

Questions 1–20 are worth 4 points each.

1. Choose the value that is not a rational number but is a real number:

~~A.~~ $\frac{\sqrt{4}}{9} = \frac{2}{9}$

~~B.~~ $-.181818\dots$

~~C.~~ $\sqrt{-5}$

D. $\frac{3}{\sqrt{7}}$

E. All of these are rational and real numbers.

2. $\sqrt{9} =$

A. 81

B. 3

C. ± 3

D. -3

E. ± 81

3. Subtract.

$$(4n^5 - 5n^3 + 7n^2 - 4n + 6) + (2n^5 + 4n^2 + 5n^3 + 11 + 2n^4) =$$

$$2n^5 - 2n^4 + 0n^3 + 3n^2 - 4n - 5$$

A. $6n^5 - 2n^4 - 10n^3 + 3n^2 - 4n - 5$

B. $6n^5 + 2n^4 - 10n^3 + 11n^2 - 4n + 17$

C. $2n^5 + 2n^4 + 11n^2 - 4n + 17$

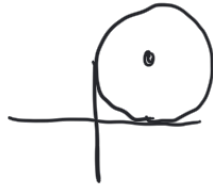
D. $2n^5 - 2n^4 + 3n^2 - 4n - 5$

E. $2n^5 - 2n^4 - 10n^3 + 11n^2 - 4n - 5$

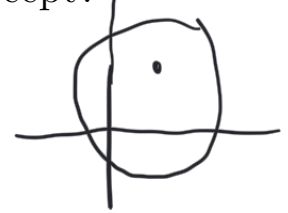
4. The graph of each equation below is a circle. Which one has exactly one x -intercept?



A. $(x - 8)^2 + (y - 1)^2 = 4$



B. $(x - 4)^2 + (y - 5)^2 = 25$



C. $(x - 3)^2 + (y - 4)^2 = 36$



D. $(x - 1)^2 + (y - 9)^2 = 1$

E. $(x - 6)^2 + (y - 6)^2 = 16$



5. Choose the *true* statement:

A. Every function is a relation, and every relation is a function

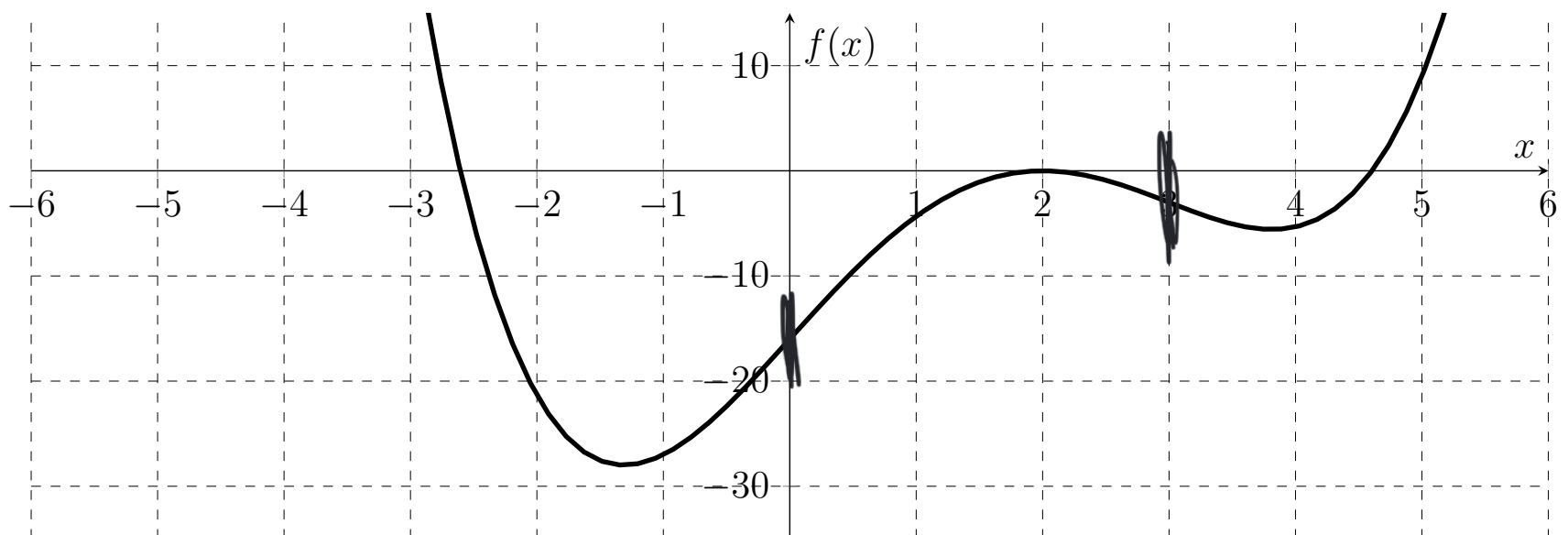
B. If $f(5) = -9$ then the points $(5, 0)$ and $(0, -9)$ lie on the graph of f .

C. Every function has a domain and a range.

D. A relation is a function if each of its inputs corresponds to one or more outputs.

E. Graphically, a zero of a function corresponds to a y -intercept.

6. On which interval(s) is the function graphed below concave down?



A. $(1, \infty)$

B. $(-\infty, 0) \cup (3, \infty)$

C. $(-\infty, 1)$

D. $(0, 3)$

E. $(0, 1) \cup (3, \infty)$

7. Use the functions below to evaluate $(f \circ g)(-3) = f(g(-3)) = f(4) = 10$

$$f(x) = -(x - 3)^2 + 11$$

x	-3	-2	-1	0	1	2	3
$g(x)$	4	3	2	1	0	-1	-2

$$(f \circ g)(-3) =$$

A. 10

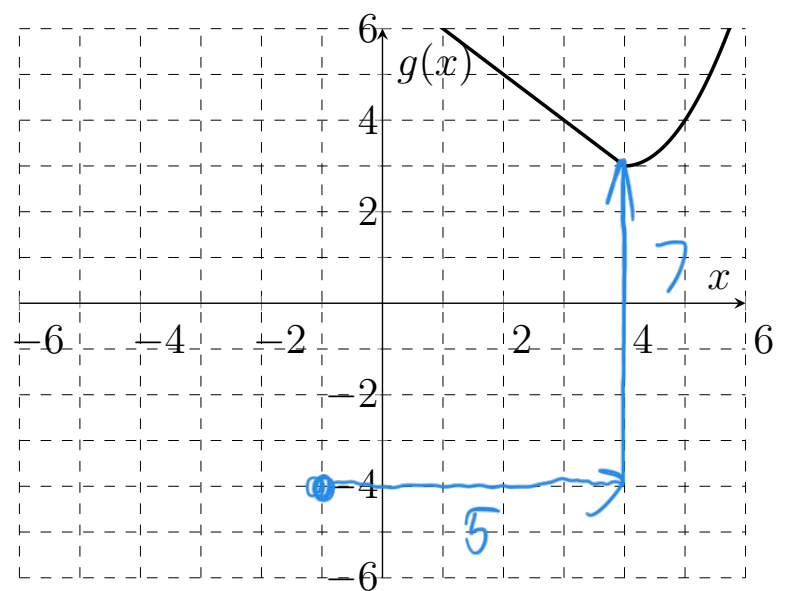
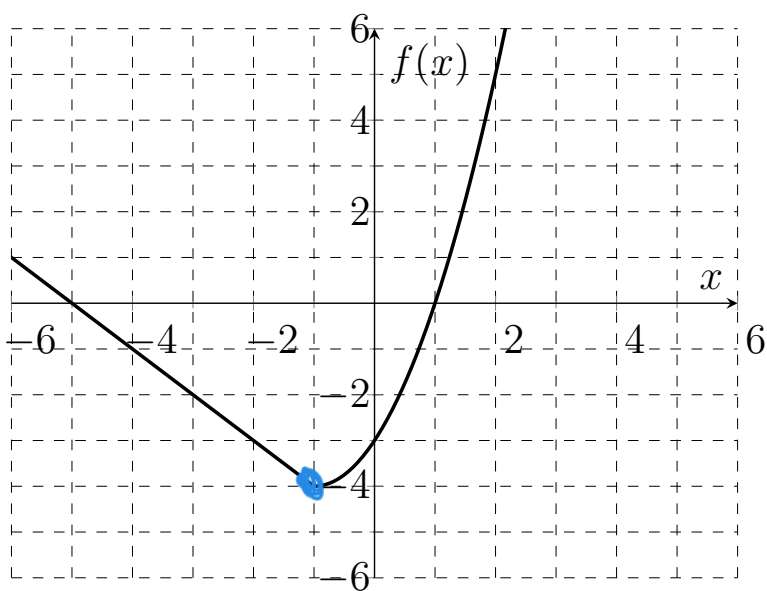
B. 26

C. -14

D. -10

E. 2

8. The graph of $g(x)$ below is a translation of the graph of $f(x)$. What is the formula for $g(x)$ in terms of $f(x)$?



A. $g(x) = f(x) - 7$

B. $g(x) = f(x - 5) + 7$

C. $g(x) = f(x + 5) + 7$

D. $g(x) = f(x + 5) - 7$

E. $g(x) = f(x - 5) - 7$

9. Select the *false* statement.

- A. If $f(x)$ and $g(x)$ are inverses, then the graph of $f(x)$ is a reflection of the graph of $g(x)$
- B. $f^{-1}(f(x)) = x$ for all x in the domain of f
- C. If the domain of $f(x)$ is all real numbers, then so is the domain of $f^{-1}(x)$
- D. If $f(x)$ and $g(x)$ are inverses, then $(f \circ g)(x) = x$ and $(g \circ f)(x) = x$
- E. If $f(9) = -8$ then $f^{-1}(-8) = 9$

10. Solve the equation. What is the sum of all the solutions?

$$x^3 - 7x^2 - 9x + 63 = 0$$

$$x^2(x-7) - 9(x-7) = 0$$

$$x^3 - 7x^2 - 9x = -63$$

$$(x^2 - 9)(x - 7) = 0$$

$$(x-3)(x+3)(x-7) = 0$$

$$x = 3, -3, 7$$

A. 10

B. 21

C. 13

D. 0

E. 7

11. Find the x -intercept(s) of the equation below.

$$y = 0$$

$$x^2y - 6y - 11 = y^2 - 2x + 7xy$$

$$-11 = -2x \quad x = \frac{11}{2}$$

A. $x = \frac{7}{6}, 0$

B. $x = \frac{7}{6}$

C. $x = \frac{6}{7}$

D. $x = \frac{11}{2}$

E. $x = \frac{11}{2}, 0$

12. Suppose that $f(x)$ is increasing on the interval (a, b) . Select the statement that *must* be true.

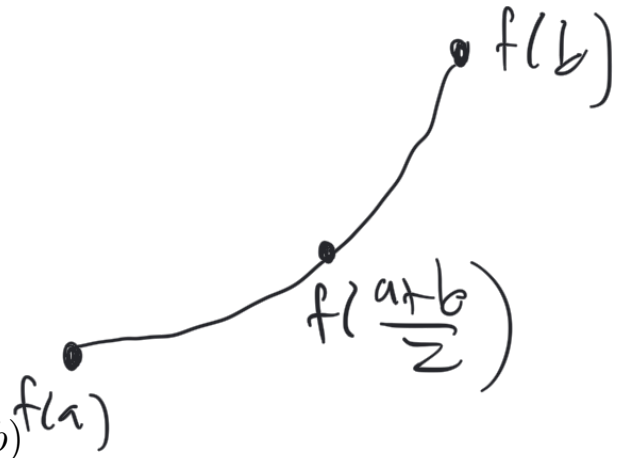
A. $f\left(\frac{a+b}{2}\right) > f(a)$

B. $f(x)$ has a root in the interval (a, b)

C. $f(x)$ has an absolute maximum in the interval (a, b)

D. $f(b) > 2 \cdot f(a)$

E. The graph of $f(x)$ bends upwards on the interval (a, b)



13. Suppose that

$$f(x) = \begin{cases} 3x + 4 & x < 5 \\ 7 & x = 5 \\ (x - 2)^2 + 7 & x > 5 \end{cases}$$

$$f(0) + f(7) = 4 + 32 = 36$$

A. 36

B. 11

C. 32

D. 20

E. 32

14. Choose the expression that is equivalent to $3\sqrt{125} + 8\sqrt{20}$.

$$= 3(5\sqrt{5}) + 8(2\sqrt{5}) = 15\sqrt{5} + 16\sqrt{5} = 31\sqrt{5}$$

A. $31\sqrt{5}$

B. $11\sqrt{145}$

C. $11\sqrt{5}$

D. $7\sqrt{10}$

E. $7\sqrt{5}$

15. Choose the equation that has symmetry across the x -axis.

A. $x^2 + y = 1$

B. $x^2 + y^2 + y = 1$

C. $x^2 + y^2 + x = 1$

D. $x^2 + x + y = 1$

E. $x^2 + y^2 + x + y = 1$

$$f(6) = -3 \quad g(6) = 7$$

16. Suppose that $f(z) = -3z + 15$ and $g(z) = (z - 8)^2 + 3$. What is $(fg)(6) + (f + g)(6)$? $(-3)(7) + (-3) + 7$

A. -2 B. -42 C. 128 **D. -17** E. 8

$$2(x+6)^2 + 2 = 2x^2 + 24x + 74$$

17. Which of the functions below transforms the graph of $f(x) = x^2$ by shifting it left by 6 units, then stretching it vertically by a factor of 2, then shifting it up by 2 units?

A. $g(x) = 2x^2 - 24x + 74$ B. $g(x) = 2x^2 - 12x + 70$ **C. $g(x) = 2x^2 + 24x + 74$**
 D. $g(x) = 2x^2 + 12x + 38$ E. $g(x) = 2x^2 + 24x + 70$

18. Express the domain of the function $h(x) = \frac{3x + 7}{x^2 - 8x - 33}$ in interval notation.

$$(x-11)(x+3)$$

$$x \neq -3, 11$$

A. $(-3, 11)$
B. $(-\infty, -3) \cup (-3, 11) \cup (11, \infty)$
 C. $(-\infty, -3) \cup (11, \infty)$
 D. $(-\infty, -3) \cup (-3, 11)$
 E. $(-3, 11)$

19. Suppose that $f(r) = (r - 4)^5 + 7$. What is $f^{-1}(r)$?

$$x = (y-4)^5 + 7$$

$$y = \sqrt[5]{x-7} + 4$$

A. $f^{-1}(r) = \sqrt[5]{r-4} + 7$ B. $f^{-1}(r) = \sqrt[5]{r} + 11$ C. $f^{-1}(r) = \sqrt[5]{r-11}$
 D. $f^{-1}(r) = \sqrt[5]{r} - \sqrt[5]{7} + 4$ **E. $f^{-1}(r) = \sqrt[5]{r-7} + 4$**

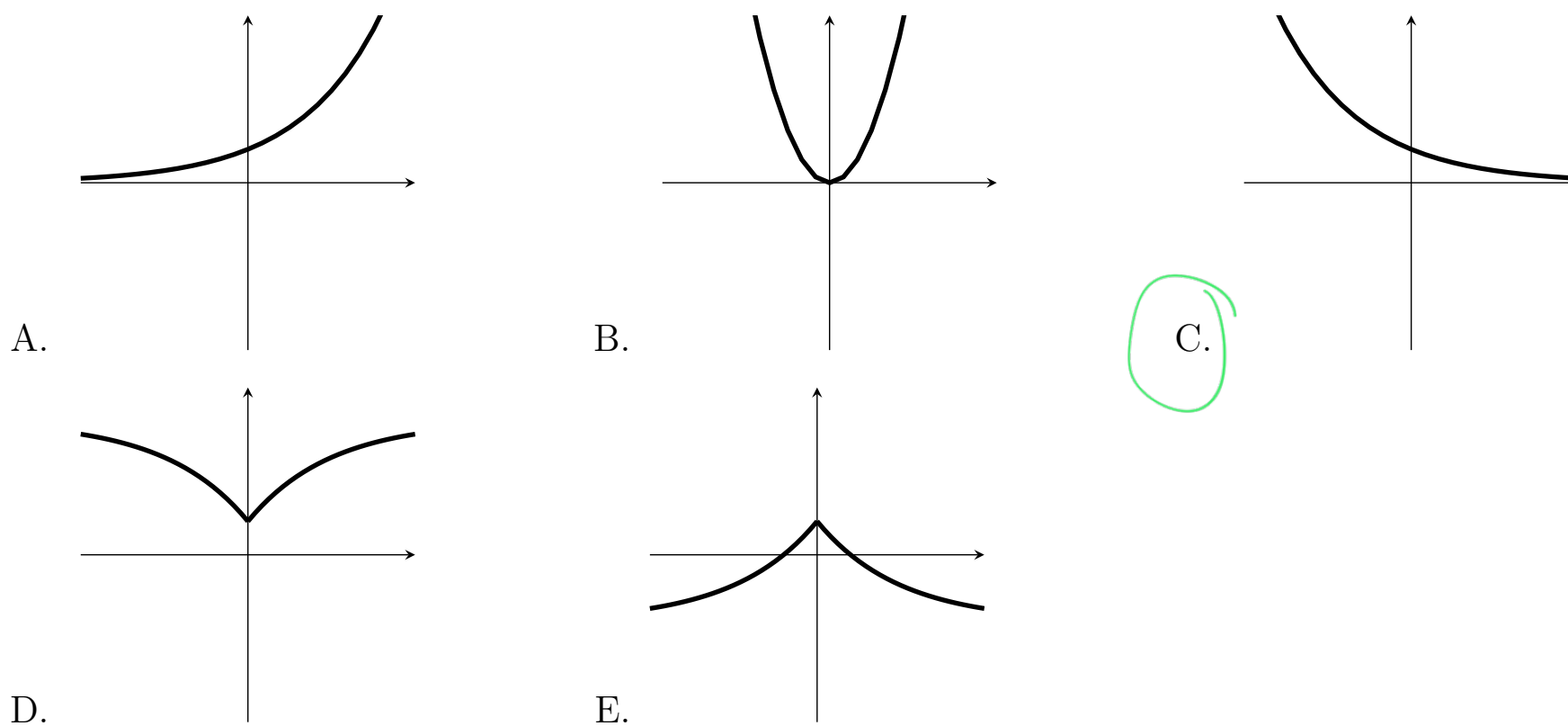
20. Suppose that $x > 0$ and $y > 0$. The expression $\frac{\sqrt[5]{x^{11}}}{\sqrt[7]{y^4}}$ can be written in the form $x^c y^d$. What is the value of $c + d$? $x^{11/5} \cdot y^{-4/7}$

A. $\frac{57}{35}$ B. $\frac{57}{2}$ C. $\frac{97}{12}$ D. $\frac{57}{12}$ E. $\frac{97}{35}$

21. Select the *false* statement.

- A. If a and b are integers then $a + b$ is also an integer.
- B. Any real number that is not a rational number is an irrational number.
- C. If n is a natural number, then \sqrt{n} is an irrational number.
- D. The integers consist of the positive and negative natural numbers, and 0.
- E. If a and b are nonzero integers then $\frac{a}{b}$ is a rational number.

22. Select the graph that is decreasing and concave up.



23. Multiply.

$$(x - 6)(x^2 + 9x + 3) =$$

- A. $x^3 - 51x^2 + 18x - 6$
- B. $x^3 - 51x^2 + 3x - 3$
- C. $x^3 + 3x^2 - 51x - 18$
- D. $x^3 + 3x^2 + 9x - 18$
- E. $x^3 + x^2 + 3x - 18$

$$x^3 + 9x^2 + 3x - 6x^2 - 54x - 18$$

T.A. _____ Disc. Per. _____ Name _____

Honor Pledge: "On my honor, I have neither given nor received unauthorized aid for this exam."

UF ID # _____ Signature _____

YOU MUST SHOW ALL WORK TO RECEIVE FULL CREDIT.

Free response questions 24-25 are worth 4 points each.

24. Use the equation of a circle given below to answer the questions. You must show understandable work in order to receive credit.

$$x^2 + y^2 - 8x - 10y + 5 = 0$$

- a. (2 pts) Find the center and radius of the circle.

$$x^2 - 8x + y^2 - 10y = -5$$

$$x^2 - 8x + 16 + y^2 - 10y + 25 = -5 + 16 + 25$$

$$(x-4)^2 + (y-5)^2 = 36$$

6^2

Center: (4, 5)Radius: 6

- b. (2 pts) Find any y -intercepts the circle has or show that it has none. Give your answers as points and simplify any radicals.

$$\text{Set } x=0$$

$$(0-4)^2 + (y-5)^2 = 36$$

$$(y-5)^2 = 20$$

$$y-5 = \pm \sqrt{20} = \pm 2\sqrt{5}$$

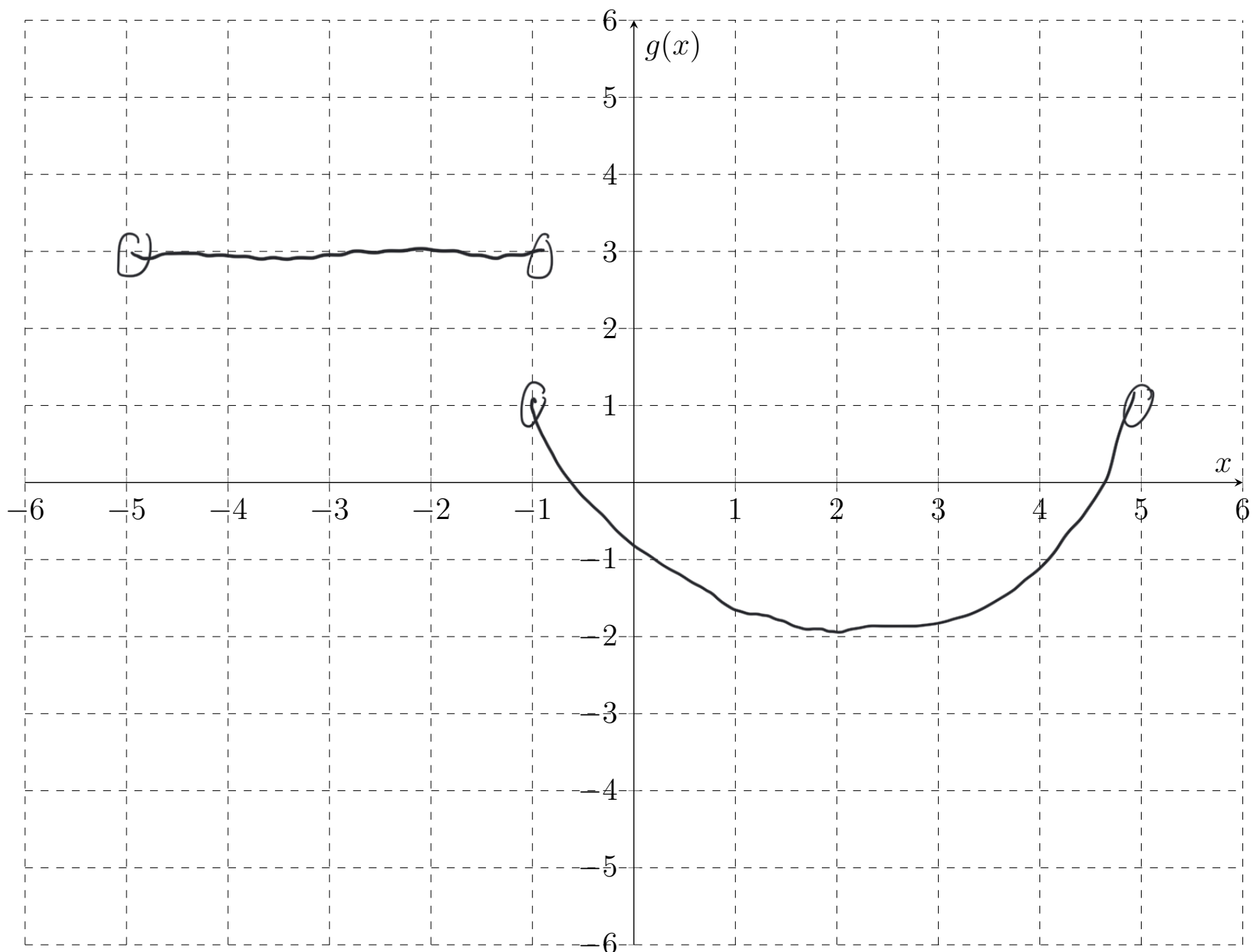
$$y = 5 + 2\sqrt{5}, 5 - 2\sqrt{5}$$

y -intercept(s): (0, 5 + 2√5) (0, 5 - 2√5)

25. On the axes below, sketch the graph of a function $g(x)$ that has the following properties. Each property is worth 1 point.

Many possible answers

- $g(x)$ is increasing only on the interval $(2, 5)$.
- $g(x)$ is concave up only on the interval $(-1, 5)$.
- $g(x)$ has an absolute minimum when $x = 2$.
- $g(x)$ is constant only on the interval $(-5, -1)$.



Turn in your scantron and your free response to your TA. The worked-out solutions will be posted on Canvas after the test.