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Part A) Knowledge and Understanding

Multiple Choice

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

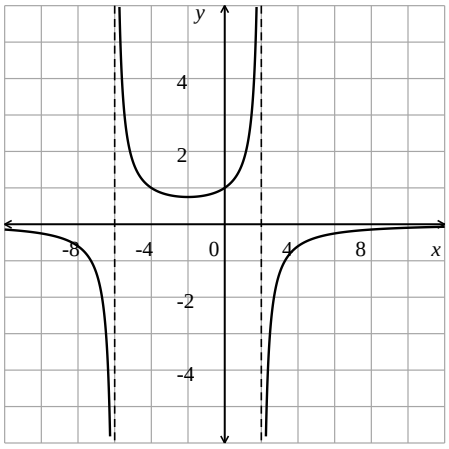
1. What is the equation of the horizontal asymptote of $f(x) = -\frac{1}{2x+10}$?

   a. $y = 0$
   c. $x = 0$
   b. $y = 5$
   d. $x = 5$

2. What is the equation of the vertical asymptote of $f(x) = \frac{3}{10x+2}$?

   a. $y = \frac{3}{5}$
   c. $x = -5$
   b. $y = -\frac{1}{5}$
   d. $x = -\frac{1}{5}$

3. Over what interval does the graph of the rational function have positive, decreasing slope?

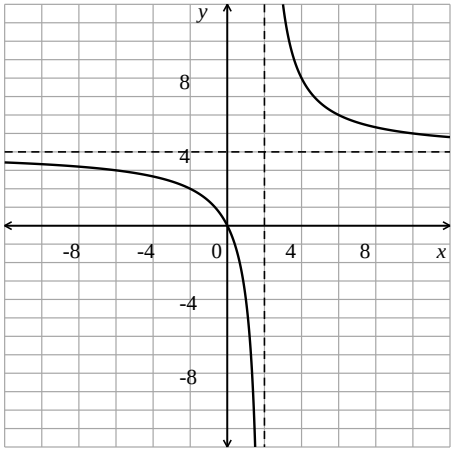


   a. $x < -6$
   c. $-2 < x < 2$
   b. $x > 2$
   d. $-6 < x < -2$

4. Which function has a horizontal asymptote of $y = -\frac{2}{3}$?

   a. $f(x) = \frac{2x+3}{6x+1}$
   c. $f(x) = \frac{4x+3}{6x+1}$
   b. $f(x) = \frac{7x-2}{5x+3}$
   d. $f(x) = -\frac{4x+3}{6x+1}$

5. What is the equation for the horizontal asymptote of the graph of the function shown?



a. $x = 2$

b. $x = 4$

c. $y = 4$

d. $y = 2$

6. What is true about the function $f(x) = \frac{1}{3x+5}$ as $x \to -\frac{5}{3}^+$?

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

b. $f(x) \to 0$

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

d. f(x) is undefined

7. What is true about the function $f(x) = -\frac{1}{x-3}$ as $x \to \infty$?

a. f(x) → 0 from above

b. f(x) → 0 from below

c. $f(x) \to \frac{1}{3}$

d. f(x) is undefined

8. Which function is always positive?

a. $f(x) = \frac{3}{2x+4}$

b. $f(x) = \frac{1}{(x-4)^2}$

c. $f(x) = \frac{1}{x^2+4}$

d. B and C

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

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

b. $f(x) = \frac{2}{2x^2+5x-3}$

c. $f(x) = -\frac{4}{x^2-7x-8}$

d. all of the above

Part B) Applications

1. Consider the function $f(x) = \frac{-4}{x^2 - 2x - 15}$ /10

a) Determine the key features of the function:

i) domain

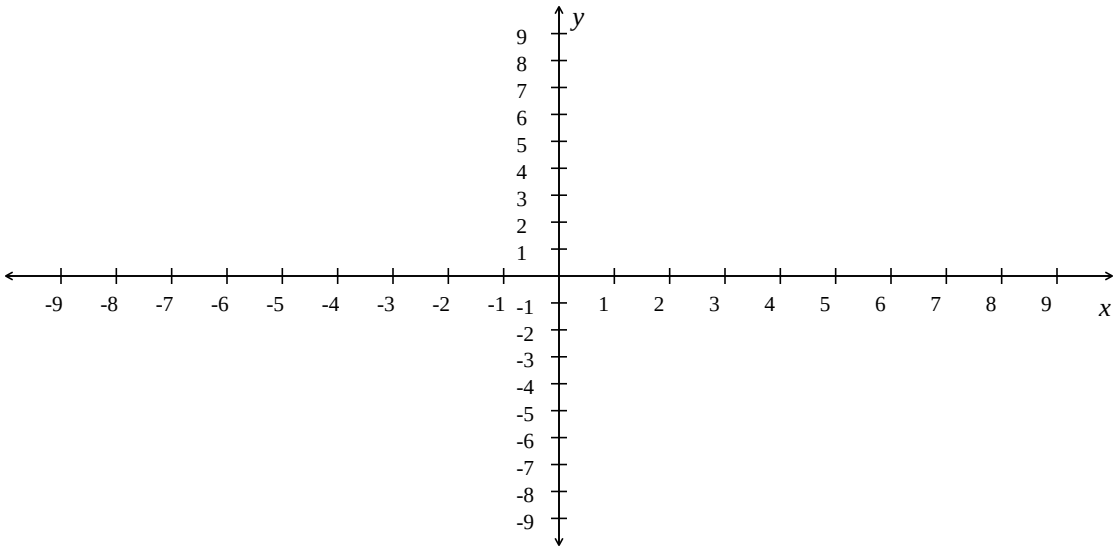
ii) range

iii) intercepts

iv) vertical asymptote(s) and tests

v) horizontal asymptote and tests

b) Sketch a graph of the function.



2. Simplify the rational expression and state any restrictions on the variable. /4

$$\frac{x-3}{x^2-3x-4} - \frac{3x+1}{x^2-9x+20} \div \frac{4x}{x-5}$$

3. Solve the rational equation. /4
(Exact and approximate answers required to the nearest tenth).

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

4. Solve the rational inequality: $\frac{2x^2-3x-2}{x^2-8x+16} \leq 0$ /5

Part C) Communication

The population of a small town is modeled by the function $P(t) = \frac{90t + 120}{2t + 8}$

where $P(t)$ is the population, in thousands, and t is the time, in years, since the start of 2000.

a) In what year will the small town have a population of 39,000? /2

b) The town will need its own transit system if the population exceeds 40000. Will the town's population ever exceed 40000? Explain. /2

c) State the domain and range for this word problem. /2

Part D) Thinking, Inquiry and Problem Solving

Sketch the following function using all the key features: $f(x) = \frac{-2x + 8}{3x^3 - 12x^2}$ /10

