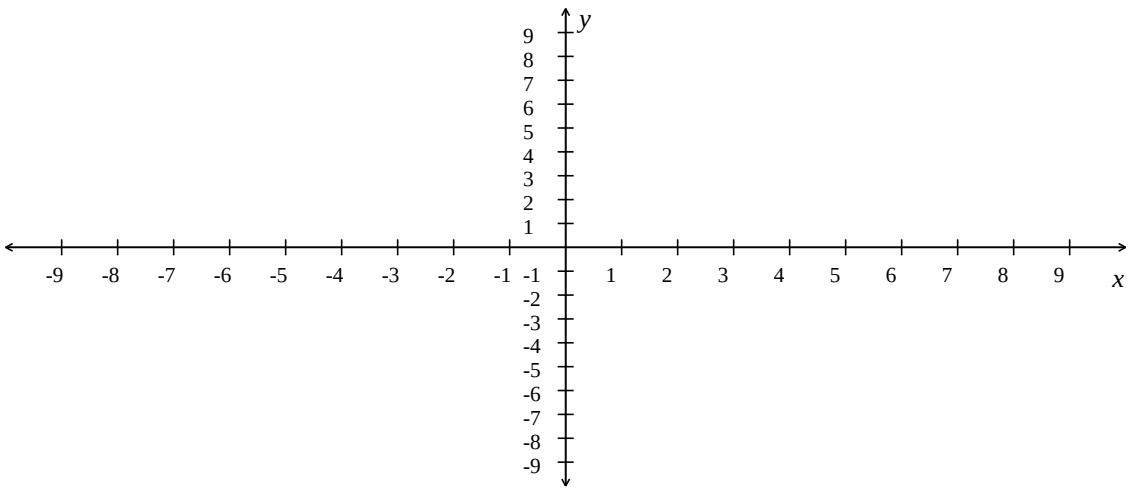
ii) domain /1

iii) horizontal asymptotes and tests /2

iv) range /1

v) intercepts /1

b) Sketch a graph of the function. /2



2. The current in an electric circuit is modeled by the function

$$I(t) = \frac{63 + 4t}{t + 3}$$

where I is the current, in amperes, and t is the time, in seconds.

a) State the horizontal asymptote and explain its significance. /2

b) State the domain and range. /2

c) When will the current be 7 amperes? /1

3. Solve: (exact answers only) $\frac{1}{3x} + \frac{6x - 9}{3x} = \frac{3x - 3}{4x}$ /4

4. Solve: $\frac{2x^2+5x-12}{x^2-6x-7} \leq 0$ /5

## Part C) Communication

1. Explain the difference between the graphs of the following functions: /3

$$f(x) = \frac{x^2 - 3x - 10}{x - 5} \quad \text{and} \quad g(x) = x + 2$$

2. Write an equation to represent a rational function with the following conditions: /2

- reciprocal of a quadratic function
- asymptotes with equations x = -2, x = 3, and y = 0
- y-intercept of -1/2

## Part D) Thinking, Inquiry and Problem Solving

**Graph the function FIRST.** Then solve the inequality. $\frac{-4x - 12}{x^2 - 3x - 4} < 0$

/5

