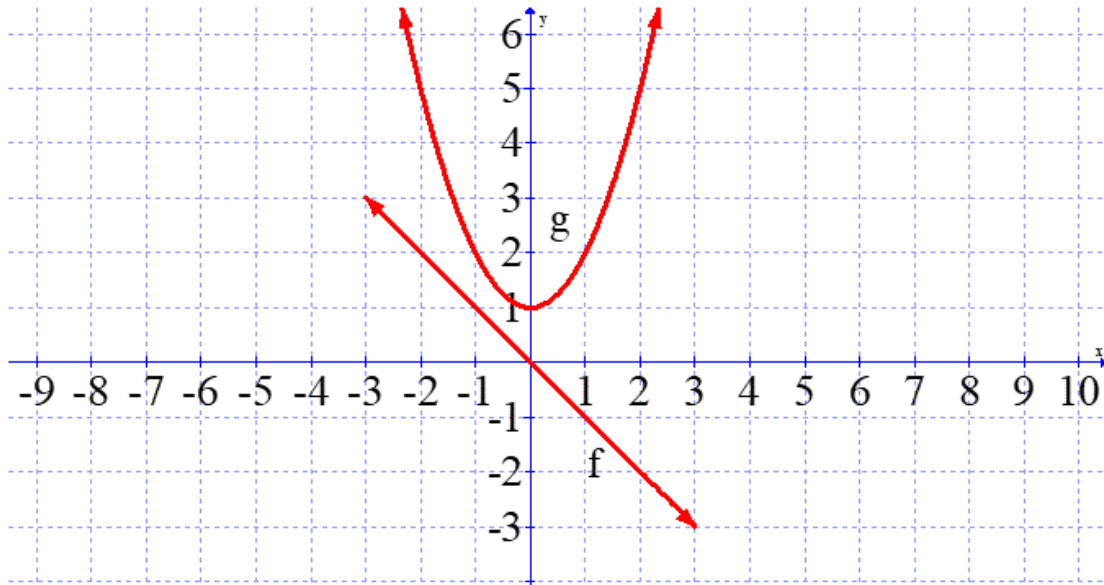# Function Operations and Rational Functions Litmus Test

Part A   Place the correct answer on the sheet provided. Each question is worth one mark.

Use the following information to answer the first question.

The graph below displays 2 functions, y = f(x) and y = g(x). A new function is given by h(x) = [f(x)g(x)] – f(x).

1. The value of h(-2) is

   A) 2   B) 4   C) 6   D) 8

2. The domain and range for both of the linear functions, f(x) = 5x + 2, and
   g(x) = x – 3, is x ∈ R and y ∈ R. For which operation applied to these functions
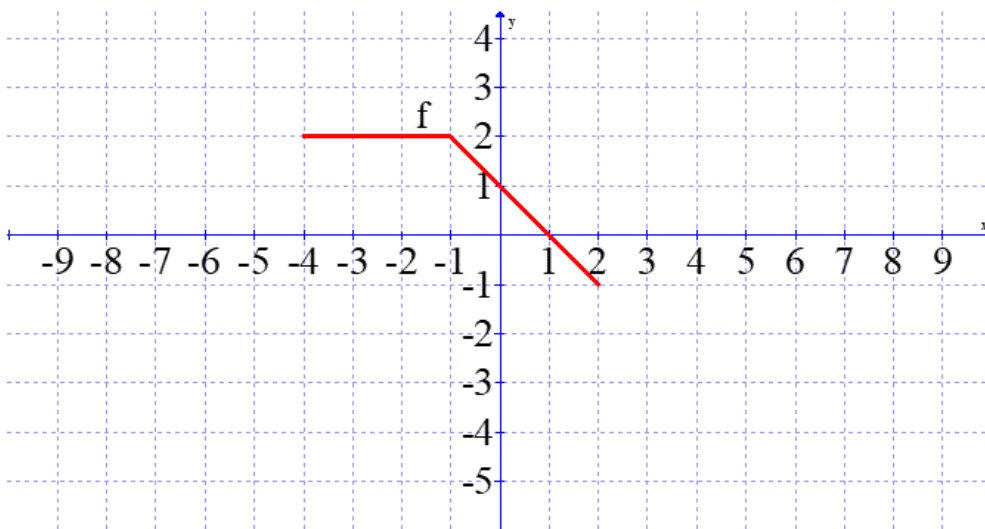   will the domain remain the same, but the range will change?

A) h(x) = f(x) + g(x)
B) h(x) = f(x) - g(x)
C) h(x) = f(x) g(x)
D) h(x) = $\left(\dfrac{f}{g}\right)(x)$

Use the following information to answer the next question.

x	g(x)
-1	$\dfrac{-4}{3}$
0	**k**
2	undefined
3	4
4	2

3. The graph above shows y = f(x) and the table of values above shows y = g(x). If h(x) = f(x) – g(x), and h(0) = 3, what is the value of **K** in the table of values above?

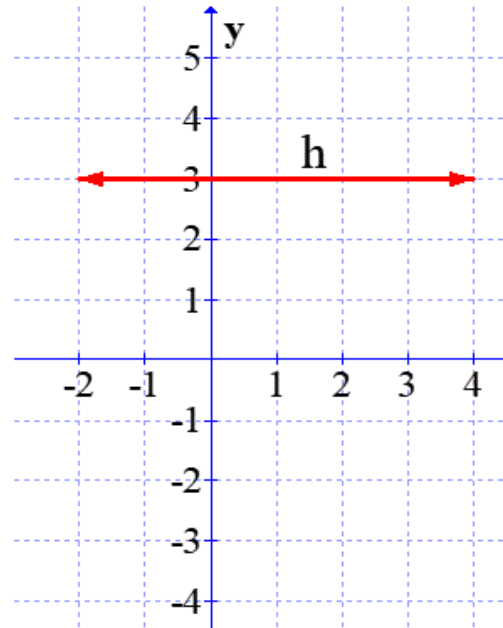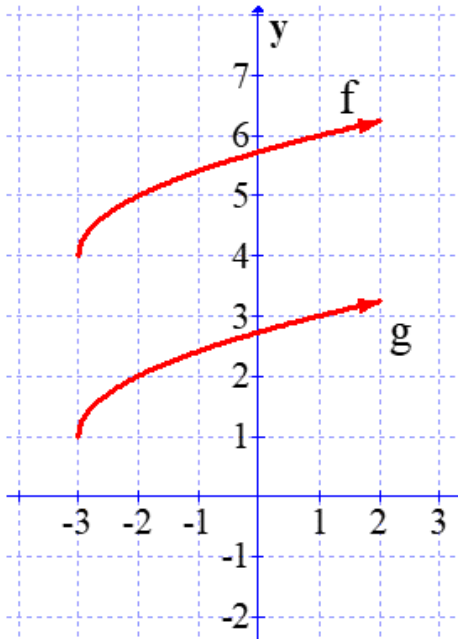A) 1   B) 2   C) -1   D) -2

Use the following information to answer the next question.

The following graphs of y = f(x) and y = g(x) are shown on the left, and the graph of y = h(x) is shown on the right.

4. Which of the following statements is correct?

A) h(x) = g(x) – f(x)
B) h(x) = g(x) f(x)
C) h(x) = g(x) + f(x)
D) h(x) = f(x) – g(x)

5. Given the functions $f(x) = 2^x$; $g(x) = x^2$ and $h(x) = 2x$, a simplified expression for $k(x) = (h \circ g \circ f)(x)$ is

    A) 2^{3x} B) 4^{2x} C) 4^{x+1} D) 2^{2x+1}

6. If $f(x) = 2x - 16$; $g(x) = \log_2 x$; and $h(x) = \dfrac{g(x)}{f(x)} + (f \circ g)(x)$,

    then h(16) is

    A) -7.75   B) -2.25   C) 5.5   D) 11.25

Use the following information to answer the next question.

$$f(x) = \frac{x+3}{x^2 - x - 12}$$

7. In relation to the function f(x) above, which of the statements below is true?

    A) The equation for the vertical asymptote is x = 3.
    B) The equation for the horizontal asymptote is y = 0.
    C) The point of discontinuity is $(-3, \frac{1}{7})$.
    D) The y-intercept is -0.5.

8. For the rational expression $\dfrac{(x+c)(2x-c)}{3m(x+c)}$, the point of discontinuity, in terms of c and m is

A) $\left(-c, \dfrac{3c}{m}\right)$

B) $\left(c, \dfrac{-c}{m}\right)$
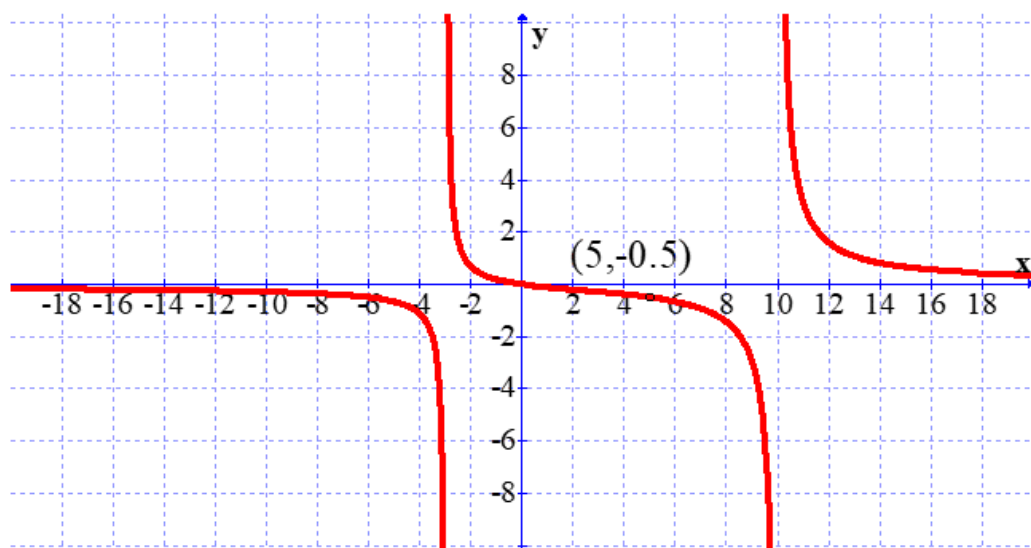
C) $\left(-c, \dfrac{-c}{m}\right)$

D) $\left(c, \dfrac{3c}{m}\right)$

Use the information below to answer the next 2 questions.

The graph of the function below can be expressed in the form

$$y = \dfrac{ax}{x^2 + bx + c}$$

The domain is $\{x \mid x \neq -3, 10, x \in R\}$

(5,-0.5)

9.   Determine the values of b and c.

      A) b = 7 and c = 30

      B) b = -3 and c = 10

      C) b = 3 and c = -10

      D) b = -7 and c = -30

10.   Determine the value of a.

      A) 4

      B) -4

      C) 5

      D) -5

11.   When solving the rational equation, $\dfrac{4}{x} = 3 - \dfrac{5x}{x-2}$ graphically by finding the intersection points of y_1 and y_2, the approximate solution in quadrant 1 is

      A) 0.44

      B) 0.52

      C) 0.70

      D)1.12

12. Given the rational equation, $y = \dfrac{a}{x+b} + c$, if a < 0, c < 0 and b > 0, the vertical

and horizontal asymptotes will intersect in quadrant

A) 1   B) 2   C) 3   D) 4

Part B   Place the correct answer in the space provided. Each correct answer
is worth 1 mark.

Use the following information to answer the next question.

As he was wrapping up his lesson related to operations on functions, a Math 30-1
teacher gave this question to his students as an exit pass. Given f(x) = -3x + 2 and

g(x) = x + 4, he asked them to consider various operations that could be performed:

1. f(x) + g(x)

2. f(x) - g(x)

3. f(x) g(x)

4. $\dfrac{f(x)}{g(x)}$

13.   Using the numbers, 1, 2, 3, or 4 from the above numbered operations, submit
three numbers, in order from left to right, which would satisfy the
following: The **first** would have a range of y ≤ 16.3; the **second** would have a
domain of x ≠ -4; and the **third** would have a y-intercept of -2.

Use the following information to answer the next question.

The partial graphs of a linear function, y = f(x), and a quadratic function, y = g(x) are shown below. The domain of f(x) is [-3,3] and the domain of g(x) is [-2,2].
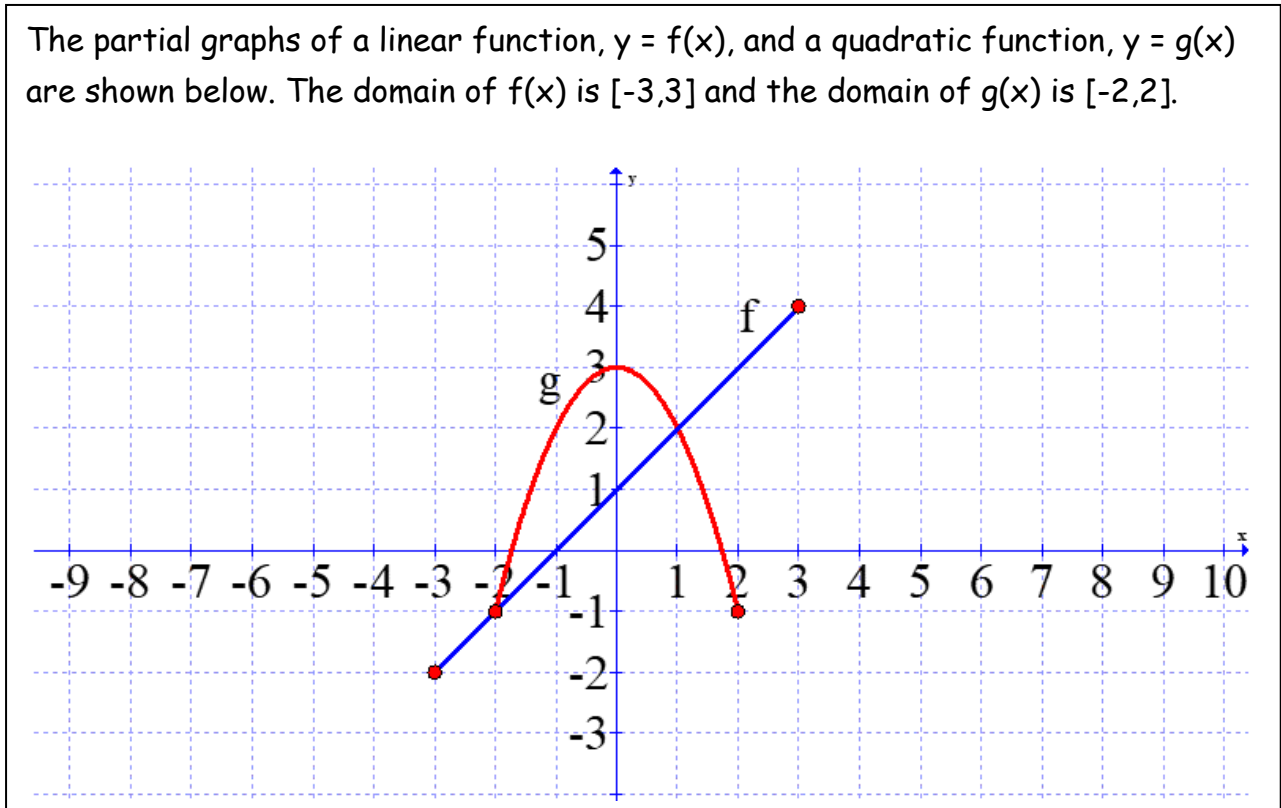
14. The range of h(x) = f(x) – g(x) can be written in the form [-m,n]. Rounding to the nearest integer, the values of m and n respectively are ____ and ____.

15. If $f(x) = \sqrt{x-1}$ and $g(x) = \sqrt{x-4}$, then h(x) = f(x) g(x). The domain of h(x) can be written in the form [m, ∞) and the range of h(x) can be written in the form

[n, ∞). The values of m and n respectively, are ____ and ____.

Use the following information to answer the next question.

$$f(x) = 2^x$$

$$g(x) = \frac{-5}{x-8}$$

$$h(x) = (g \circ f)(x),$$

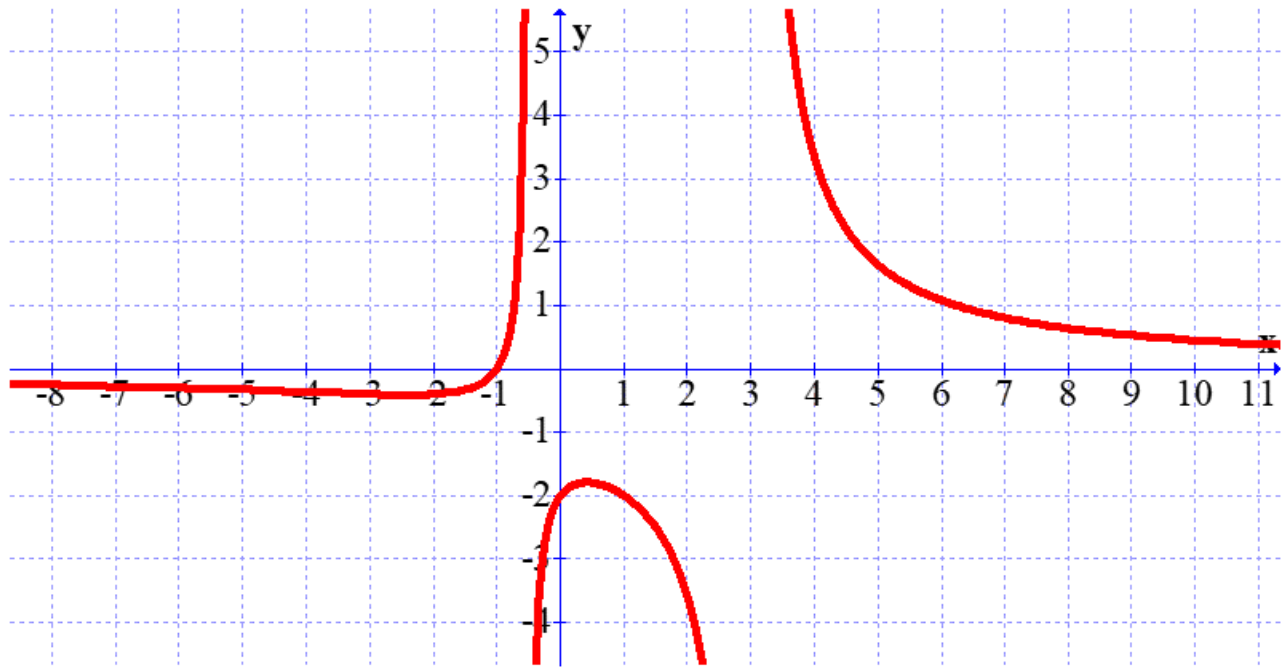16. The domain of h(x) can be written in the form, x ≠ k. The value of k

    is ____.

17. Given $\dfrac{(2x-1)(x+w)}{(2x-1)(x-2)}$, there is a point of discontinuity at $\left(\dfrac{1}{2},-1\right)$. The value

    of w is ____.

The graph below has two vertical asymptotes having the equations:

$x = \dfrac{-1}{2}$, and x = 3. This graph can be written in the form:

$$\frac{a(x+1)}{2x^2 - bx - c}$$

18.   If the y-intercept of the graph is (0,-2), determine the values of a, b, and c and place them respectively in the box below.

19. Carl is practicing for an up-coming curling tournament. On a particular day of practice, his focus in on drawing to the house, in particular to the 4 foot rings. So far he has been successful on 34 of 55 attempts. If he tries x attempts from now on and is successful on 75% of them, how many attempts will it take before his average is above 70%?

The number of attempts is _____.

Use the following information to answer the next question.

Consider the following list of functions, where b > 1.

Function 1 $y = x^2 + b$

Function 2 $y = \log_b x$

Function 3 $y = \sqrt{x - b}$

20. A new function, h(x) , which is the quotient of 2 different functions from the above list is determined and the domain of h(x) is {x | x > 0, x ∈ R}. If h(x) = $\dfrac{f(x)}{g(x)}$,

then what 2 functions should be selected for f(x) and g(x)? Explain. Include a diagram sketch of the graphs.

21. Given the functions, $f(x) = x^2 - 4x$, $g(x) = \dfrac{1}{x+3}$, and $h(x) = g(x) - (f \circ g)(x)$, find the value of $h(-2)$.

22. Convert $y = \dfrac{-3x+1}{x-1}$ to the form $y = \dfrac{a}{x-h} + k$. Sketch the graph below and identify the equations of all asymptotes, state the domain and range and state all intercepts.
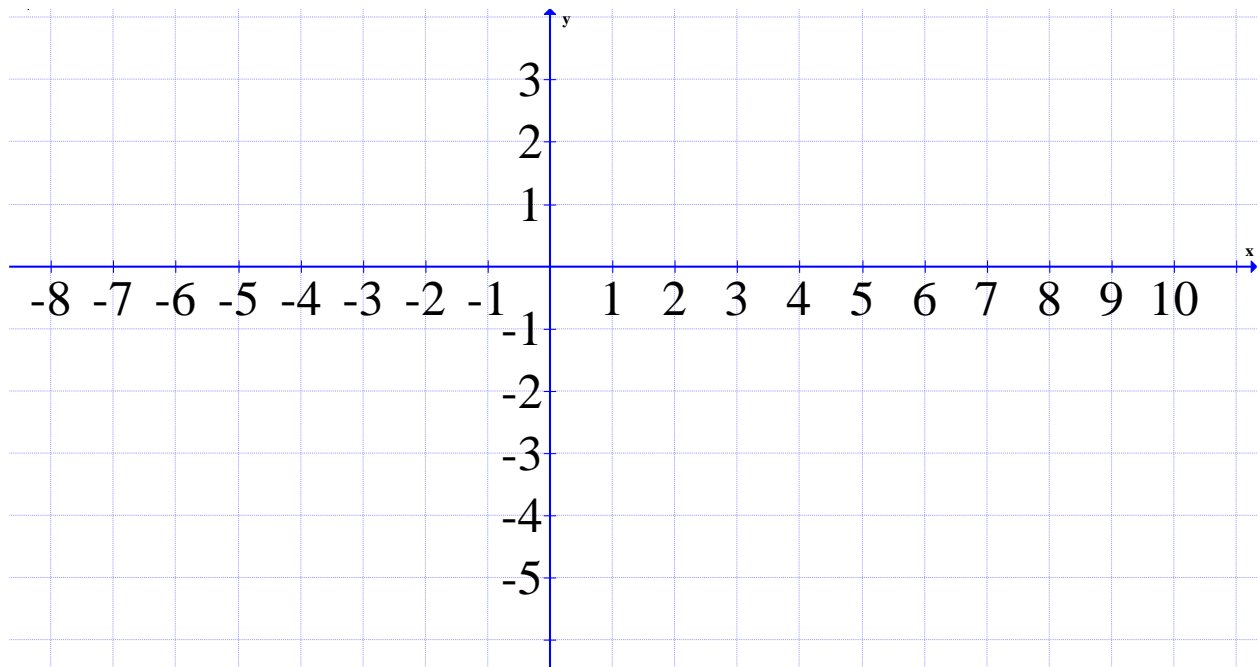
23. a) When solving the rational equation, $3x + 2 = \dfrac{15 - 2x}{x - 4} + 12$, algebraically, a quadratic equation, in the form, $ax^2 + bx + c = 0$, will be part of the process leading to the solution. What are the values of a, b, and c?

b) Explain how to solve the rational equation above by a graphical method.

c) Of the 2 roots to the rational equation above, what is the non-integer root, to an exact answer?