



# **Pre-Calculus 12**

## **Resource Exam A**

### **Exam Booklet II**

Multiple-Choice and Written-Response Questions  
**Calculator NOT Permitted**



**MULTIPLE-CHOICE QUESTIONS**  
**(Calculator NOT permitted)**

**Value: 53 marks**

**INSTRUCTIONS: No calculator may be used for this section of the examination.**

For each question select the **best** answer.

15. The students at a graduation dinner are separated into groups to be seated at 10 different tables. The order in which these 10 groups will approach the buffet is to be determined randomly. In how many ways can this order be determined?

- A.  $10^{10}$
- B.  ${}_{10}C_{10}$
- C.  ${}_{10}P_{10}$
- D.  $10 \times 10$

16. Consider the graph of  $y = -3 \cos \frac{\pi(x - 2)}{10} + 4$ . Which statement is false?

I.	The amplitude is 3
II.	The period is 10
III.	The phase shift is 2 to the right
IV.	The vertical displacement is 4 up

- A. I
- B. II
- C. III
- D. IV

17. Solve:  $\cos x = \frac{\sqrt{3}}{2}$ ,  $0 \leq x < 2\pi$

A.  $\frac{\pi}{6}, \frac{5\pi}{6}$

B.  $\frac{\pi}{6}, \frac{11\pi}{6}$

C.  $\frac{\pi}{3}, \frac{2\pi}{3}$

D.  $\frac{\pi}{3}, \frac{5\pi}{3}$

18. Determine an expression for all angles coterminal with a standard position angle measuring  $120^\circ$ . Express your answer in radians.

A.  $\frac{5\pi}{6} + \pi n$ ,  $n$  is an integer

B.  $\frac{2\pi}{3} + \pi n$ ,  $n$  is an integer

C.  $\frac{5\pi}{6} + 2\pi n$ ,  $n$  is an integer

D.  $\frac{2\pi}{3} + 2\pi n$ ,  $n$  is an integer



The phrase "an angle in standard position" is equivalent to "standard position angle" as well as "position angle."

19. Determine the exact value of  $\tan 75^\circ$ .

A.  $2 + \sqrt{3}$

B.  $-2 - \sqrt{3}$

C.  $\frac{5 + \sqrt{3}}{4}$

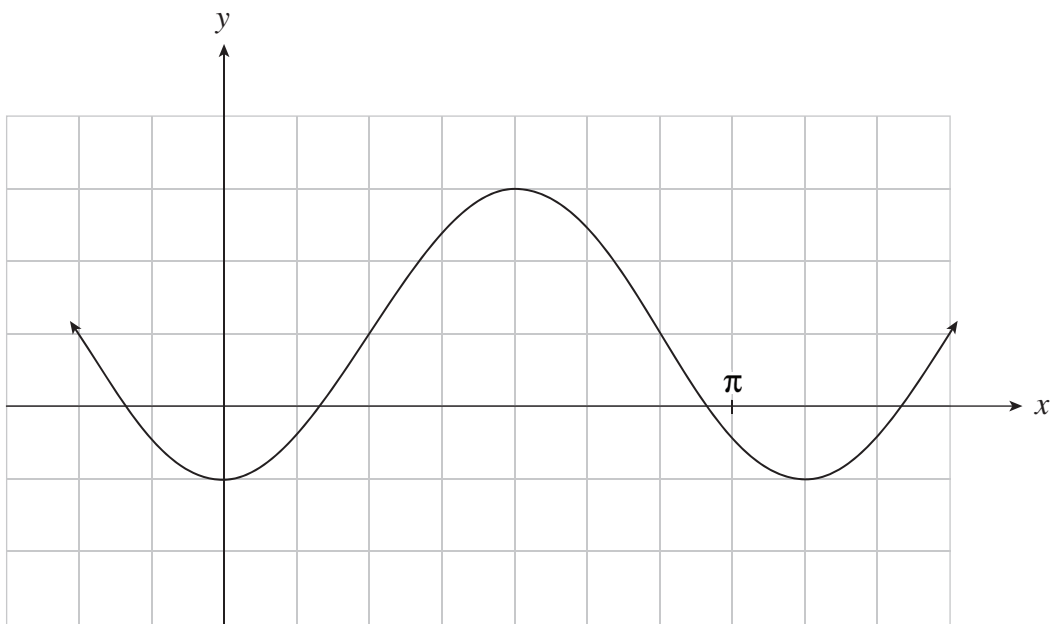
D.  $\frac{3 + \sqrt{3}}{\sqrt{3}}$



Students may be required to rationalize the denominator.

20. A point with an  $x$  value of 2 lies on the circle with equation  $x^2 + y^2 = 5$ . This point also lies on the terminal arm of  $\theta$  in standard position. Determine the value of  $\sec \theta$ .
- A.  $\frac{\sqrt{5}}{2}$
  - B.  $\frac{5}{2}$
  - C.  $\frac{2}{\sqrt{5}}$
  - D.  $\frac{2}{5}$

21. The graph of  $y = 2 \sin b(x - c) + 1$  is shown below. Determine a value of  $c$ .



- A.  $-\frac{2\pi}{2}$
- B. 2
- C.  $\frac{\pi}{4}$
- D.  $\frac{2\pi}{7}$

22. Determine all restrictions for the expression  $\frac{\tan x}{\cos x - 1}$ .

- A.  $\cos x \neq 0$
- B.  $\cos x \neq 1$
- C.  $\sin x \neq 0, \cos x \neq 1$
- D.  $\cos x \neq 0, \cos x \neq 1$

23. Solve:  $\sin x = -\cos x, -\pi \leq x \leq \pi$

- A.  $-\frac{\pi}{4}, \frac{3\pi}{4}$
- B.  $\frac{\pi}{4}, \frac{3\pi}{4}$
- C.  $\frac{3\pi}{4}, \frac{7\pi}{4}$
- D.  $\frac{3\pi}{4}, \frac{5\pi}{4}$

24. Simplify:  $\frac{\csc \theta - \sin \theta}{\sec \theta - \cos \theta}$

- A.  $\cot^2 \theta$
- B.  $\cot^3 \theta$
- C.  $\tan^2 \theta$
- D.  $\tan^3 \theta$

25. Solve:  $2^{3x-1} = 8^{2x+1}$

A.  $x = -\frac{4}{3}$

B.  $x = -1$

C.  $x = -\frac{2}{3}$

D.  $x = -\frac{3}{4}$

26. Express  $\log \frac{x^2}{10y^3}$  in terms of  $\log x$  and  $\log y$ .

A.  $2\log x - 1 - 3\log y$

B.  $2\log x - 1 + 3\log y$

C.  $2\log x - 10 - 3\log y$

D.  $2\log x - 10 + 3\log y$

27. Evaluate:  $\log_3 \sqrt{27}$

A.  $\frac{2}{9}$

B.  $\frac{2}{3}$

C.  $\frac{3}{2}$

D.  $\frac{9}{2}$



28. Bart and Arnie presented separate solutions to the statement:

“Write  $\log_2 x + \log_4 y$  as a single log.”

Bart	Arnie
$\log_2 x + \log_4 y$	$\log_2 x + \log_4 y$
$= \frac{\log_4 x}{\log_4 2} + \log_4 y$	$= \log_2 x + \frac{\log_2 y}{\log_2 4}$
$= 2\log_4 x + \log_4 y$	$= \log_2 x + \frac{1}{2}\log_2 y$
$= \log_4 x^2 y$	$= \log_2 x \sqrt{y}$

Which statement is true?

- A. Only Bart is correct.
- B. Only Arnie is correct.
- C. They are both wrong.
- D. They are both correct.



Omission of steps is not considered incorrect.

29. Which statement must be true for  $f(x) = \log_{\frac{1}{2}} x$  when  $x_2 > x_1$ ?

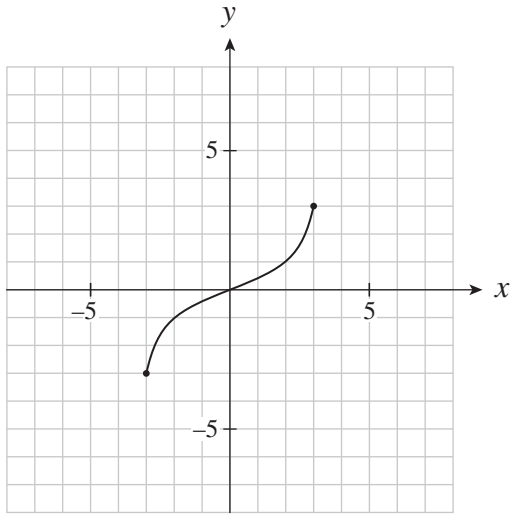
- A.  $f(x_1) > f(x_2)$
- B.  $f(x_2) > f(x_1)$
- C.  $f(x_1) > 0, f(x_2) < 0$
- D.  $f(x_2) > 0, f(x_1) < 0$



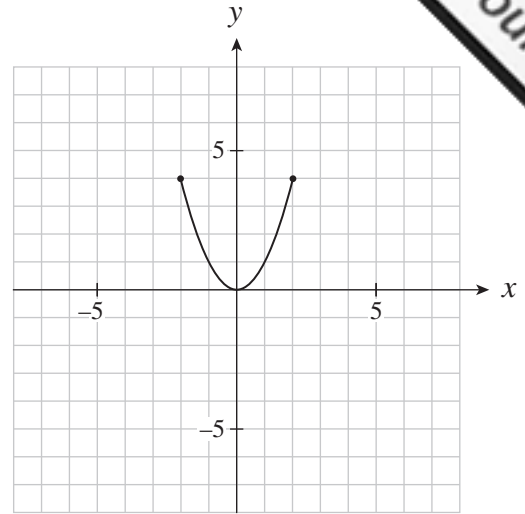
Students should recognize that  $y = \log_{\frac{1}{2}} x$  is equivalent to  $y = -\log_2 x$ .

30. For which graph is the relation and its inverse both functions?

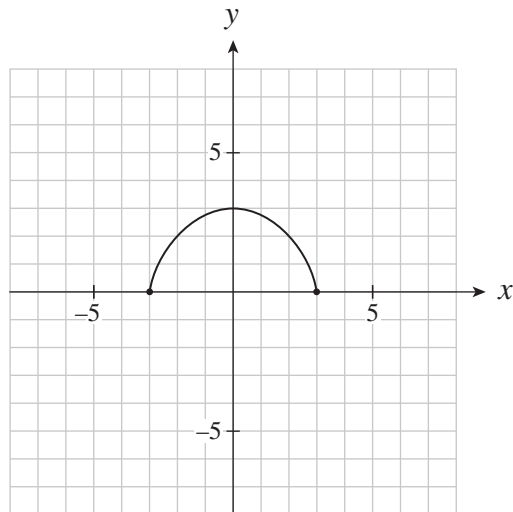
A.



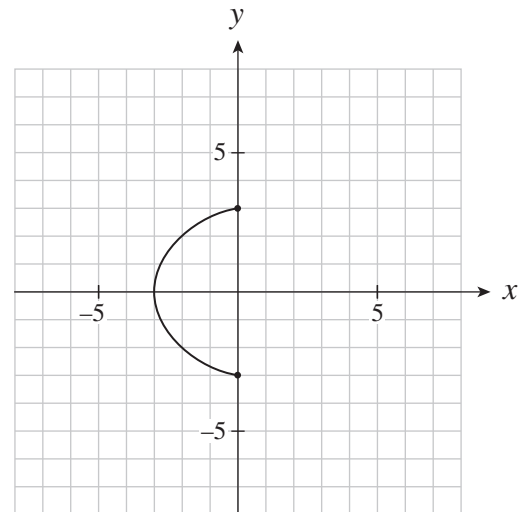
B.



C.

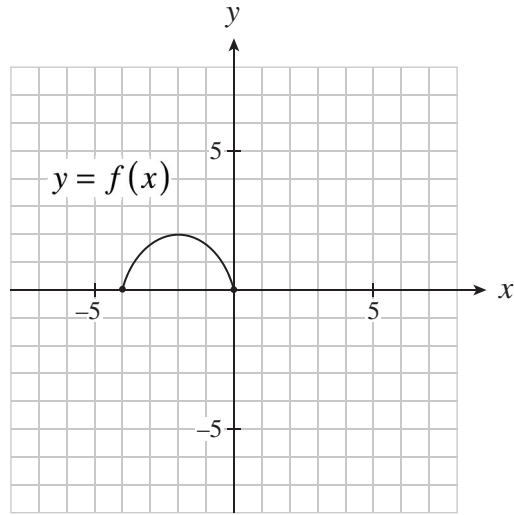


D.



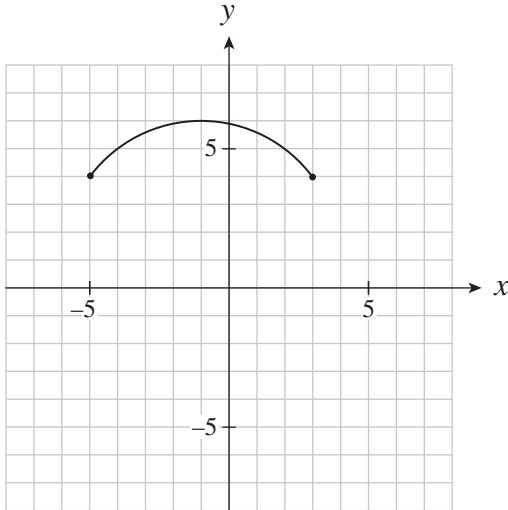
Students may find the horizontal line test an efficient method for testing if the inverse relations are functions or not.

31. The graph of  $y = f(x)$  is shown below.

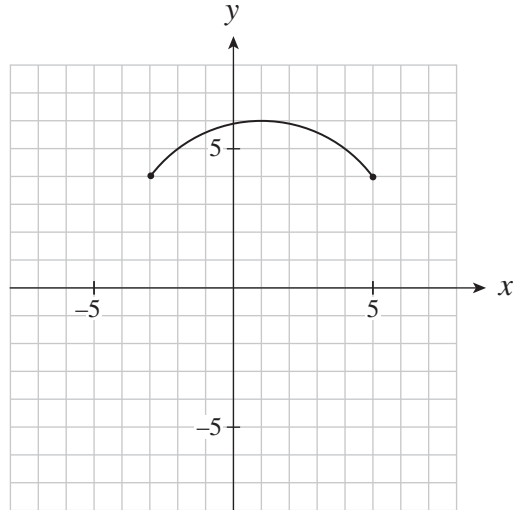


Which graph represents the graph of  $y = f(2(x-3)) + 4$ ?

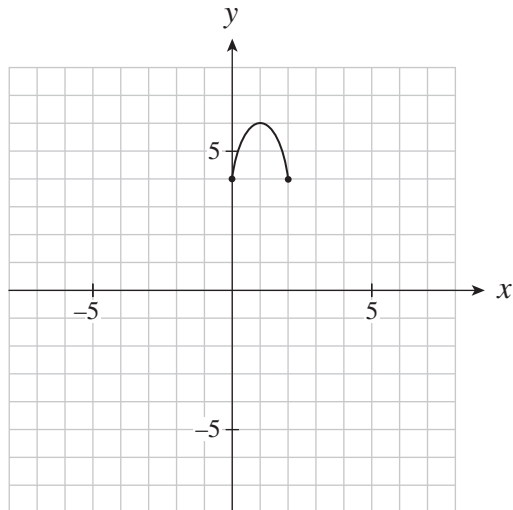
A.



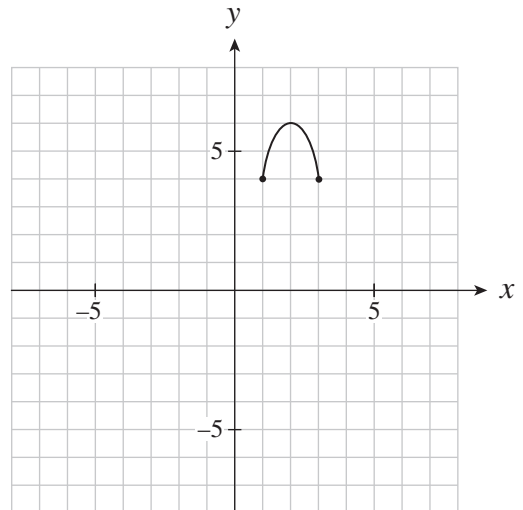
B.



C.



D.



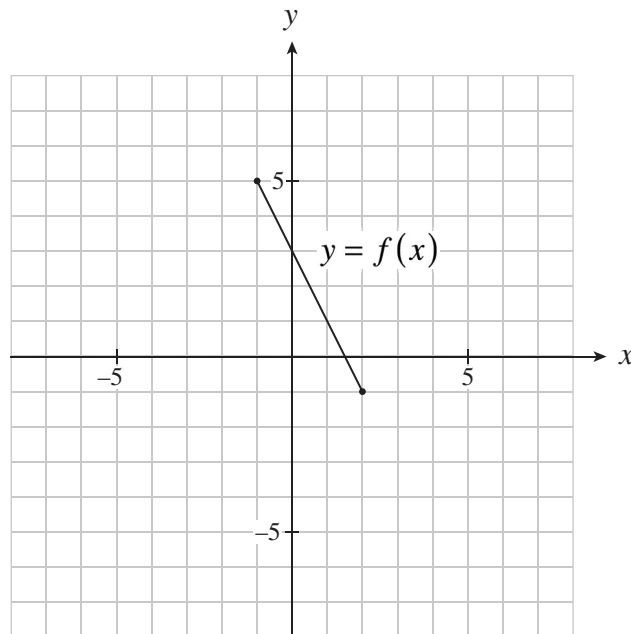
32. Consider the following transformations on the graph of  $y = f(x)$ .

I.	$y = f(x+2)$
II.	$y = 2f(x)$
III.	$y = f(-x)$
IV.	$y = -f(x)$

Which transformations will have no effect on the zeros of the original graph of  $y = f(x)$ ?

- A. I and II only
- B. II and III only
- C. II and IV only
- D. III and IV only

33. The graph of  $y = f(x)$  as shown below is transformed to  $x = f(y)$ . Determine all invariant points.



- A. (0, 3)
- B. (1, 1)
- C. (2, -1)
- D. (1, 1) and (2, -1)



Students should be familiar with the term invariant. Invariant points are points that remain unaltered under a transformation.

34. The point  $P(4, 6)$  lies on the graph of  $y = f(x)$ . Which point must lie on the graph of  $y = -\frac{1}{2}f\left(\frac{1}{2}x + 2\right)$ ?
- A. (7, -3)
  - B. (4, -3)
  - C. (1, -3)
  - D. (-2, -3)

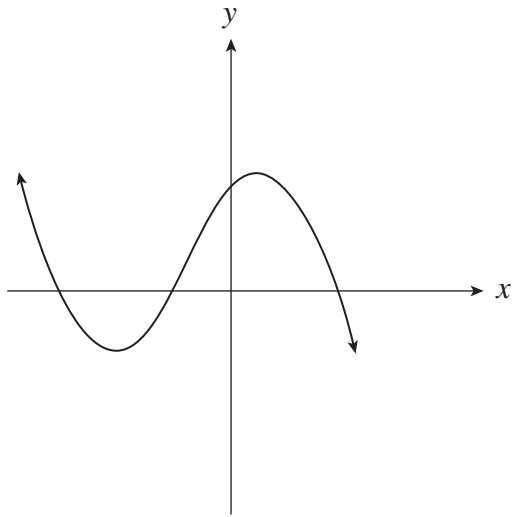
35. Which of the following functions are polynomial functions?

I.	$y = x^3 - \sqrt{2}x^2 + x + 3$
II.	$y = x^3 - \frac{2}{x^2} - x + 3$
III.	$y = x^3 - 2x^{1.5} + x + 3$
IV.	$y = x^3 - \frac{1}{2}x^2 - x + 3$

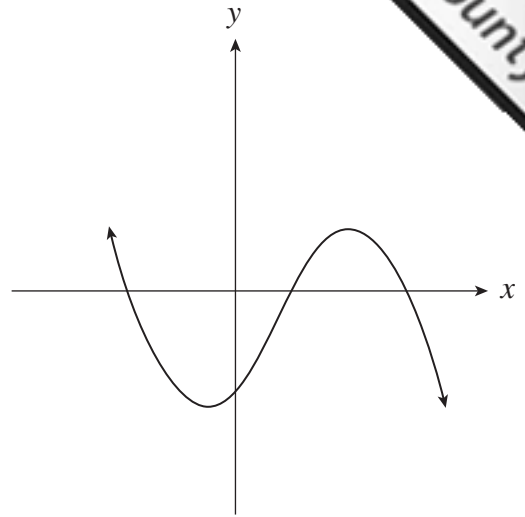
- A. III only
- B. IV only
- C. I and IV only
- D. II and III only

36. Which sketch best represents the graph of  $y = ax^3 - bx^2 + cx + 24$  if  $a < 0$ ?

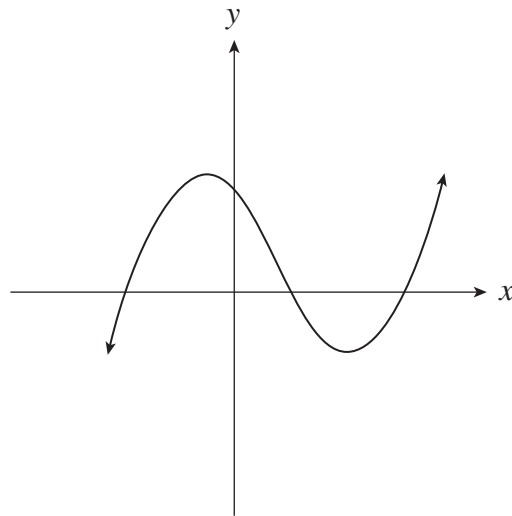
A.



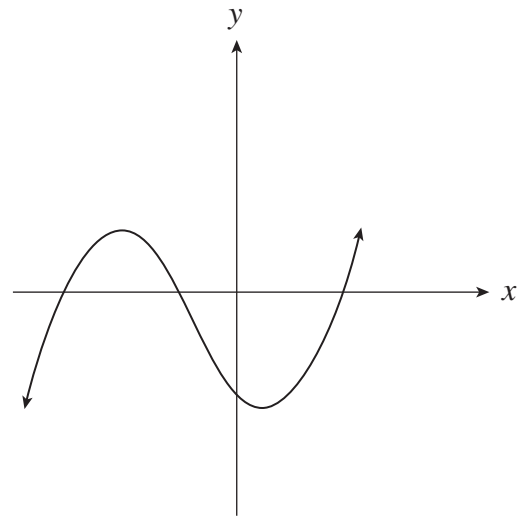
B.



C.



D.



37. Which three expressions are factors of  $9x^3 - 36x^2 - 4x + 16$ ?

I.	$x - 4$
II.	$x + 4$
III.	$3x - 2$
IV.	$3x + 2$

- A. I, II, III only
- B. I, II, IV only
- C. I, III, IV only
- D. II, III, IV only



This could be factored by synthetic division or by grouping.



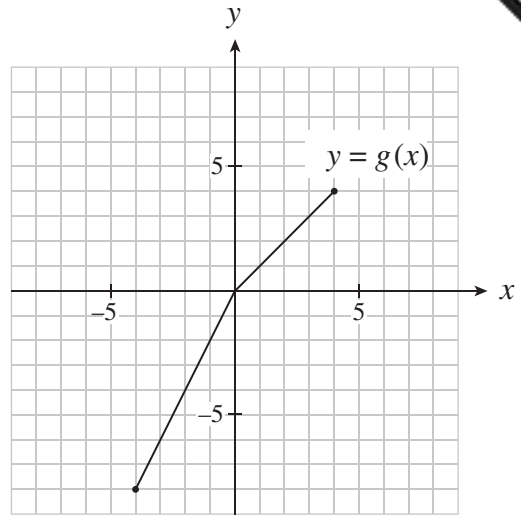
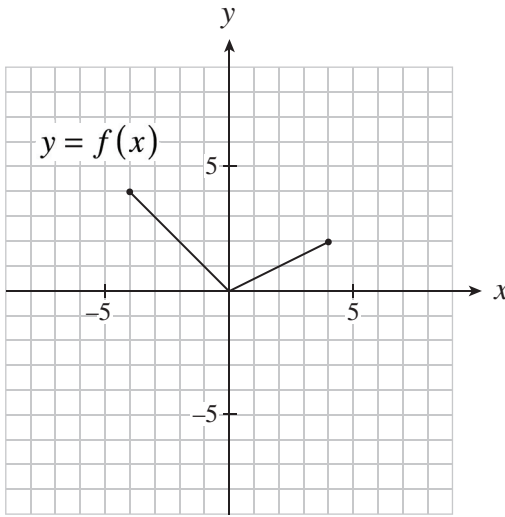
38. When  $x^3 - 2kx^2 + 3k^2x - 15$  is divided by  $x - 2$ , the remainder is 1. Determine all values for  $k$ .
- A.  $k = -4$
- B.  $k = \frac{17}{8}$
- C.  $k = -\frac{2}{3}, 2$
- D.  $k = \frac{2}{3}, -2$



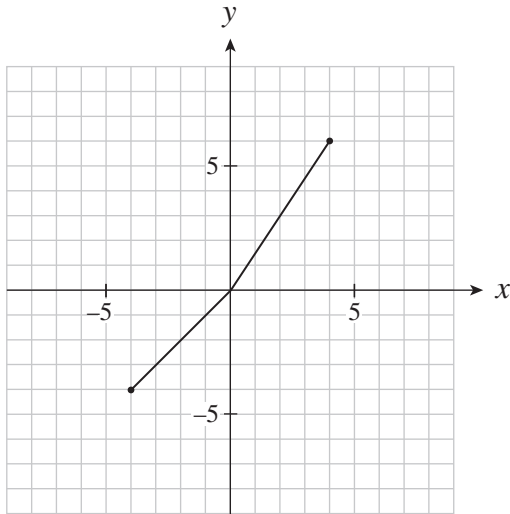
This question can be done with either synthetic division or substitution.

39. Given  $f(x) = x + 2$  and  $g(x) = x^2 + 3x - 1$ , determine the value of  $f(g(3))$ .
- A. 16
- B. 17
- C. 19
- D. 39

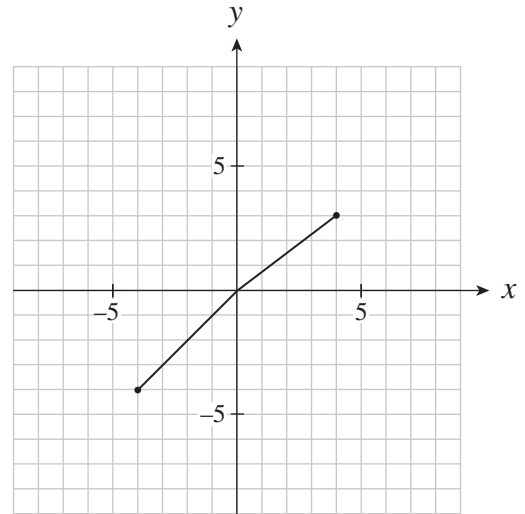
40. The graphs of  $y = f(x)$  and  $y = g(x)$  are graphed below. Which graph represents  $y = f(x) + g(x)$ ?



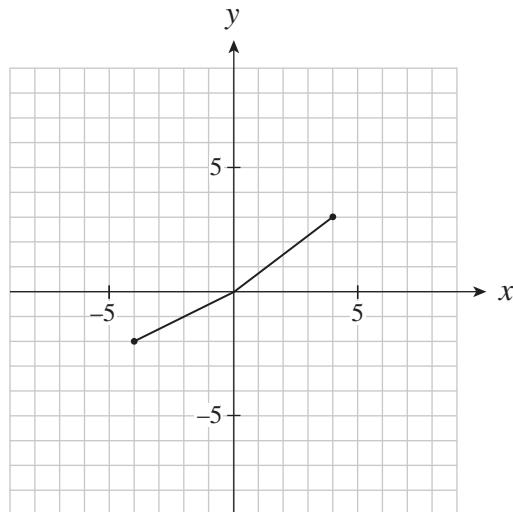
A.



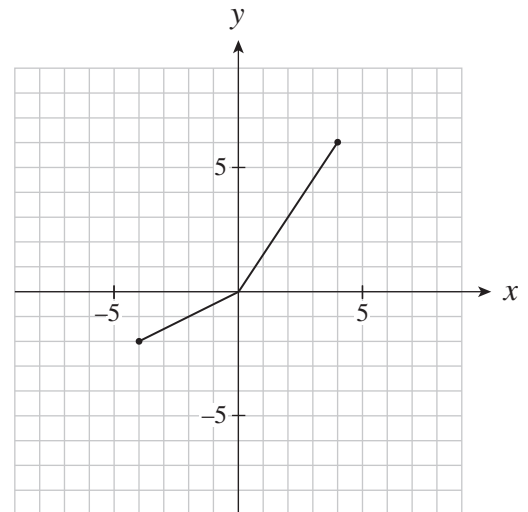
B.



C.



D.



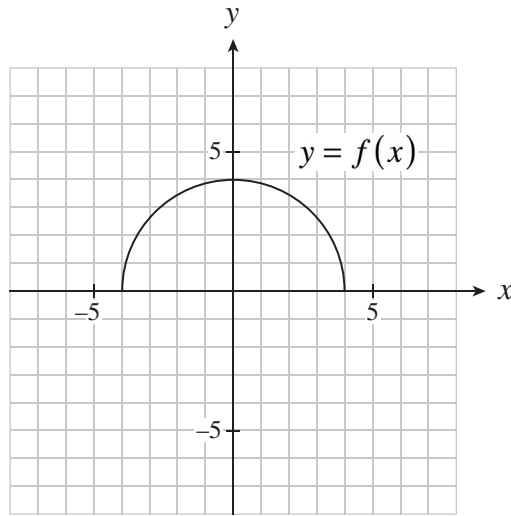
41. As a furniture salesperson, Chacci gets a 3% commission on all his weekly sales above \$5000. Which row in the table shows the composite function that will determine his commission if  $x$  represents his weekly sales?

	<b>Amount Eligible for Commission</b> $f(x)$	<b>Commission</b> $g(x)$	<b>Composite function</b>
A.	$f(x) = 5000 - x$	$g(x) = 0.03x$	$f(g(x))$
B.	$f(x) = x - 5000$	$g(x) = 0.03x$	$f(g(x))$
C.	$f(x) = 5000 - x$	$g(x) = 0.03x$	$g(f(x))$
D.	$f(x) = x - 5000$	$g(x) = 0.03x$	$g(f(x))$

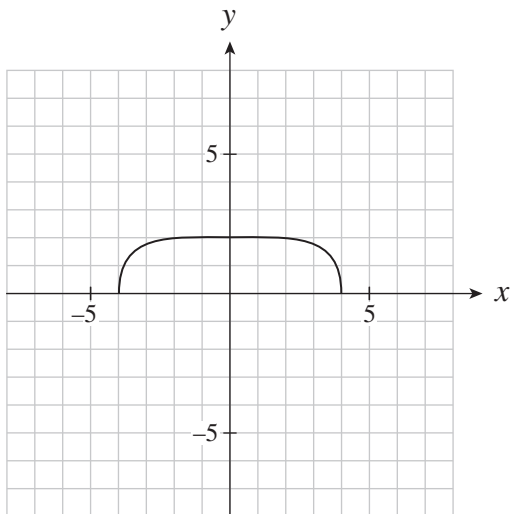
42. Consider the graphs of the functions  $f(x) = x^2$  and  $g(x) = \sqrt{f(x)}$ . Which row describes the domains and range of  $g(x)$ ?

	<b>Domain</b>	<b>Range</b>
A.	all reals	all reals
B.	has restrictions	has restrictions
C.	has restrictions	all reals
D.	all reals	has restrictions

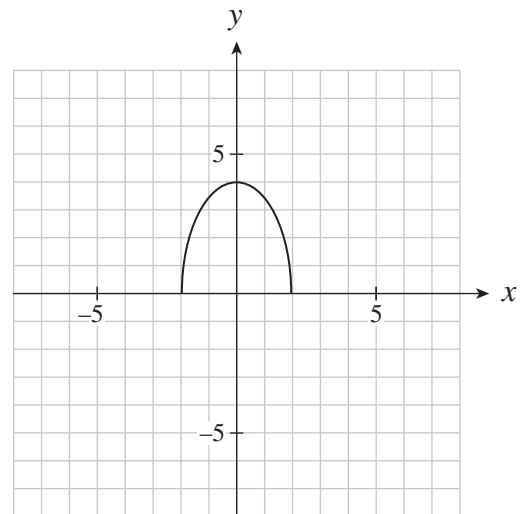
43. Given the graph of  $y = f(x)$  as shown, determine the graph of  $y = \sqrt{f(x)}$ .



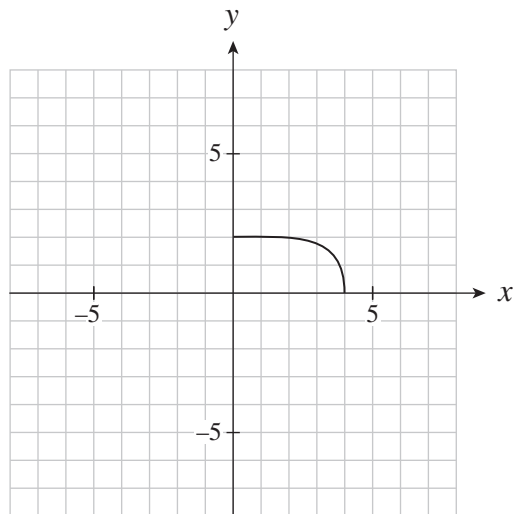
A.



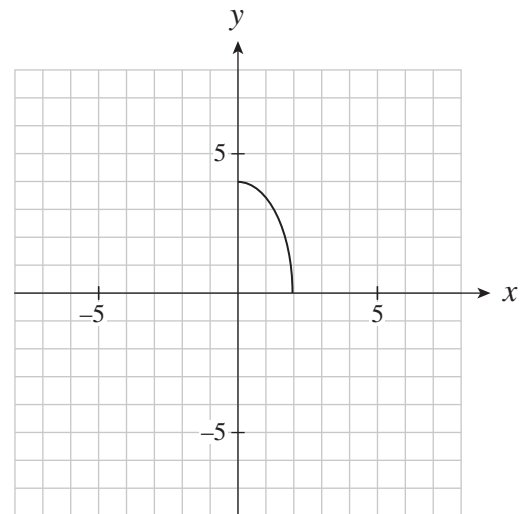
B.



C.



D.



44. Determine the range of the function  $y = \sqrt{3x - 9} + 2$ .

- A.  $y \geq 0$
- B.  $y \geq 2$
- C.  $y \geq 3$
- D.  $y \geq 9$

**This is the end of the Multiple-Choice section.  
Answer the remaining Written-Response questions directly in this booklet.**

THIS PAGE INTENTIONALLY BLANK

**WRITTEN-RESPONSE QUESTIONS**  
**(Calculator NOT permitted)**

**Value: 8 marks**

**INSTRUCTIONS:** Answer the following questions in the space provided.

Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question.

**Full marks will NOT be given for a final answer only.**

1. Solve algebraically:  $\log_{15}(3-x) + \log_{15}(1-x) = 1$

Justify the validity of each solution.





2. Consider the graphs of  $f(x) = \frac{x^2 - x - 6}{x^2 - 9}$  and  $g(x) = \frac{x}{x^2 - 9}$ .

Use your knowledge of rational functions to outline the similarities and differences between these two graphs. You will be evaluated on the concepts expressed, the organization and accuracy of your work, and your use of language.

**End of Exam Booklet II**