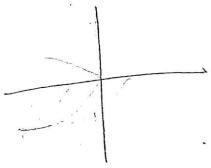
Analyzing Radical and Rational Functions Lesson #7: Practice Test

No calculator may be used for this section of the test.

1. The domain and range of the function $y = -\sqrt{-x+1}$ are, respectively, all real numbers such that



A. $x \geq 1, y \geq 0$

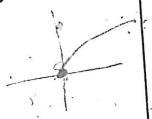
B. $x \geq -1, y \leq 0$

C. $x \leq -1, y \geq 0$

D. $x \leq 1, y \leq 0$

Use the following information to answer the next two questions.

A student is analyzing the graph of the function $y = g(x)$. She correctly deduces that the range of the function $y = \sqrt{g(x)}$ is $\{y \mid 0 \leq y \leq 4, y \in R\}$.



She makes four statements about the graph of $y = g(x)$.

Statement 1: The point $(1, 2)$ lies on the graph of $y = g(x)$.

Statement 2: The graph of $y = g(x)$ has no x-intercepts.

Statement 3: The graph of $y = g(x)$ has no points in quadrants three or four.

Statement 4: The maximum value of $y = g(x)$ is 2.

2. Which statement(s) **must** be false?

A. Statement 2 only

B. Statement 4 only

C. Statement 2 and 4 only

D. Some other statement, or combination of statements, must be false.

3. Which statement(s) **must** be true?

A. Statement 1 only

B. Statement 3 only

C. None of the statements must be true.

D. Some other statement, or combination of statements, must be true.

Numerical Response **2.** To the nearest hundredth, the solution of the equation $\frac{x-9}{8-x} = 20$ is _____.

(Record your answer in the numerical response box from left to right.)

8	.	0	5

Use the following information to answer the next five questions.

Consider the function $f(x) = 2 - 4\sqrt{5x-3}$

8. The range of the function $y = f(x)$ is

A. $\{y \mid y \in R\}$ **B.** $\{y \mid -2 \le y \le 2, y \in R\}$

C. $\{y \mid y \le 2, y \in R\}$ **D.** $\{y \mid y \ge 2, y \in R\}$

Numerical Response **3.** The domain of the function $y = f(x)$ is $x \ge c$.
The value of c, to the nearest tenth, is _____.

(Record your answer in the numerical response box from left to right.)

0	.	6	

9. If $g(x) = \sqrt{f(x)}$, then the domain of $g(x)$ is

A. $\{x \mid x \ge 0, x \in R\}$

B. $\{x \mid x \ge 0.6, x \in R\}$

C. $\{x \mid x \ge 0.65, x \in R\}$

D. $\{x \mid 0.6 \le x \le 0.65, x \in R\}$

10. The solution of the equation $f(x) = -5$ can be determined from the x-intercepts of the graph of

A. $y = 2 - 4\sqrt{5x-3}$

B. $y = -3 - 4\sqrt{5x-3}$

C. $y = -7 - 4\sqrt{5x-3}$

D. $y = 7 - 4\sqrt{5x-3}$

Numerical Response **4.** The solution of the equation $f(x) = -5$, to the nearest hundredth, is _____.

(Record your answer in the numerical response box from left to right.)

1	.	2	1

Use the following information to answer the next three questions.

Consider the graph of the rational function $f(x) = \dfrac{x-7}{x^2-9x+14}$.

4. Which one of the following statements is true regarding the graph of $f(x)$?

   A. The horizontal asymptote has equation $y = 0$.
   B. The horizontal asymptote has equation $y = 1$.
   C. The horizontal asymptote has equation $x = 7$.
   D. There is no horizontal asymptote.

5. Which one of the following statements is true regarding the graph of $f(x)$?

   A. The vertical asymptote has equation $x = 0$.
   B. The vertical asymptote has equation $x = 2$.
   C. The vertical asymptote has equation $x = 7$.
   D. There is no vertical asymptote.

Numerical Response

1. If the point of discontinuity of the graph can be represented by (a, b), then the value of $a + b$, correct to the nearest tenth, is _____.
   (Record your answer in the numerical response box from left to right.)

7	.	2	

Section B ***A graphing calculator may be used for the remainder of the test.***

6. The range of $y = \sqrt{f(x)}$ is $\{y \mid 3 \le y \le 12, y \in R\}$. Which one of the following points could lie on the graph of $y = f(x)$?

   A. $(3, \sqrt{3})$ **B.** $(9, 2)$
   C. $(8, 5)$ **D.** $(18, 18)$

7. Which of the following statements concerning the roots of the equation $\dfrac{2x^3 - 19x^2 + 56x - 48}{x - 4} = 0$ is correct?

   A. The only root is 1.5.
   B. The only root is 4.0.
   C. There are two roots, 1.5 and 4.0.
   D. There are no roots.

Use the following information to answer the next two questions.

$y = f(x)$ is a continuous function with zeros -5, 1, and 4, and domain $x \in R$
The domain of $y = \sqrt{f(x)}$ is the set of real numbers such that $x \leq -5$ or $x \geq 4$.

Zach has been given a code to describe whether the function is positive, negative, zero, or does not exist for particular values of x.

For the function value $f(x_0)$, he used the following code:

- If the function is **negative** at $x = x_0$, use the code number 1.
- If the function is **zero** at $x = x_0$, use the code number 2.
- If the function is **positive** at $x = x_0$, use the code number 3.
- If the function **does not exist** at $x = x_0$, use the code number 4.

Numerical Response

5. In the first box, write the code number for $f(-6)$.
In the second box, write the code for $f(-3)$.
In the third box, write the code number for $f(1)$.
In the last box, write the code number for $f(6)$.

(Record your answer in the numerical response box from left to right.)

3	1	2	3

11. If the function $f(x)$ has the lowest possible degree, then the multiplicity of the zero at

A. 1 **B.** 2 **C.** 3
D. unable to be determined

Use the following information to answer the next three questions.

Consider the functions

$$f(x) = \frac{x + a}{x^2 + a}, \quad g(x) = \frac{(x + a)(x + c)}{x^2 + xa + xb + ab}, \quad h(x) = \frac{2x + b}{x^2 - b}, \quad k(x) = \frac{x^2 + b}{x^2 + a}$$

where a, b, and c are natural numbers.

12. Which of the following lists all the functions which have no discontinuities and whose graph has a horizontal asymptote at the x-axis?

A. $f(x)$
B. $k(x)$
C. both $f(x)$ and $h(x)$
D. both $h(x)$ and $k(x)$

13. Function $g(x)$ has

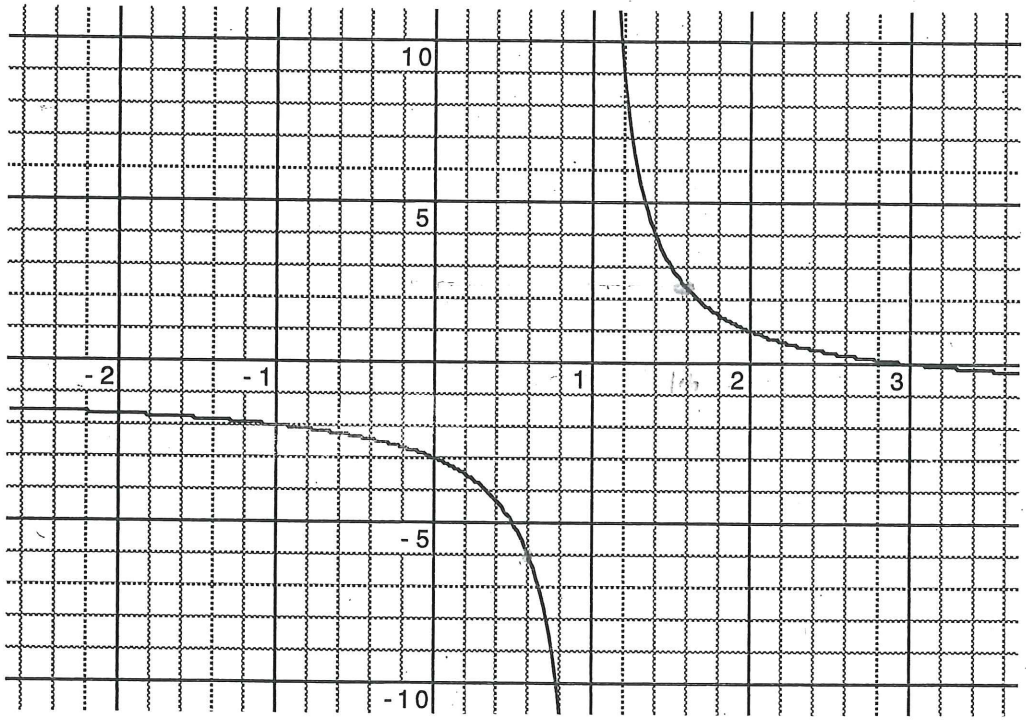
A. no points of discontinuity
B. two points of discontinuity
C. one vertical asymptote
D. two vertical asymptotes

14. The function(s) whose graph(s) has an x-intercept at $x = -a$ is

A. $f(x)$ only
B. $g(x)$ only
C. $f(x)$ and $g(x)$ only
D. some other function or combination of functions

Use the following information to answer the next two questions.

The partial graph of a rational function $y = f(x)$ is shown.



15. The solution of the equation $f(x) - 2.2 = 0$ is

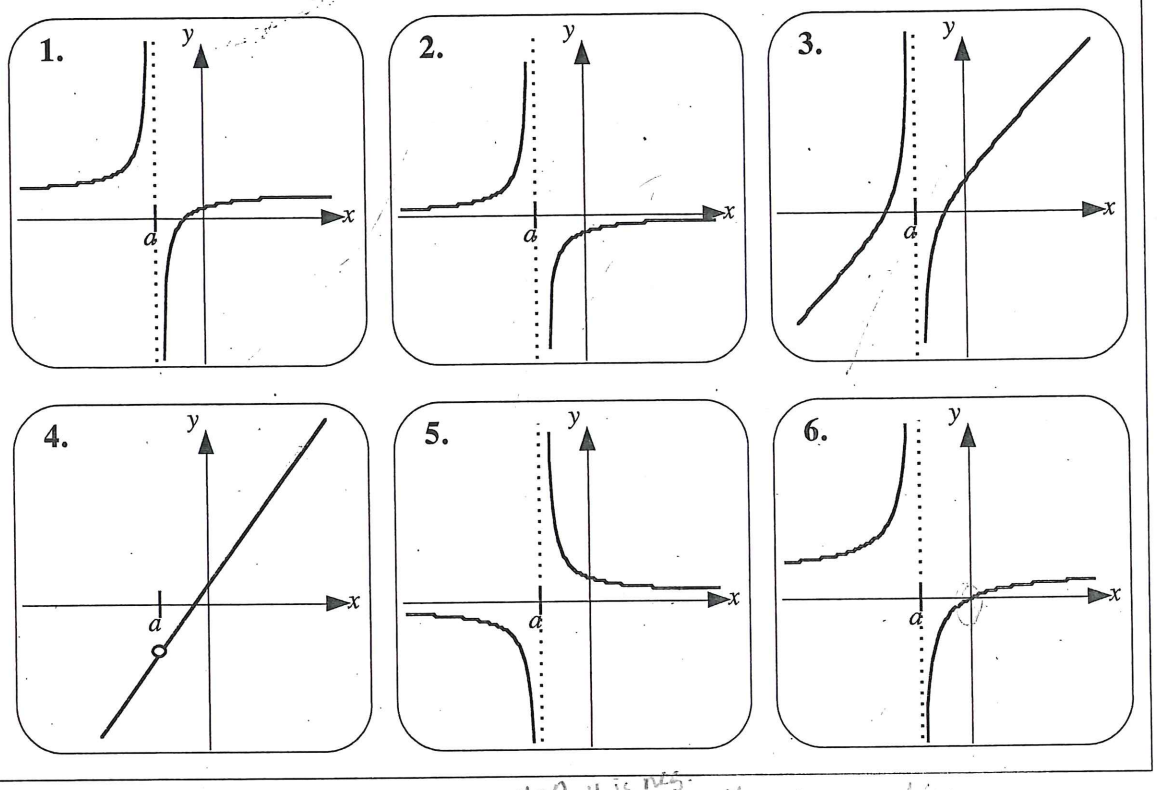
A. $x = -1.5$ **B.** $x = -0.9$
C. $x = 0.8$ **D.** $x = 1.6$

16. The root of the equation $f(2x) = -6$ is

A. 0.3 **B.** 0.6
C. 1.2 **D.** –3.0

Use the following information to answer the next question.

The partial graphs of six rational functions are shown below.



2, 5 $x=0$, y is neg. $*a$ is negative

Numerical Response **6.** Write the diagram number for the function $y = \dfrac{-2}{x-a}$ in the first box. $n<d$ $y=0$

1, 6 no $(0,0)$

Write the diagram number for the function $y = \dfrac{x+2}{x-a}$ in the second box. $n=d$ $y=1$

$(0,0)$ exists

Write the diagram number for the function $y = \dfrac{x}{x-a}$ in the third box. $n=d$ $y=1$

Write the diagram number for the function $y = \dfrac{x^2+2x-ax-2a}{x-a}$ in the last box. $n>d$ $n\neq$

(Record your answer in the numerical response box from left to right.)

2	1	6	4

$\dfrac{(x-a)(x+2)}{(x-a)}$ linear with PoD

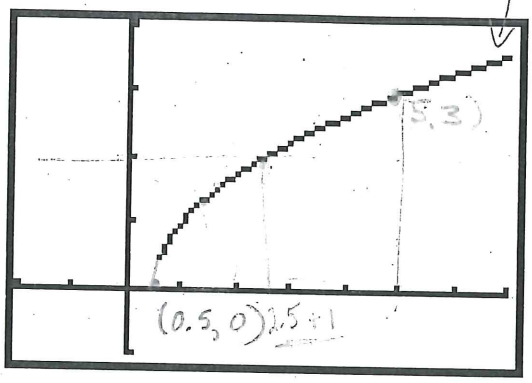
17. The domain and range of $g(x) = a\sqrt{b(x-h)} + k$, $a>0, b<0$, are, respectively

A. $\{x \mid x \geq h, x \in R\}$, $\{g(x) \mid g(x) \leq k, g(x) \in R\}$
B. $\{x \mid x \geq h, x \in R\}$, $\{g(x) \mid g(x) \geq k, g(x) \in R\}$
C. $\{x \mid x \leq h, x \in R\}$, $\{g(x) \mid g(x) \geq -k, g(x) \in R\}$
D. $\{x \mid x \leq h, x \in R\}$, $\{g(x) \mid g(x) \geq k, g(x) \in R\}$

Use the following information to answer the next three questions.

$f(x)$ is a linear function. The graphing calculator screenshot of the graph of $y = \sqrt{f(x)}$ is shown with window x:[–2, 7, 1], y[–1, 4, 1].

The points (0.5, 0) and (5, 3) lie on the graph of $y = \sqrt{f(x)}$.



18. $f(5)$ is

A. 25 **B.** $\sqrt{9}$ **C.** $\sqrt{3}$
D. unable to be determined from the given information

19. $f(-5)$ is

A. –11
B. –9
C. –3
D. unable to be determined from the given information

20. The solution of the equation $\sqrt{f(x-1)} - 2 = 0$ is closest to

A. 1.5 **B.** 2.5
C. 3.5 **D.** 4.5

Written Response

Consider the function defined by $f(x) = \dfrac{2x^3 + x^2 - 25x + 12}{(x-3)}$.

- Algebraically determine the coordinates of the point of discontinuity of the graph of the function.

1, 2, 3, 4, 6, 12 / 1, 2 — $f(3) = 0$

3 | 2 1 −25 12
| 6 21 −12
2 7 −4 0

$2x + 7x - 4$

$(x-3)(2x-1)(x+4)$ / $(x-3)$

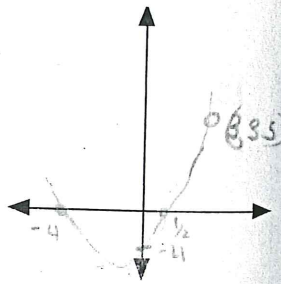
$y = (2(3)+1)(7)$
$y = (5)(7)$
$y = 35$
PoD: $(3, 25)$

- Describe the relationship between the roots of the equation $\dfrac{2x^3 + x^2 - 25x + 12}{(x-3)} = 0$ and the x-intercepts of the graph of f. SAME THING

- Solve the equation $\dfrac{2x^3 + x^2 - 25x + 12}{(x-3)} = 0$ $(x-3)(2x-1)(x+4)$

$x = \frac{1}{2}, -4$

- Sketch the graph of the function on the grid showing the intercepts and the point of discontinuity.



Answer Key

Multiple Choice

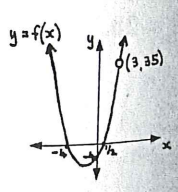
1. D	2. C	3. C	4. A	5. B	6. D	7. A	8. C
9. D	10. D	11. B	12. A	13. C	14. A	15. D	16. A
17. D	18. B	19. A	20. C				

Numerical Response

1. 7 . 2 ( )
2. 8 . 0 5
3. 0 . 6 ( )
4. 1 .. 2 1
5. 3 1 2 3
6. 2 1 6 4

Written Response

- (3, 35)
- The roots of the equation are the same as the x-intercepts of the graph.
- $x = -4, \frac{1}{2}$



Functions and Relations Lesson #8:
Practice Test

Section A ***No calculator may be used for this section of the test.***

1. If $f(x) = 3x^2 - 2$, then $f(3x)$ is

$3(3x)^2 - 2$

$3(9x^2) - 2$

A. $9x^2 - 2$ **B.** $9x^2 - 6$

C. $27x^2 - 2$ **D.** $27x^2 - 6$

2. If a polynomial function is defined by $P(a) = a^3 + 1$, then $2a^3 + 1$ represents

$2a^3 + 2 + 1$

$(2a)^3 + 1$

$8a^3 + 1$

A. $2P(a)$

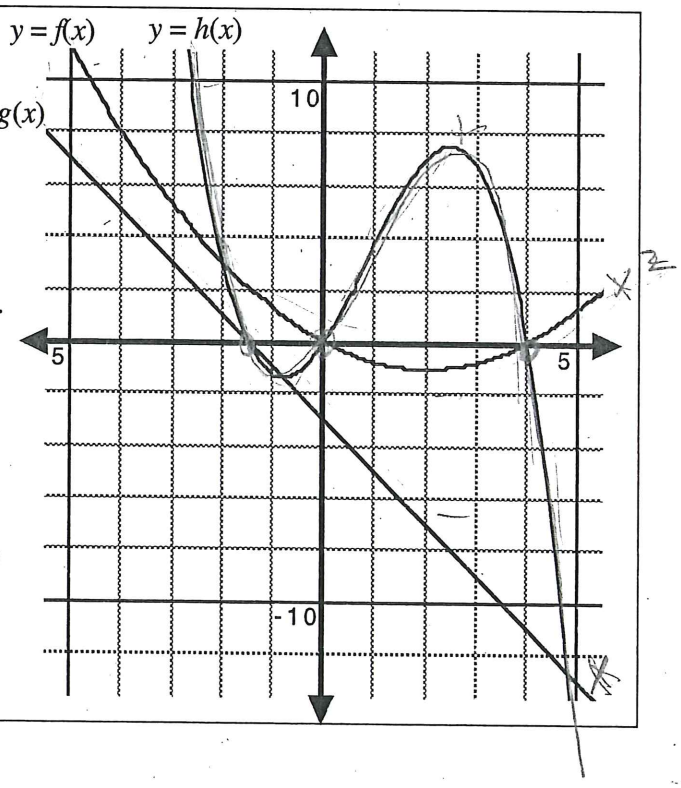
B. $P(2a)$

C. $2P(a) + 1$

D. none of A, B, or C

Use the following information to answer the next question.

The graphs of $y = f(x)$, $y = g(x)$, and $y = h(x)$ are shown on the grid.



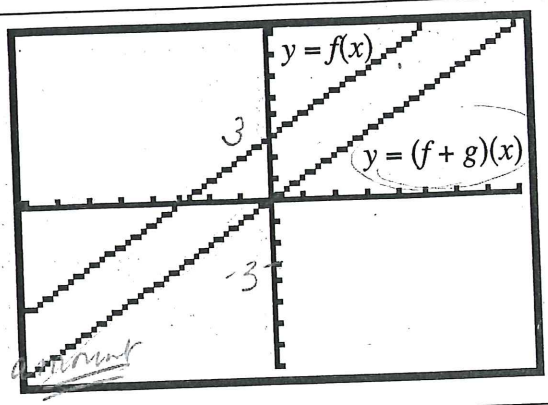
$(x^2)(x) = x^3$

3. $h(x)$ is equivalent to

A. $(f + g)(x)$ **B.** $(f - g)(x)$ **C.** $(g - f)(x)$ **D.** $(fg)(x)$

Use the following information to answer the next question.

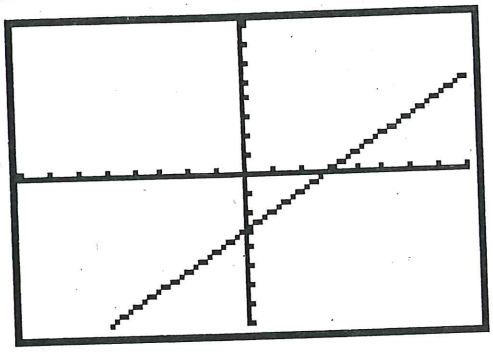
The screen shot from a graphing calculator shows the graphs of $y = f(x)$ and $y = (f + g)(x)$.



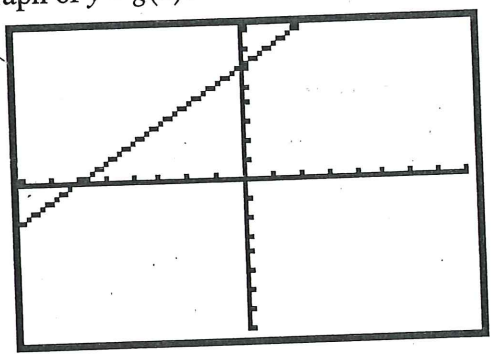
moves up by equal amount

4. Which of the following screen shots shows the graph of $y = g(x)$?

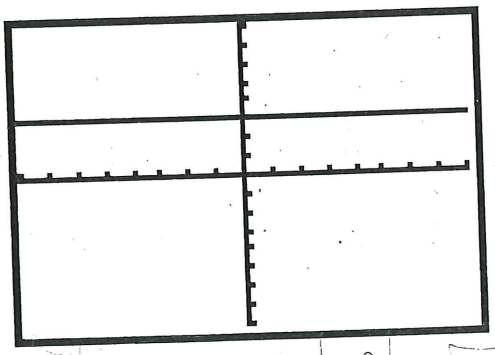
A.



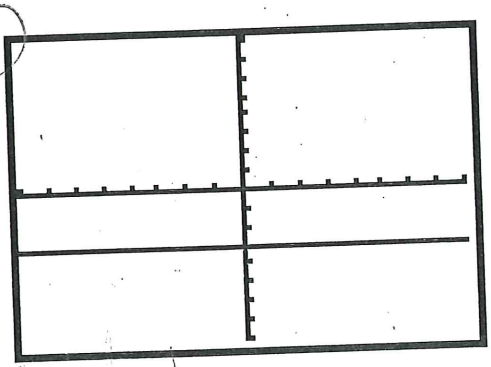
B.



C.



D.



$\frac{4}{3} - \frac{3}{4}$ $\quad -9$ $\quad -16$ $\qquad \frac{4}{3} - \frac{3}{4}$ $\quad -9$ $\quad +16$

5. If $a(x) = 12x^2 - 25x + 12$ and $b(x) = 12x^2 + 7x - 12$, then the domain of the function $\left(\frac{a}{b}\right)(x)$ is

$\frac{(4x-3)(3x-4)}{(4x-3)(3x+4)}$

$x \neq \frac{3}{4}, \frac{-4}{3}$

A. $x \neq \frac{3}{4}, -\frac{4}{3}, x \in R$

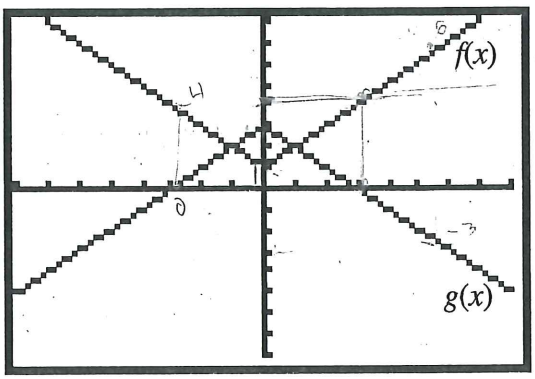
B. $x \neq -\frac{4}{3}, x \in R$

C. $x \neq \frac{3}{4}, \frac{4}{3}, x \in R$

D. $x \in R$

Use the following information to answer the next question.

Calculator representations of the graphs of two functions, $f(x)$ and $g(x)$, are shown.



The calculator representations below show the graphs of operations on these functions.

Diagram 1

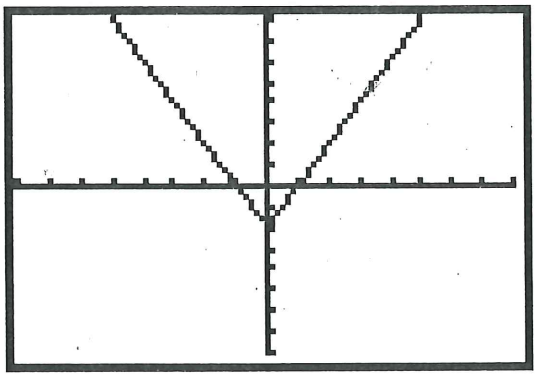


Diagram 2

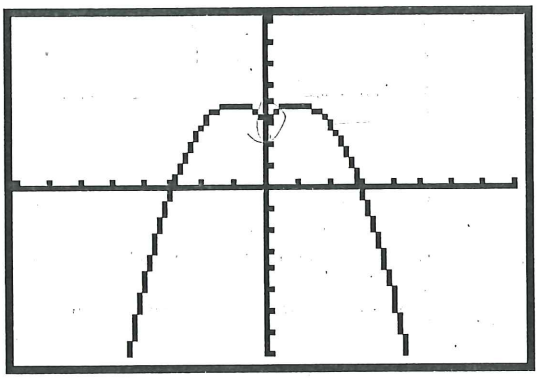


Diagram 3

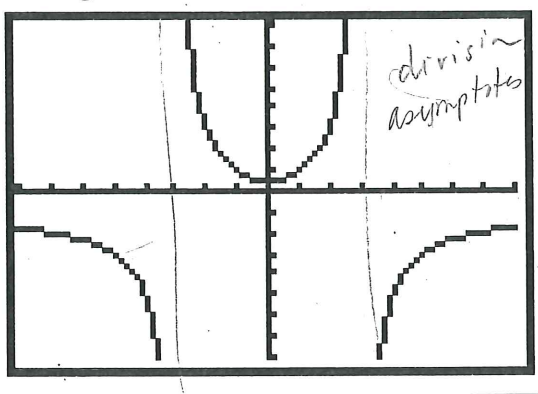
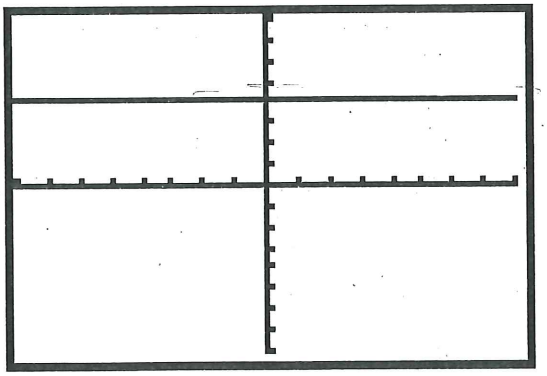


Diagram 4



Numerical Response

1. Write the diagram number for the graph of $(f+g)(x)$ in the first box. 4
Write the diagram number for the graph of $(f-g)(x)$ in the second box. 1
Write the diagram number for the graph of $(fg)(x)$ in the third box. 2
Write the diagram number for the graph of $\left(\frac{f}{g}\right)(x)$ in the fourth box. 3

(Record your answer in the numerical response box from left to right.)

4	1	2	3

Section B ***A graphing calculator may be used for the remainder of the test.***

6. If $f(x) = x^2 - 3x - 1$ and $g(x) = 2x - 5$, then the value of $(fg)(-1)$ is

$g(-1) = -7$

$f(-1) = 1 + 3 - 1$

$= 3$

A. -7

B. -21

C. 7

D. 21

Numerical Response

2. $P(x) = 8x^2 - 4x - 14$ and $Q(x) = 9 - 2x$. The function $(P + Q)(x)$ can be written in the form $(ax - b)(cx + d)$ where a, b, c, and d are all positive integers.

Write the value of a in the first box. Write the value of b in the second box.
Write the value of c in the third box. Write the value of d in the fourth box.

(Record your answer in the numerical response box from left to right.)

4	5	2	1

$8x^2 - 4x - 14 + 9 - 2x$

$8x^2 - 6x - 5$

$4 \quad - \quad 5 \quad -10$

$2 \quad + \quad 1 \quad +4$

$(4x - 5)(2x + 1)$

Use the following information to answer the next two questions.

Consider the two linear functions $f(x) = 4x - 5$ and $g(x) = x - 3$, defined for all real numbers.

7. Which of the following is an expression for $3(f + g)(x) - 2(f - g)(x)$?

$3(5x - 8) - 2(3x - 2)$

$15x - 24 - 6x + 4$

$9x - 20$

A. $9x - 8$

B. $9x - 20$

C. $9x - 28$

D. $10x - 9$

8. Which of the following is an expression for $(ff)(x)$?

A. $8x - 10$

B. $16x - 25$

C. $16x^2 + 25$

D. $16x^2 - 40x + 25$

Numerical Response

3. If $f(x) = 3x^2 - 4x + 17$ and $g(x) = 5x^2 + 9x - 2$, then the value of $(f - g)(-2) - (g - f)(2)$ is _____ .

(Record your answer in the numerical response box from left to right.)

2	2		

$f(-2) = 3(4) + 8 + 17 = 37$

$g(-2) = 5(4) - 18 - 2 = 0$

$f - g = 37$

$f(2) = 12 - 8 + 17 = 21$

$g(2) = 20 + 18 - 2 = 36$

$g - f = 15$

$37 - 15 = 22$

Use the following information to answer the next two questions.

Rational functions f and g are defined as $f(x) = \dfrac{x-1}{x+1}$ and $g(x) = \dfrac{2x-1}{2x+1}$.

9. $\left(\dfrac{f}{g}\right)(x)$ can be written in the form

$\dfrac{(x-1)}{(x+1)} \cdot \dfrac{(2x+1)}{(2x-1)} = \dfrac{2x^2 - x + 1}{2x^2 + x - 1}$

A. $\dfrac{2x^2 - 3x + 1}{2x^2 + 3x + 1}$

B. $\dfrac{2x^2 - x - 1}{2x^2 + x - 1}$

C. $\dfrac{2x^2 + x - 1}{2x^2 - x - 1}$

D. $\dfrac{2x^2 + 3x + 1}{2x^2 - 3x + 1}$

10. The domain of the function $\left(\dfrac{f}{g}\right)(x)$ is $x \neq -1, \frac{1}{2}, -\frac{1}{2}$

A. $x \neq -1, \frac{1}{2}, x \in R$

B. $x \neq -1, -\frac{1}{2}, \frac{1}{2}, x \in R$

C. $x \neq -1, -\frac{1}{2}, 1, x \in R$

D. $x \neq -1, -\frac{1}{2}, \frac{1}{2}, 1, x \in R$

11. If $f(x) = x^2 + 14x + 24$ and $g(x) = x + 2$, then the value of $\left(\frac{f}{g}\right)(-2)$ is

A. 0
B. −24
C. 10
D. not defined

$f(-2) = 4 - 28 + 24 = 0$

$g(-2) = 0$

$\frac{0}{0}$

12. Given that $m(x) = 3x + 1$ and $n(x) = x^2 - 3$, then $m(n(x))$ equals

A. $3x^2 - 2$
B. $3x^2 - 8$
C. $9x^2 + 6x - 2$
D. $3x^3 + x^2 - 9x - 3$

$m(x^2-3)$
$= 3(x^2-3) + 1$
$= 3x^2 - 9 + 1$

Use the following information to answer the next two questions.

Consider the functions $f(x) = x^2 + 4$ and $g(x) = \sqrt{4x}$.

13. The composite function $(g \circ f)(x)$ is

A. $\sqrt{4x^2 + 16}$
B. $\sqrt{4x^2 + 4}$
C. $16x + 4$
D. $4x + 4$

$g(x^2+4)$
$\sqrt{4(x^2+4)}$
$\sqrt{4x^2+16}$

14. The domain and range of $y = (f \circ g)(x)$ are, respectively, real numbers such that

A. $x \geq 0$ and $y \geq 4$
B. $x \geq 0$ and $y \geq 0$
C. $x \in R$ and $y \geq 0$
D. $x \in R$ and $y \in R$

$f(\sqrt{4x})$
$(\sqrt{4x})^2 + 4$
$= 4x + 4$

$x \geq 0$
$y \geq 0$

Numerical Response **4.** The functions f, g, and h are given by $f(x) = |x + 15|$, $g(x) = 4x + 2$, and $h(x) = x^2 - 10$. The value of $(f \circ g \circ h)(-3)$, to the nearest whole number, is _____.

(Record your answer in the numerical response box from left to right.)

1	3		

$h(-3) = -1$

$g(-1) = -2$

$f(-2) = |13|$

15. Given $f(x) = \dfrac{1}{2x+1}$ and $g(x) = 5x - 1$, then $(g \circ f)(x)$ can be written in the form

A. $\dfrac{4-2x}{2x+1}$ $\quad g\left(\dfrac{1}{2x+1}\right)$

B. $\dfrac{6-2x}{2x+1}$ $\quad 5\left(\dfrac{1}{2x+1}\right) - 1$

C. $\dfrac{5}{2x}$ $\quad \dfrac{5-(2x+1)}{2x+1} = \dfrac{5-2x-1}{2x+1} = \dfrac{4-2x}{2x+1}$

D. $\dfrac{1}{10x-1}$

Numerical Response **5.** $f(x) = 2^x$ and $g(x) = x - 2$. To the nearest tenth, the smallest positive solution of the equation $(f \circ g)(x) = (g \circ f)(x)$ is _____.

(Record your answer in the numerical response box from left to right.)

1	.	4	

$2^{(x-2)} = 2^x - 2$ graph.

16. If $g(x) = \dfrac{x^3 - 1}{2}$, $x \in R$, then $g^{-1}(x)$ is

A. $\dfrac{2}{x^3 - 1}$

B. $\sqrt[3]{2x+1}$

C. $2\sqrt[3]{x} + 1$

D. 2

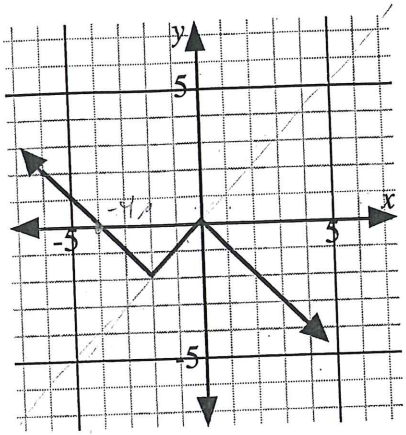
$x = \dfrac{y^3 - 1}{2}$

$2x = y^3 - 1$

$y = \sqrt[3]{2x+1}$

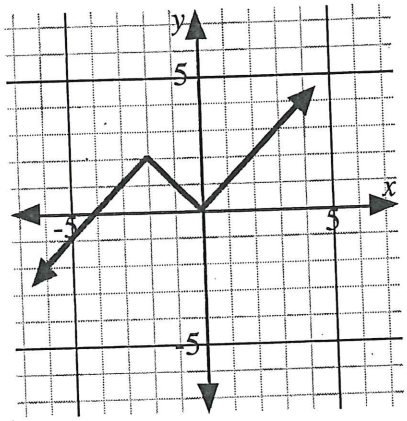
Use the following information to answer the next question.

The partial graph of the function $y = f(x)$ is shown.

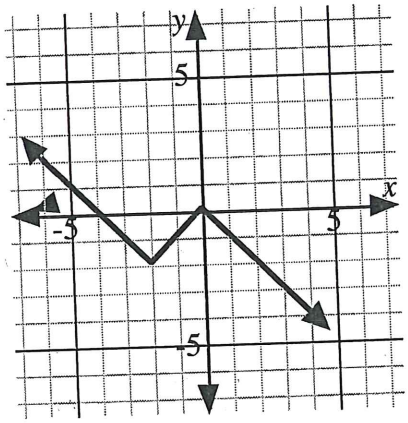


16. Which of the following is the partial graph of $x = f(y)$?

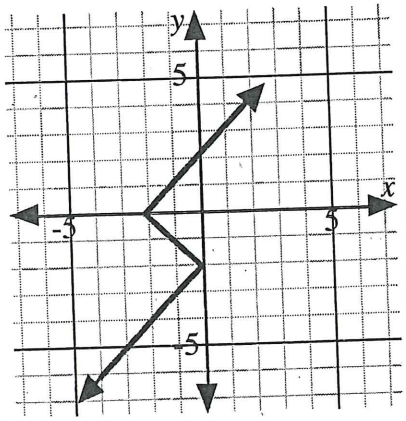
A.



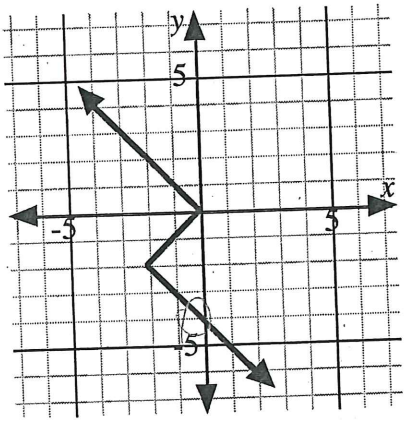
B.



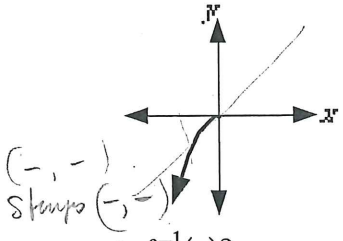
C.



D.

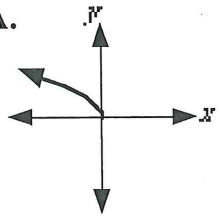


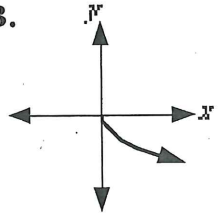
18. The graph of the function $y = f(x)$ is shown in the diagram below.

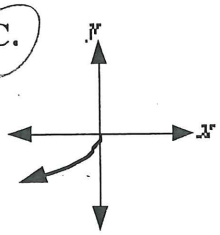


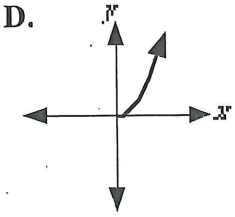
(−, −)
Stays (−, −)

Which of the following represents $f^{-1}(x)$?

A.


B.


C.


D.


Use the following information to answer the next two questions.

The mapping diagram shows the composition of two functions f and g.

$$x \xrightarrow{f} x^3 \xrightarrow{g} x^3 + 4$$

opt **19.** The expression which represents $g(x)$ is

A. x^3

B. $x^3 + 4$

C. $x + 4$

D. 4

opt **20.** The expression which represents $(g \circ f)^{-1}(x)$ is

A. $\sqrt[3]{x} - 4$

B. $\sqrt[3]{x - 4}$

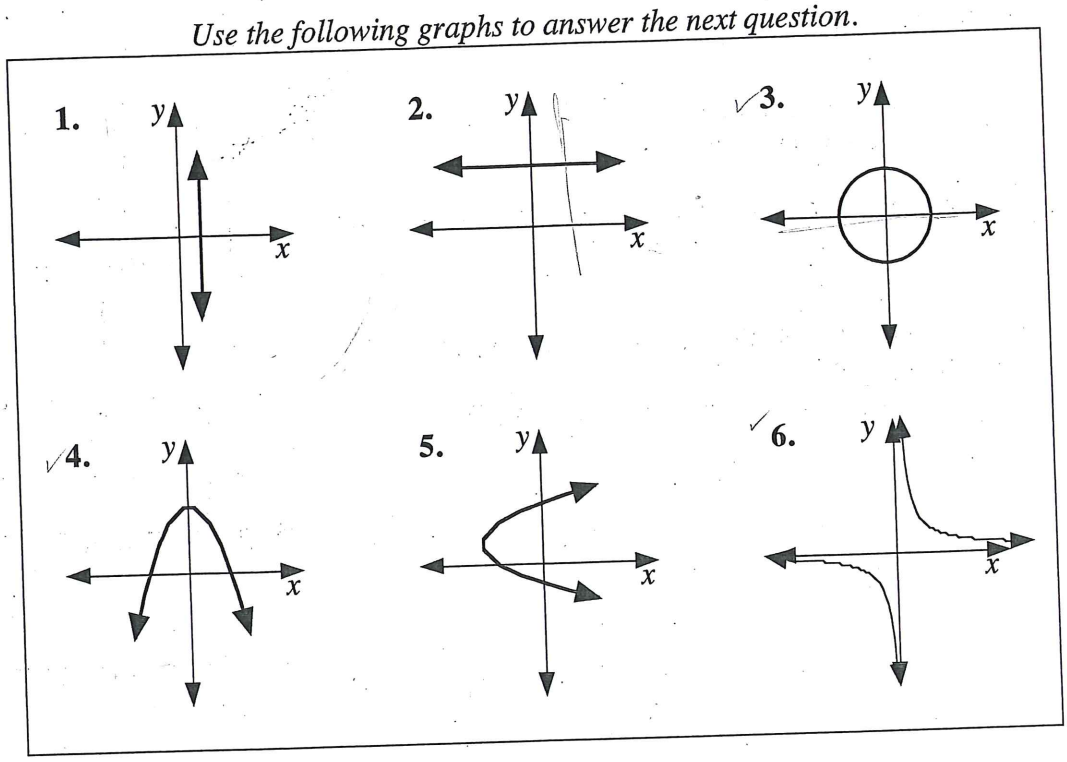
C. $4 - \sqrt[3]{x}$

D. $\sqrt[3]{4 - x}$

$g(\sqrt[3]{x})$ $\quad y^3 + 4$

$\sqrt[3]{x}$ $\quad \sqrt[3]{x + 4}$

Use the following graphs to answer the next question.



Numerical Response **6.** Consider the following questions:

6 **a)** Which graph represents a function whose inverse is also a function?

3 **b)** Which graph does not represent a function, but **could** be made to represent a functior if the range were restricted to $y \geq 0$?

4 **c)** Which graph represents a function whose inverse is not a function, but **could** be mad to represent a function whose inverse is also a function if the domain were restricted t $x \leq 0$?

yikes! 2 **d)** Which graph represents a function whose inverse is not a function but could **not** be made to represent a function whose inverse is also a function if the domain were restricted to $x \leq 0$?

not 1, not 5

Write the graph number corresponding to answer a) in the first box, the graph number corresponding to answer b) in the second box, the graph number corresponding to answ c) in the third box, and the graph number corresponding to answer d) in the fourth box.

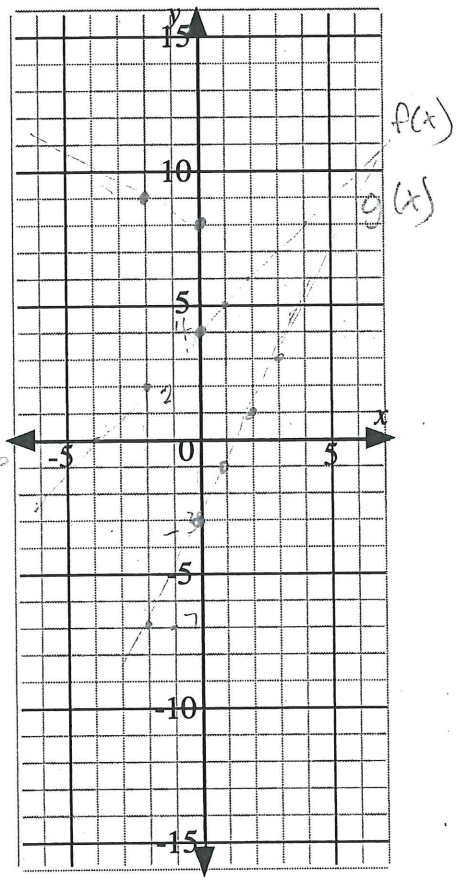
(Record your answer in the numerical response box from left to right.)

6	3	4	2

Written Response

Consider the functions $f(x) = x + 4$ and $g(x) = 2x - 3$ defined for all real numbers.

- Sketch the graphs of $y = f(x)$ and $y = g(x)$ on the grid.



- Explain how to use the graphs of f and g to sketch the graph of $f - g$.
  Sketch the graph of $y = (f - g)(x)$ on the grid.

Keeping x values, simply subtract the f(x)s y values from g(x) y values

- Algebraically, determine to the nearest tenth the root(s) of the equation $(f \circ g)(x) = (fg)(x)$.

$f(2x-3)$

$(2x-3)+4$

$f \circ g(x) = 2x+1$ $=$

$(fg)(x)$

$=(x+4)(2x-3)$

$= 2x^2+5x-12$

$0 = 2x^2+3x-13$

$x = \dfrac{-3 \pm \sqrt{9-4(2)(-13)}}{4}$

$= \dfrac{-3 \pm \sqrt{113}}{4}$

$\doteq 3.4, 1.9$