Exam One Review

This is a (lengthy) practice exam for Exam 1.

NOTE: There may be random lines that look like `\texttt{(SOME TEXT)}` and maybe even some `{ }` within that text. You can ignore everything that isn't the text itself; ie the texttt bit and the braces, they are an artifact of how some randomization is being done that I haven't had time to fix yet. If you literally delete the `\texttt` and the braces from what you see, and just keep the text itself, it will read exactly as intended. So just ignore all those texttt and braces whenever you see them.

Also note: Some of the below has randomized elements, some do not. Currently Xronos does not support randomized graphing (although we're working on it!) so a lot of the graphing problems won't randomize, but a surprising amount of the other problems will change values or text if you hit the green "another" button in the top right corner to get another version of this practice exam. This also means it may take some time for the entire test to render because we have to rely on public servers to do the randomization for us currently, so please be patient. If it takes more than 3-5 minutes to fill out the random values (meaning: if there are still spinning wheels of death going after 3-5 minutes) there is a problem. Try hitting the "another" button to see if it resolves itself. If it keeps doing this, please contact your instructor and let him know!

Problem 1 *Suppose* $f(x) = x^2 - 3$ *and* $g(x) = x^2 + 1$*; compute* $(f \circ g)(-4)$.

Multiple Choice:

(a) 286 ✓

(b) -286

(c) 170

(d) 30

(e) 221

Problem 2 *Given:* $f(-1) = 6, \quad f(-5) = -4, \quad g(-5) = -9, \quad g(-3) = -1$
Compute:

a. $(fg)(-5)$

b. $(f \circ g)(-3)$

c. $(f-g)(-5)$

Multiple Choice:

(a) $(fg)(-5) = 6$, $(f \circ g)(-3) = 6$, $(f-g)(-5) = -13$

(b) $(fg)(-5) = 6$, $(f \circ g)(-3) = 5$, $(f-g)(-5) = 5$

(c) $(fg)(-5) = 36$, $(f \circ g)(-3) = 6$, $(f-g)(-5) = 5$ ✓

(d) $(fg)(-5) = 36$, $(f \circ g)(-3) = 6$, $(f-g)(-5) = -13$

(e) $(fg)(-5) = 6$, $(f \circ g)(-3) = 6$, $(f-g)(-5) = 5$

Problem 3 *Suppose* $f(x) = x^2$ *and* $g(x) = x^2 - 1$*; compute* $(f \circ g)(3)$.

Multiple Choice:

(a) -64

(b) 80

(c) 64 ✓

(d) 17

(e) 72

Problem 4 *If* $f^{-1}(x)$ *exists, then* $f(x)$ *passes the horizontal line test.*

Multiple Choice:

(a) *There is not enough information to know if this is true.*

(b) *This is only true if* $f^{-1}(x)$ *is a function.* ✓

(c) *This is never true.*

(d) *This is only true for continuous functions*

(e) *This is true, whether or not* $f^{-1}(x)$ *is a function.*

Problem 5 *What is the parent function of* $g(x) = 4\,x^3 + 12\,x^4 + 7\,x^2 + 2\,x + 6$*?*

Multiple Choice:

(a) $f(x) = x^4$ ✓

(b) $f(x) = 12\,x^4$

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

(d) $f(x) = x^5$

(e) $f(x) = 4\,x^3$

Problem 6 *Which of the following is best described as a mathematical expression?*

Multiple Choice:

(a) $81\,x^2 - 4 \geq y$

(b) *force is mass times acceleration*

(c) $25\,x^2 + 25\,y^2 + 1 = 49$

(d) $y = 9\,x^5 - 8\,x^4 + x^3 + 9\,x^2$

(e) $\sqrt{a^2 + b^2}$ ✓

Problem 7 *The function* $f(x)$ *is transformed and the points* $(3, -2)$ *and* $(-3, 3)$ *on the graph of* f *are sent to the points* $(-\frac{3}{2}, 8)$ *and* $(0, -17)$ *respectively. Which of following expressions could describe the transformations applied to* $f(x)$*?*

Multiple Choice:

(a) $(-5)f(-4\,x + 3) + (-2)$

(b) $(-5)f(-4\,x - 3) + (10)$

(c) $(-5)f(-4\,x + 12) + (-2)$

(d) $(-2)f(-4\,x-3)+(-5)$

(e) $(-5)f(-4\,x-3)+(-2)$ ✓

Problem 8 *If the function $f(x)$ has 4 zeros, then how many zeros must $f(x)+3$ have?*

Multiple Choice:

(a) *There is not enough information to tell.* ✓

(b) 4

(c) 0

(d) 1

(e) -4

Problem 9 *A university parking lot designates spaces based on parking permit colors. The lot has 6 rows of 12 parking spaces each. The rows are labelled A-F and the spaces are numbered 1-12 in each row. The different color permits are allowed to park as follows:*

- *Red permits may park in any space.*
- *Orange permits may park in any space in rows B-E.*
- *Green permits are allowed to park in row E spots 6-12 and (any spot) in row F.*
- *Blue permits may only park in row D.*

Is the relationship that determines your potential parking space based on your permit color a function?

Multiple Choice:

(a) *No.* ✓

(b) *Yes.*

Problem 10 *Suppose $f(x) = x^2$ and $g(x) = x + 2$; compute $(f \circ g)(x)$.*

Multiple Choice:

(a) $-(x+2)^2$

(b) $x^2 + x + 2$

(c) $x^3 + 2\,x^2$

(d) $x^2 + 2$

(e) $(x+2)^2$ ✓

Problem 11 *If you double the height of $f(x)$ and then move it up by 4 is it the same as doubling the height and then moving it to the left by 4?*

Multiple Choice:

(a) *There is not enough information to answer.*

(b) *Sometimes this is true, but definitely not always.* ✓

(c) *This is never true.*

(d) *This is always true.*

Problem 12 *If the point $(-1, 5)$ is on the graph of $g(x)$. Which of the following points must be on the graph of $g^{-1}(x)$?*

Multiple Choice:

(a) $(-1, -5)$

(b) $(-5, 1)$

(c) $(5, 1)$

(d) $(1, -5)$

(e) $(5, -1)$ ✓

Problem 13 *When someone calls you and they are in your contacts, your phone uses their phone number to display their name. What are the domain and codomain of this relationship?*

Multiple Choice:

(a) *Domain: names; Codomain: phone numbers*

(b) *Domain: names in your contacts; Codomain: phone numbers*

(c) *Domain: phone numbers; Codomain: names*

(d) *Domain: phone numbers in your contacts; Codomain: names* ✓

Problem 14 *Suppose, for some function $f(x)$ we have that $f(3) = 4$. What can we say about $f^{-1}(4)$?*

Multiple Choice:

(a) $f^{-1}(4)$ *must be* -3

(b) $f^{-1}(4)$ *must be* 3. ✓

(c) *There is not enough information to know if $f^{-1}(4)$ exists.*

(d) $f^{-1}(4)$ *exists, but the value is unknown.*

(e) $f^{-1}(4)$ *definitely does not exist.*

Problem 15 *If a function is invertible, then f and f^{-1} must have the same parent function.*

Multiple Choice:

(a) *True, but only if f^{-1} is actually a true inverse.*

(b) *This would be true, but only for (all) partial inverse functions.*

(c) *This is false, but only because f^{-1} is invertible.*

(d) *False, it is possible for a function and its inverse to have different parent functions.* ✓

(e) *This is true even for partial inverses.*

Problem 16 *Grades in a particular class are determined using the following numeric scale.*

Grade	***Point Range***	***Grade***	***Point Range***	***Grade***	***Point Range***
A	*555-600*	*B-*	*480-499*	*D+*	*400-419*
A-	*540-554*	*C+*	*465-479*	*D*	*360-399*
B+	*525-539*	*C*	*435-464*	*D-*	*340-359*
B	*500-524*	*C-*	*420-434*	*E*	*0-339*

Clearly, given any point value, a student can determine their letter grade in the class. This means we have a relationship from point values to letter grades.

What is the domain and codomain of this relationship?

Multiple Choice:

(a) *Domain: Letter Grades. Codomain: Point Values.*

(b) *Domain: Real numbers. Codomain: Letters.*

(c) *Domain: Scores on assignments. Codomain: Letter Grades.*

(d) *Domain: Letter Grades. Codomain: Scores on assignments.*

(e) *Domain: Point Values. Codomain: Letter Grades.* ✓

Problem 17 *Suppose* $f(x) = x^3 - 4$, $g(x) = x^2 + 5$; *compute* $(f - g)(x)$.

Multiple Choice:

(a) $x^3 - x^2 + 1$

(b) $x^5 + 5\,x^3 - 4\,x^2 - 20$

(c) $x^3 - x^2 - 9$ ✓

(d) $\left(x^2 + 5\right)^3 - 4$

(e) $x^3 + x^2 + 1$

Problem 18 *You are reviewing a model your company has to calculate the cost to modify one of your software packages for individual usage. You need to update the model due to inflation and changes in the industry, and you have developed a transform that does exactly this. In particular, the updated cost is calculated by* $U(x) = 2.90C(x) - 370$*, where* $C(x)$ *is the original cost. If a customer had originally been quoted a cost of* \$400 *for modifying* 7 *software packages, what would the updated cost be?*

Multiple Choice:

(a) \$5530.

(b) \$1860.

(c) \$113.

(d) \$266.

(e) \$790. ✓

Problem 19 *Is it possible to have a discontinuous function without any relative extrema?*

Multiple Choice:

(a) *No, regardless of the type of discontinuity.*

(b) *Yes, but only if it is an infinite discontinuity.*

(c) *Yes, but only if it is a jump discontinuity*

(d) *Yes, regardless of the type of discontinuity.* ✓

(e) *Yes, but only if it is an infinite or jump discontinuity.*

Problem 20 *If a function has a relative maximum and a relative minimum,* ***must*** *it have an absolute extrema?*

Multiple Choice:

(a) *Yes because there must be an absolute extrema between the relative minumum or maximum.*

(b) *No, it's possible to have relative maximums and minimums, but no absolute extrema.* ✓

(c) *Yes because there must be an absolute extrema beyond the relative minumum/maximum.*

(d) *There is not enough information to know.*

(e) *Yes, because one of the relative extrema must also be an absolute extrema.*

Problem 21 *If a continuous function has no absolute extrema, and it has a relative maximum, must it have a relative minimum?*

Multiple Choice:

(a) *No, it's not possible to have a function with no absolute maximum or minimums, yet still have a relative maximum.*

(b) *No, it's possible to have no absolute maximum or minimums, and only relative maximums.*

(c) *Yes.* ✓

(d) *There is not enough information to answer this question.*

(e) *No, but if it had a relative minimum, then it would have to have a relative maximum.*

Problem 22 *Describe the following set with its "English-translation":*

$$\{x : x \in \mathbb{R}, 17 \leq x < 38\}$$

Multiple Choice:

(a) *The set of numbers between 17 and 38.*

(b) *The set of all rational numbers between 17 and 38, including 17.*

(c) *The set of x such that x is between 17 and 38.*

(d) *The set of real numbers x such that $17 \leq x \leq 38$*

(e) *The set of x such that x is a real number, and x is strictly less than 38, but no smaller than 17.* ✓

Problem 23 *Which of the following definitions of $f(x)$ and $g(x)$ could result in the function $\left(x^3-4\right)^2-2$*

Multiple Choice:

(a) $f(x)=x^2+2$ *and* $g(x)=x^3+4$

(b) $f(x)=x^3-4$ *and* $g(x)=x^2-2$

(c) $f(x)=x^2+2$ *and* $g(x)=x^3-4$

(d) $f(x)=x^2-2$ *and* $g(x)=x^3+4$

(e) $f(x)=x^2-2$ *and* $g(x)=x^3-4$ ✓

Problem 24 *Suppose $h(x)$ is the result after some other function $f(x)$ has been through the following changes; horizontally stretched to $\frac{1}{4}$ its original width, shifted right by 9, vertically stretched to 2 times it's original height, flipped over the x-axis, and shifted down by 3. If the point $(2,2)$ was on the graph of $f(x)$, what is the corresponding point on the graph of $h(x)$?*

Multiple Choice:

(a) $(-10,-\frac{5}{2})$

(b) $(\frac{19}{2},-\frac{5}{2})$

(c) $(-10,-7)$

(d) *It is impossible to determine.*

(e) $(\frac{19}{2},-7)$ ✓

Problem 25 *Let $f : \mathbb{R} \to \mathbb{R}^+$ and $g : (-\infty, 0] \to \mathbb{R}$ be defined by: $f(x) = x^2 + 1337$ and $g(x) = \sqrt{(-x)^2}$.*
What is $(g \circ f)(x)$?

Multiple Choice:

(a) $|-x^2 + 1337|$

(b) *The composition fails to exist, so $(g \circ f)(x)$ is undefined.* ✓

(c) $|x^2| + 1337$

(d) $\sqrt{-(x^2 + 1337)^2}$

(e) $(\sqrt{-x^2})^2 + 1337)$

Problem 26 *Suppose $f(x) = x^3 - 4$, $g(x) = x^3 + 1$; compute $(f - g)(-5)$.*

Multiple Choice:

(a) -5 ✓

(b) -3

(c) -1906628

(d) -253

(e) 15996

Problem 27 *Choose the option that fills in the blank: If $f(x)$ is a function, then it suffices to know that it* _____ *in order to know it has a (true) inverse.*

Multiple Choice:

(a) *is continuous with no relative extrema*

(b) *passes the vertical line test*

(c) *has no relative extrema*

(d) *is one to one* ✓

(e) *has no absolute extrema*

Problem 28 *Suppose* $f(x) = x^2 + 3$, $g(x) = x^3 - 5$, *and* $h(x) = x^3 - 5$; *compute* $(f \cdot (g - h))(1)$.

Multiple Choice:

(a) -12

(b) 0 ✓

(c) -32

(d) -22

(e) -40

Problem 29 *Let* $f(x)$ *be a relation. If* $f^{-1}(x)$ *is a function, must it be true that* $f(x)$ *is a function?*

Multiple Choice:

(a) *Yes,* $f^{-1}(x)$ *being a function means it passes the vertical line test, so* $f(x)$ *is therefore a function.*

(b) *Yes,* $f^{-1}(x)$ *being a function means it passes the horizontal line test, so* $f(x)$ *is therefore a function.*

(c) *Yes, because the inverse can only be defined if* $f(x)$ *is a function.*

(d) *No, if the inverse is a function, then* $f(x)$ *cannot be a function.*

(e) *No, it's possible the inverse is a function but the original would not be.* ✓

Problem 30 *Which of the following represents the translation that moves the graph of* $f(x)$ *up by* 3*?*

Multiple Choice:

(a) $f(x + 3)$

(b) $f(3x)$

(c) $f(x) - 3$

(d) $f(x - 3)$

(e) $f(x) + 3$ ✓

Problem 31 *If the point $(-3, 1)$ is on the graph of $f(x)$, then which point is on the graph of $g^{-1}(x)$ (the graph of g inverse) where $g(x) = -5f(-3\,x-5)+(5)$?*

Multiple Choice:

(a) $(0, -\frac{2}{3})$ ✓

(b) $(\frac{24}{5}, -\frac{2}{3})$

(c) $(\frac{24}{5}, 12)$

(d) $(-\frac{2}{3}, 0)$

(e) $(12, \frac{24}{5})$

Problem 32 *Let $f(x)$ be a relation. If $f^{-1}(x)$ is a function, must it be true that $f(x)$ is a function?*

Multiple Choice:

(a) *Yes, $f^{-1}(x)$ being a function means it passes the vertical line test, so $f(x)$ is therefore a function.*

(b) *Yes, because the inverse can only be defined if $f(x)$ is a function.*

(c) *No, if the inverse is a function, then $f(x)$ cannot be a function.*

(d) *Yes, $f^{-1}(x)$ being a function means it passes the horizontal line test, so $f(x)$ is therefore a function.*

(e) *No, it's possible the inverse is a function but the original would not be.* ✓

Problem 33 *Simplify the following set:* $\{x \in \mathbb{R}^+ \cup \{0\} : x \leq 0\}$

Multiple Choice:

(a) $x \leq 0$

(b) $(0, \infty)$

(c) $(-\infty, \infty)$

(d) $(-\infty, 0)$

(e) $\{0\}$ ✓

Problem 34 *Suppose* $f(x) = x+4$, $g(x) = x^3-3$, *and* $h(x) = x^3-1$; *compute* $(f \circ g)(1) \cdot h(x)$.

Multiple Choice:

(a) $\left(x^3+1\right)\left(x^3-1\right)$

(b) 61

(c) $2\,x^3 - 2$ ✓

(d) 0

(e) $-10\,x^3 + 10$

Problem 35 *Fill in the blank: Given a graph of a function, you can determine the* _____ *of points of interest.*

Multiple Choice:

(a) *exact coordinates; if they are close enough to the axes*

(b) *importance*

(c) *coordinates (within an error of* $\pm$ *1 unit)*

(d) *meaning*

(e) *existance* ✓

Problem 36 *Which of the following represents a* ***rigid translation****?*

Multiple Choice:

(a) $f(4\,x) - 2$

(b) $f(4\,x)$

(c) $4f(-2\,x)$

(d) $2f(x - 4)$

(e) $f(x - 4) + 2$ ✓

Problem 37 *Consider the relationship that takes in your individual assignment grades for this course, and returns the letter grade you earn at the end of the semester. Is this relation a function?*

Multiple Choice:

(a) *No, there is only one possible letter grade for each point value.*

(b) *Yes, there is one point value for each letter grade.*

(c) *There is not enough information here to tell.*

(d) *No, there is one point value for each letter grade.*

(e) *Yes, there is only one possible letter grade for each point value.* ✓

Problem 38 *Which of the following represents the set of all rational numbers that are no larger (more positive) than 5? (Note: The set of rational numbers is denoted $\mathbb{Q}$)*

Multiple Choice:

(a) $\{x \in \mathbb{Q} : x \leq 5\}$ ✓

(b) $(-\infty, 5]$

(c) $(-\infty, 5)$

(d) $\{x \in \mathbb{R} : x \leq 5\}$

(e) $\{x \in \mathbb{Q} : x < 5\}$

Problem 39 *Which of the following accurately describes the sequence of transformations applied to $f(x)$ to obtain $-10f(-2(x+2)) + (-7)$?*

Multiple Choice:

(a) *The function f is flipped over the y-axis, horizontally stretched to $\frac{1}{2}$ its original width, shifted left by 2, vertically stretched to 10 times it's original height, flipped over the x-axis, and shifted down by 7.* ✓

(b) *The function f is flipped over the y-axis, horizontally stretched to $\frac{1}{2}$ its original width, shifted left by 2, vertically stretched to 10 times it's original height, and shifted down by 7.*

(c) *The function f is flipped over the y-axis, horizontally stretched to $\frac{1}{10}$ its original width, shifted left by 7, vertically stretched to 2 times it's original height, flipped over the x-axis, and shifted down by 2.*

(d) *The function f is flipped over the y-axis, horizontally stretched to $\frac{1}{2}$ its original width, shifted left by 2, vertically stretched to 10 times it's original height, flipped over the x-axis, and shifted down by 7.*

(e) *The function f is flipped over the y-axis, horizontally stretched to $\frac{1}{10}$ its original width, shifted left by 7, vertically stretched to 2 times it's original height, flipped over the x-axis, and shifted down by 2.*

Problem 40 *If a function has a single absolute extrema, **must** it have a relative maximum or a relative minimum?*

Multiple Choice:

(a) *Yes, because all relative extrema must also be absolute extrema.*

(b) *No because it's impossible to have a function that has only one absolute extrema.*

(c) *No, it is possible to have an absolute extrema without any relative maximum or minimums.*

(d) *There is not enough information to know.*

(e) *Yes, the absolute extrema must be either a relative maximum or relative minimum.* ✓

Problem 41 *Suppose $f(x)$ has a zero at an x-value of 2. What would a zero of $g(x)$ be if $g(x) = 6f(-5x + 4)$?*

Multiple Choice:

(a) $\frac{2}{5}$ ✓

(b) -6

(c) $\frac{12}{5}$

(d) $-\frac{2}{5}$

(e) 2

Problem 42 *If $f(x) = -x^2 - x$ and $g(x) = -8x - 5$, what is $\big((-5) \cdot f + (-4) \cdot g\big)(x)$?*

Multiple Choice:

(a) $5x^2 + 37x + 20$ ✓

(b) $5120x^2 + 6560x + 2100$

(c) $4x^2 + 44x + 25$

(d) $160x^3 + 260x^2 + 100x$

(e) $160x^2 + 160x + 20$

Problem 43 *If the function $f(x)$ has 5 zeros, then how many zeros must $f(x-1)$ have? (**Hint**, consider this in terms of translations or transformations)*

Multiple Choice:

(a) 5 ✓

(b) *There is not enough information to tell.*

(c) 4

(d) 0

(e) 1

Problem 44 ***Any** change in the domain of $f(x)$ corresponds to a change in what for $f^{-1}(x)$?*

Multiple Choice:

(a) *Change in range.* ✓

(b) *Change in the definition (but not context) for $f^{-1}(x)$.*

(c) *Change in domain.*

(d) *Whether or not $f^{-1}(x)$ exists.*

(e) *Forces $f^{-1}(x)$ to be discontinuous.*

Problem 45 *If the point $(-3, 1)$ is on the graph of $f(x)$, then which point is on the graph of $g^{-1}(x)$ (the graph of g inverse) where $g(x) = -5f(-3\,x-5)+(5)$?*

Multiple Choice:

(a) $(\frac{24}{5}, -\frac{2}{3})$

(b) $(\frac{24}{5}, 12)$

(c) $(0, -\frac{2}{3})$ ✓

(d) $(12, \frac{24}{5})$

(e) $(-\frac{2}{3}, 0)$

Problem 46 *Which coordinates describe a point that is* 2 *units down and* 4 *units to the left of the origin?*

Multiple Choice:

(a) $(-4, 2)$

(b) $(-2, -4)$

(c) $(2, 4)$

(d) $(-4, -2)$ ✓

(e) $(4, -2)$

Problem 47 *Which equation accurately reflects the following sequence of transformations (in the correct order)? The function g is flipped over the y-axis, horizontally stretched to* $\frac{1}{4}$ *its original width, shifted left by* 8*, vertically stretched to* 10 *times it's original height, flipped over the x-axis, and shifted up by* 3*.*

Multiple Choice:

(a) $-10g(-4\,x + 8) + (3)$

(b) $-10g(-4(x + 8)) + (3)$ ✓

(c) $-10g(-4\,x + 32) + (3)$

(d) $-10g(-4\,x - 8) + (3)$

(e) $-10g(-4\,x + 8) - (3)$

Problem 48 *Given:* $f(x) = x^2$ *and* $g(x) = x - 1$*. Which of the following is equivalent to* $(g \circ f)(x + 2)$

Multiple Choice:

(a) $x^2 - 1$

(b) $x^2 + 1$

(c) $(x+2)^2 - 1$ ✓

(d) $x^2 + 2$

(e) $(x-2)^2 - 1$

Problem 49 *Which of the following represents the translation that moves the graph of $f(x)$ to the left by 3?*

Multiple Choice:

(a) $f(x-3)$

(b) $f(x) - 3$

(c) $f(x+3)$ ✓

(d) $f(x) + 3$

(e) $f(3x)$

Problem 50 *If $f(x) = -x^2 - x$ and $g(x) = -8\,x - 5$, what is $(g \circ f)(x)$?*

Multiple Choice:

(a) $-x^2 - 9\,x - 5$

(b) $8\,x^3 + 13\,x^2 + 5\,x$

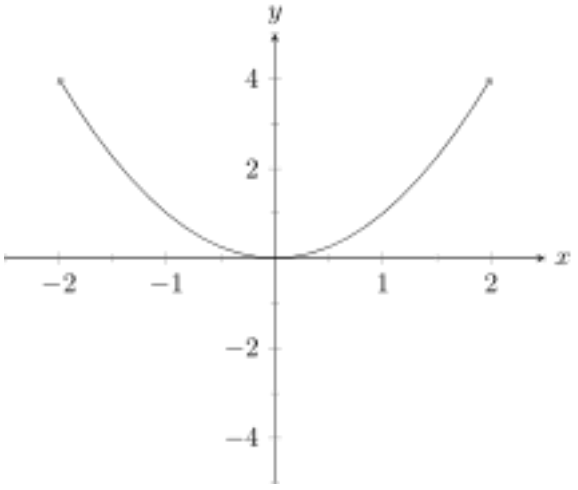
(c) $\dfrac{x^2 + x}{8\,x + 5}$

(d) $8\,x^2 + 8\,x - 5$ ✓

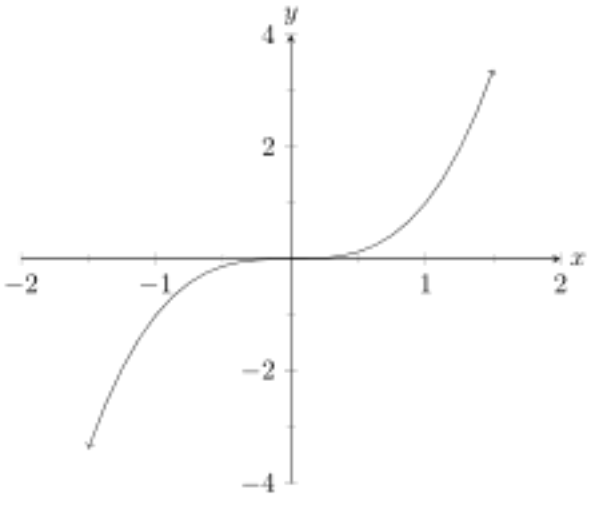
(e) $-64\,x^2 - 72\,x - 20$

Problem 51 *Which of the following has an absolute maximum?*

Multiple Choice:

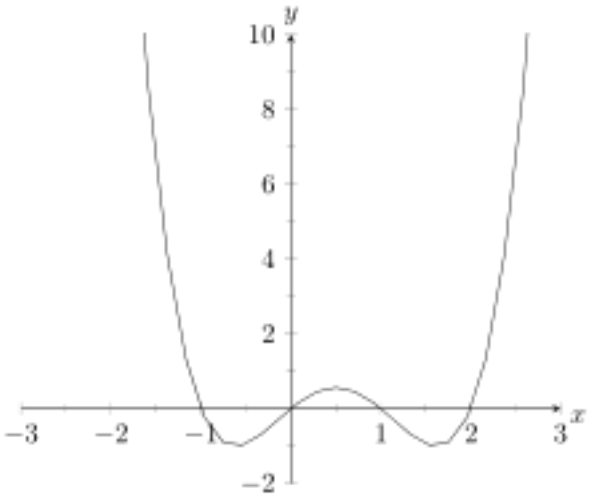


(a)

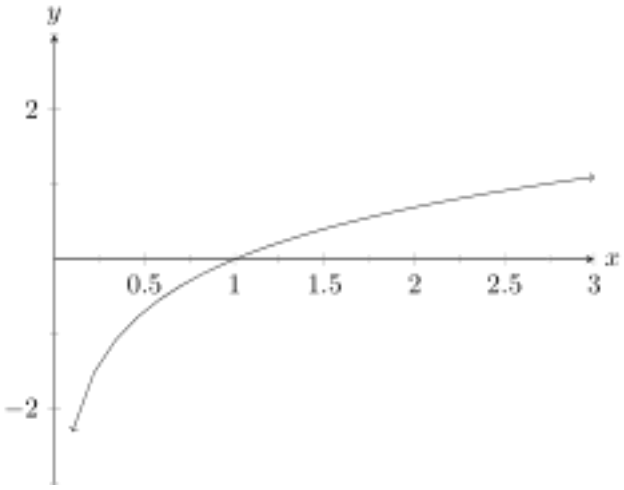


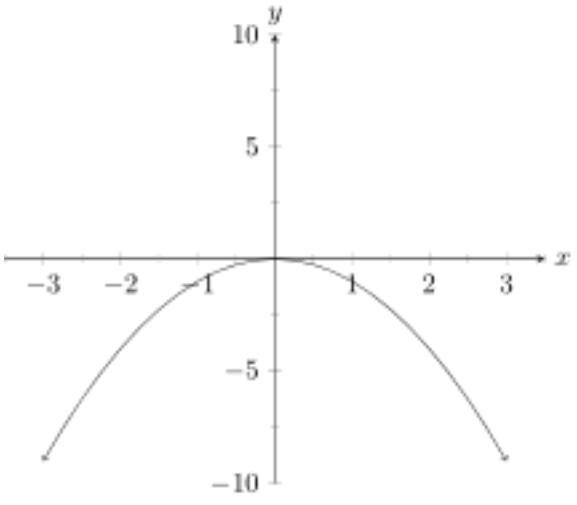
(b)

(c)



(d)

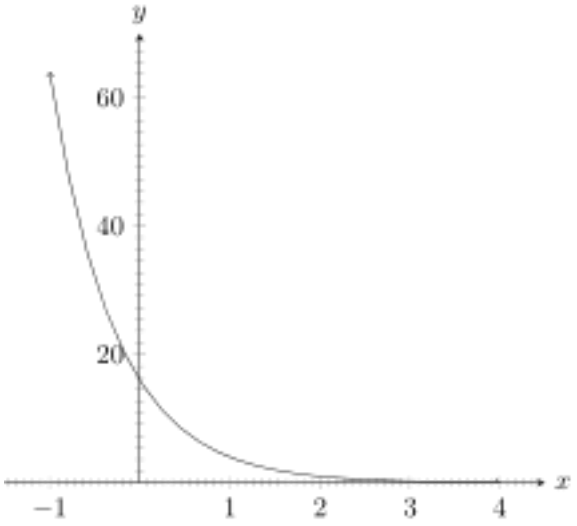




(e) ✓

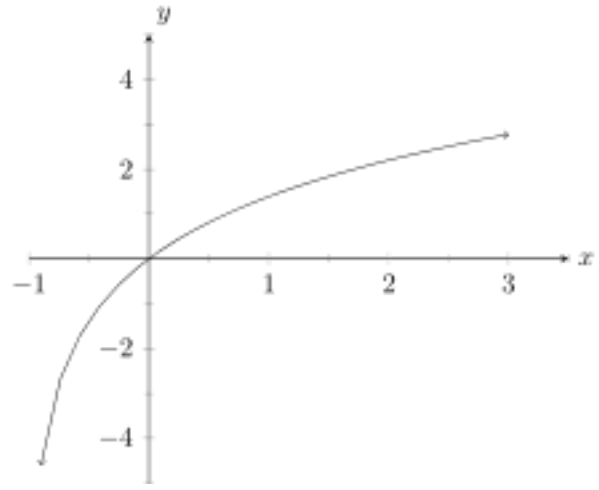
Problem 52 *Which of the following graphs would most properly be said to have the parent function* $f(x) = e^x$*?*

Multiple Choice:

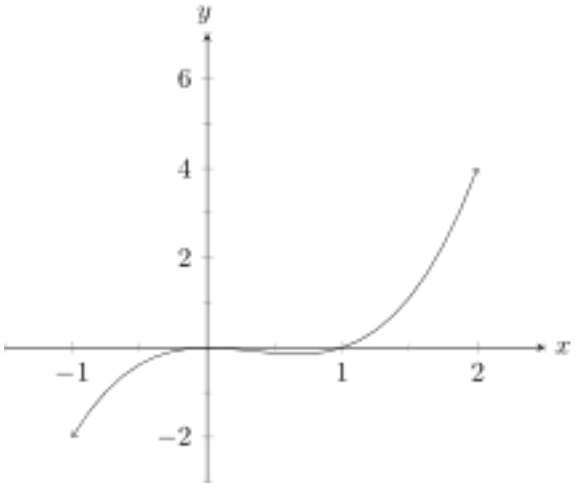


(a) ✓

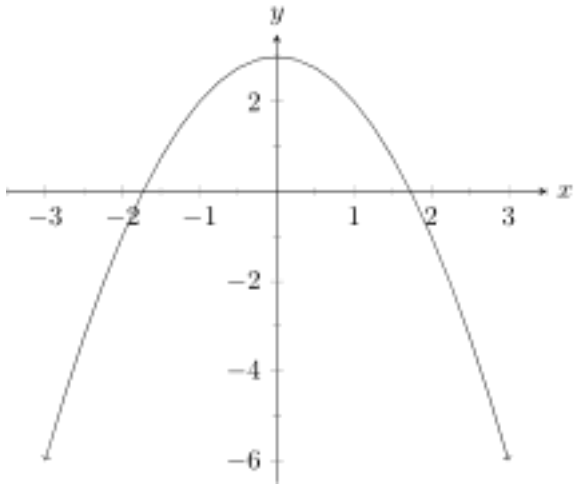
(b)



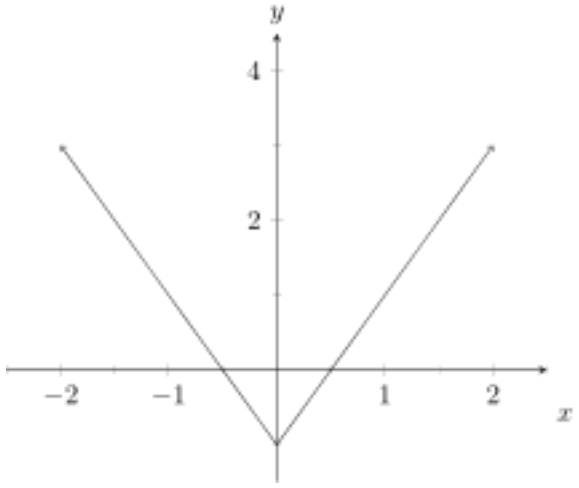
(c)



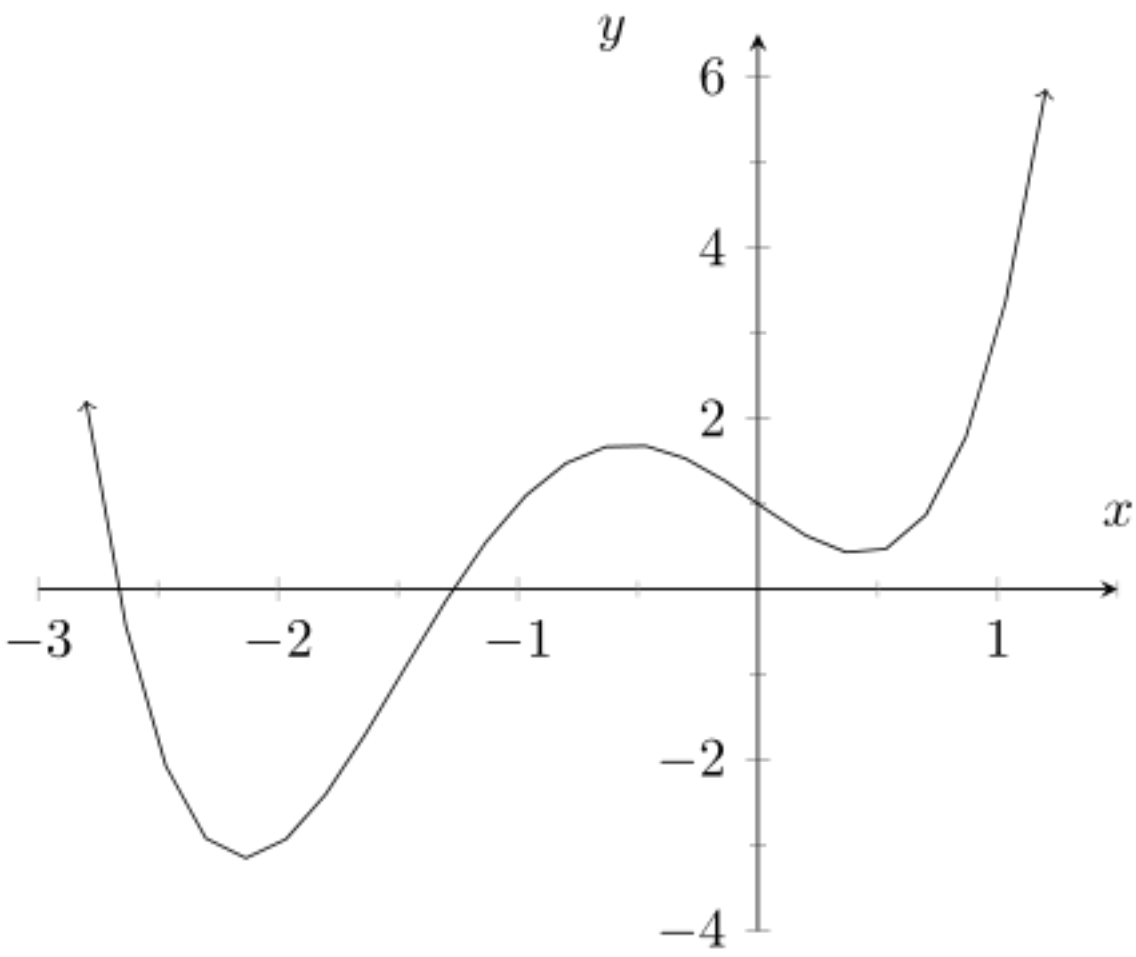
(d)



(e)



Problem 53 *Given the following graph:*



What are the approximate (x,y) coordinates of the local minimum(s), if any exist? (Select all that are local minimums; keep in mind we are asking for an approximation, not precise values)

Multiple Choice:

(a) $\left(-\frac{9}{4}, -\frac{5}{2}\right)$ *and* $\left(\frac{1}{2}, \frac{1}{4}\right)$ ✓

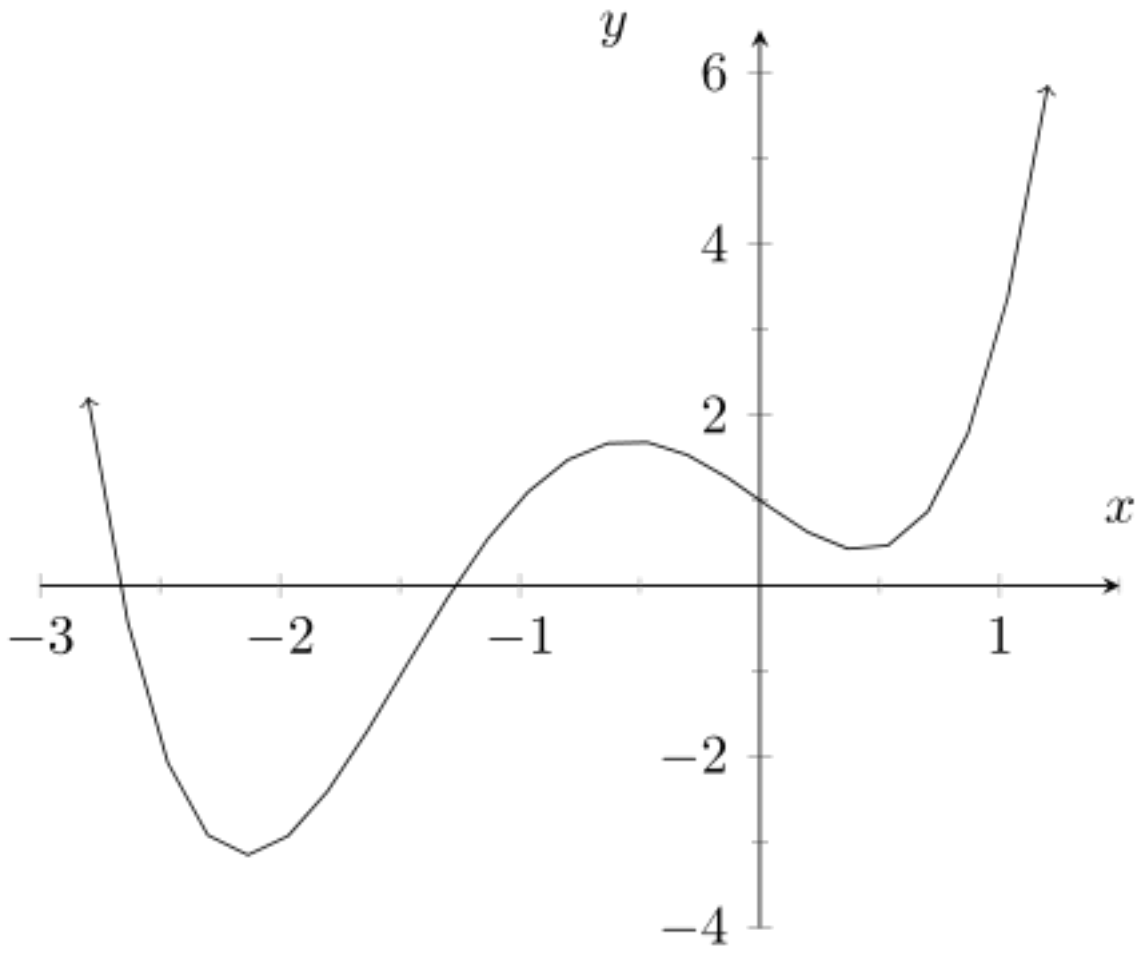
(b) $\left(\frac{1}{2}, \frac{1}{4}\right)$

(c) $\left(-\frac{3}{4}, \frac{19}{10}\right)$

(d) $\left(-\frac{9}{4}, -\frac{5}{2}\right)$

(e) *There are no local minimums.*

Problem 54 *Given the following graph:*



What are the approximate (x,y) coordinates of the absolute maximum(s), if any exist?

Multiple Choice:

(a) $\left(-\frac{9}{4}, -\frac{5}{2}\right)$

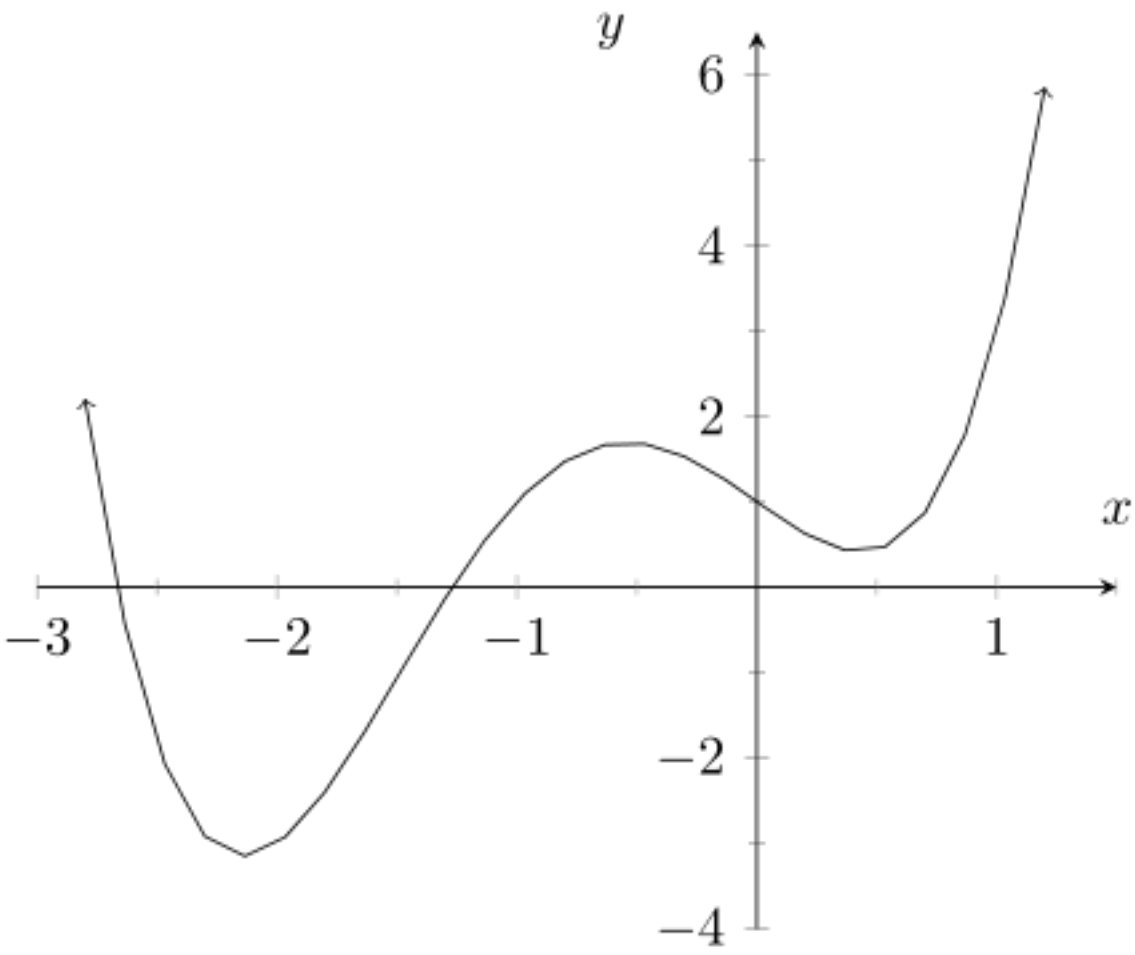
(b) $\left(\frac{1}{2}, \frac{1}{4}\right)$

(c) $\left(-\frac{3}{4}, \frac{19}{10}\right)$

(d) $\left(\frac{5}{4}, 6\right)$

(e) *There are no absolute maximums.* ✓

Problem 55 *Given the following graph:*



On what interval(s) is the function f(x) decreasing? (Approximate the endpoints if needed.)

Multiple Choice:

(a) $\left(-\infty, -\frac{9}{4}\right) \cup \left(-\frac{3}{4}, \frac{1}{2}\right)$ ✓

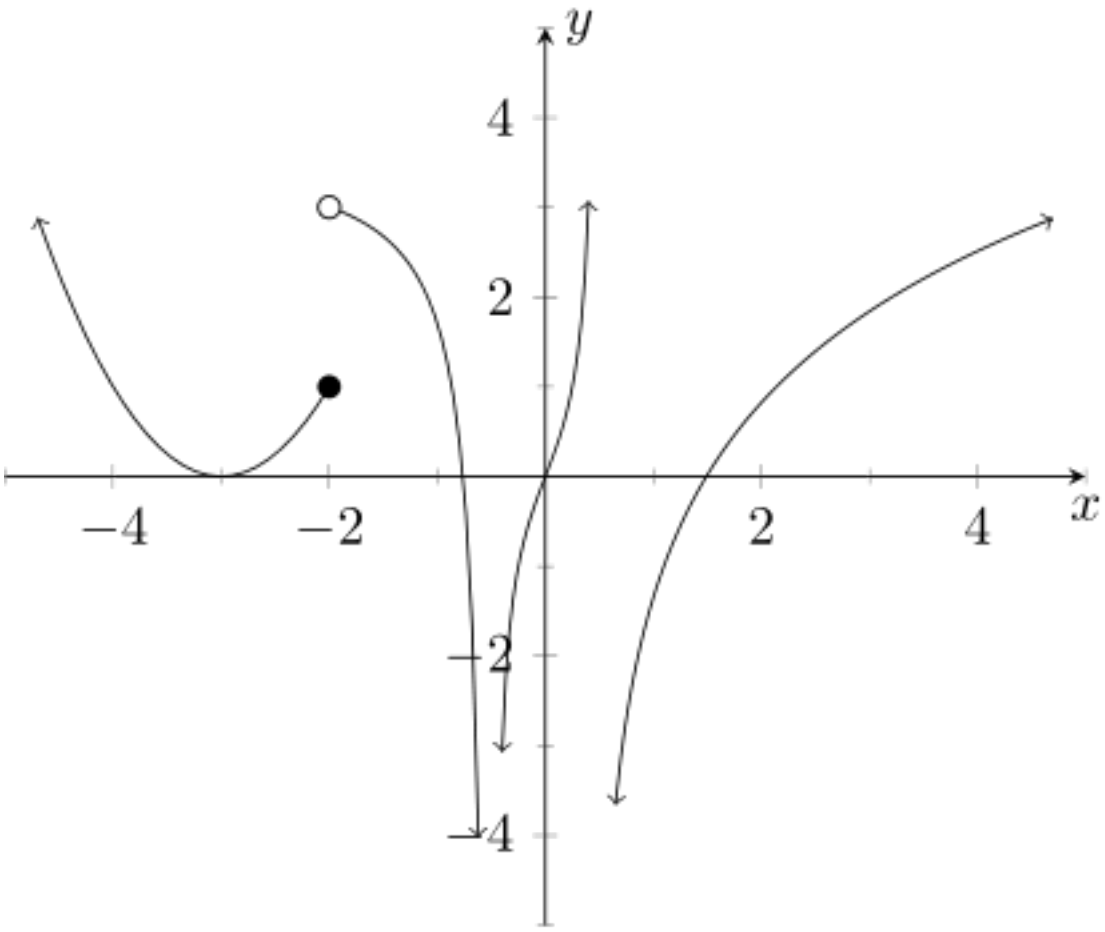
(b) $\left(-\frac{9}{4}, -\frac{3}{4}\right)$

(c) $\left(-\frac{3}{4}, \frac{1}{2}\right)$

(d) $\left(-\infty, -\frac{9}{4}\right)$

(e) $\left(\frac{5}{4}, \infty\right)$

Problem 56 *Consider the following graph:*



Does the graph have any ***relative*** *extrema? If so, (approximately) where?*

Multiple Choice:

(a) *Yes; a minimum at* $(-3, 0)$ ✓

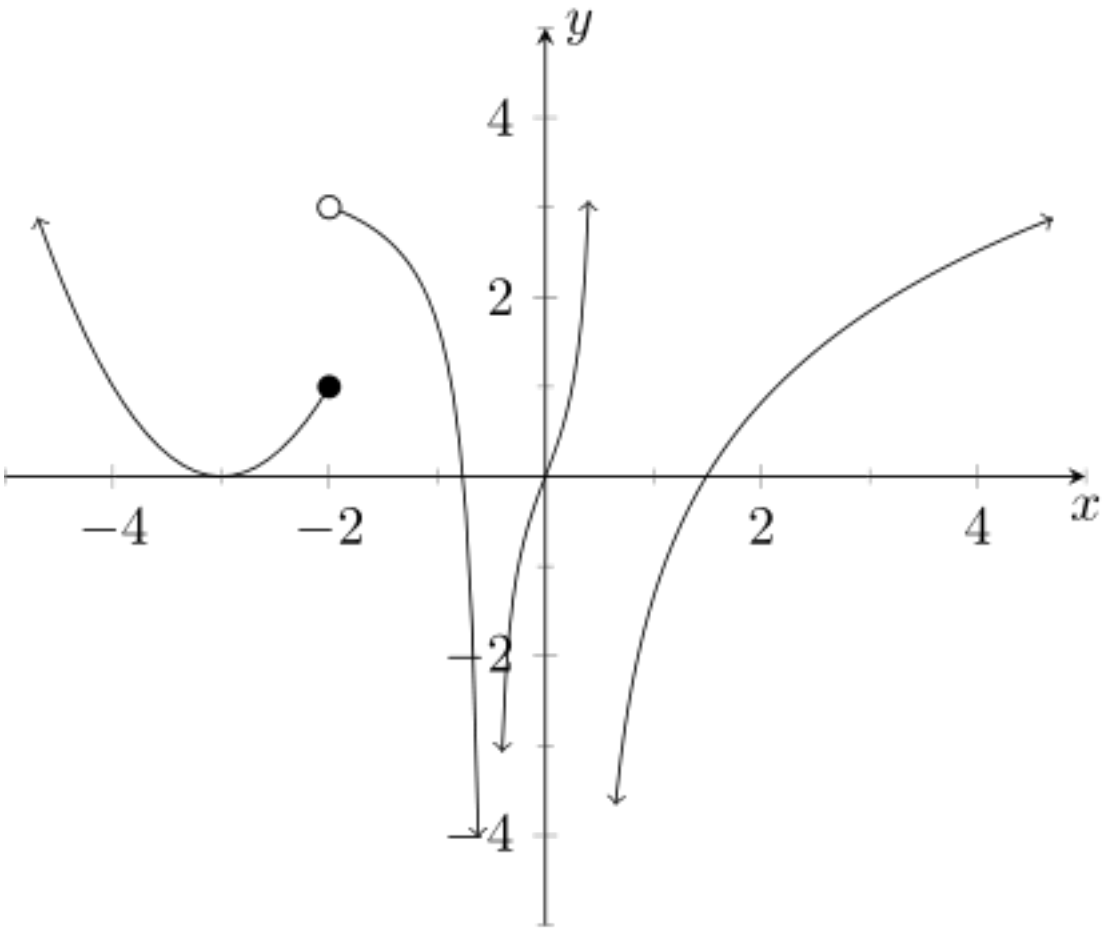
(b) *Yes; a minimum at* $(-3, 0)$ *and a maximum at* $(-2, 3)$

(c) *Yes; a minimum at* $(-3, 0)$ *and a maximum at* $(-2, 1)$

(d) *Yes; a maximum at* $(-2, 3)$

(e) *Yes; a maximum at* $(-2, 1)$

Problem 57 *Consider the following graph:*



Does the graph have any discontinuities? If so, what type?

Multiple Choice:

(a) *Yes, it has both infinite and jump discontinuities.* ✓

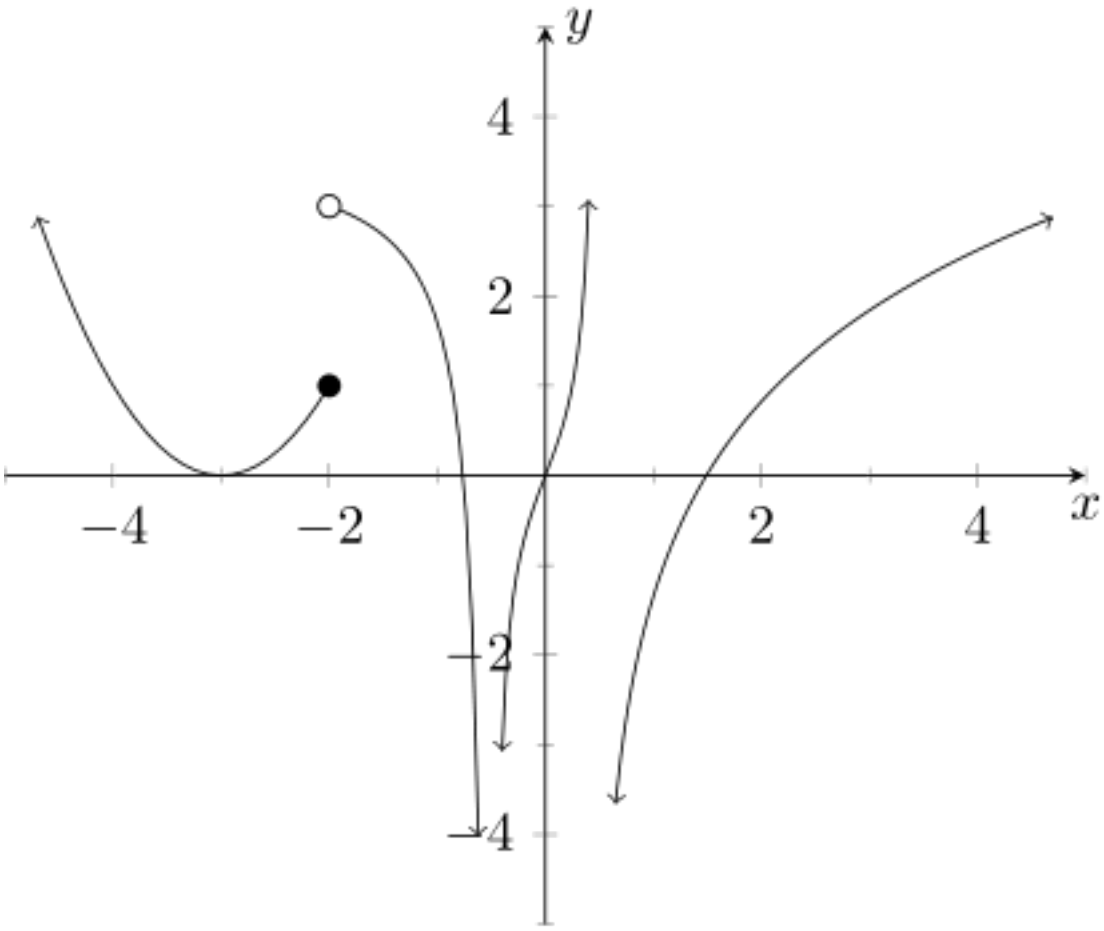
(b) *Yes, it (only) has jump discontinuities.*

(c) *Yes, it (only) has infinite discontinuities.*

(d) *Yes, it has jump, infinite, and hole discontinuities.*

(e) *Yes, it has infinite and hole discontinuities.*

Problem 58 *Consider the following graph:*



Does this graph have any ***absolute*** *extrema?*

Multiple Choice:

(a) *No, because the graph extendws infinitely up and down.* ✓

(b) *No, because the graph extendws infinitely left and right.*

(c) *No, because the graph has discontinuities.*

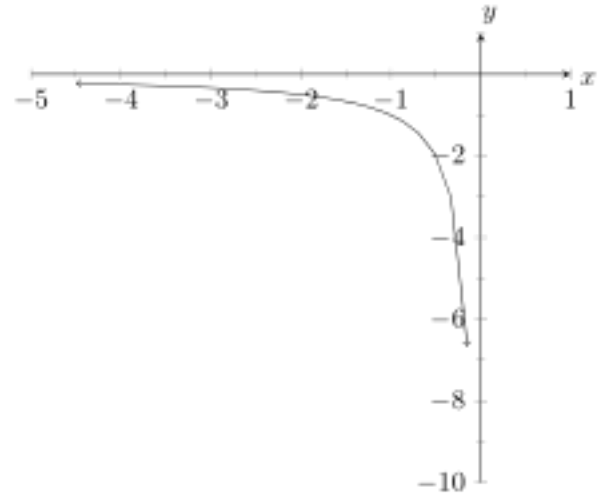
(d) *Yes, it has an absolute minimum.*

(e) *Yes, it has an absolute minimum and maximum.*

Problem 59 *Which of the following graphs depicts a continuous relationship?*

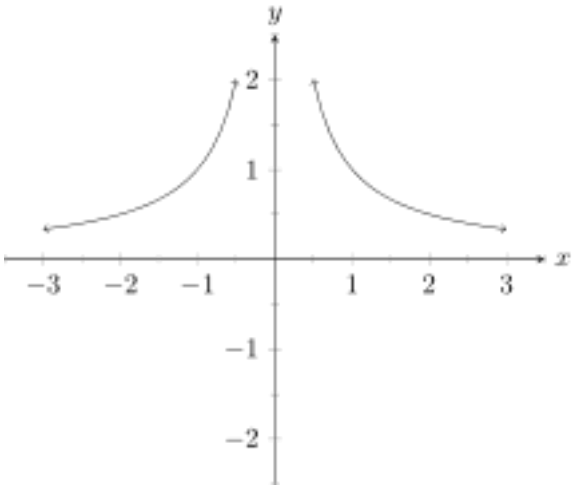
Multiple Choice:

(a)

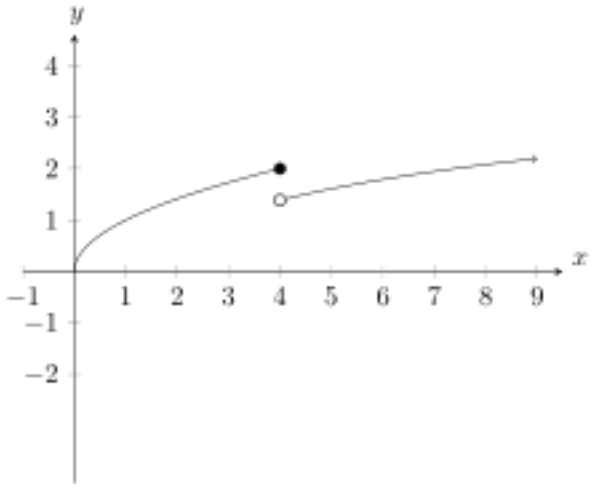


✓

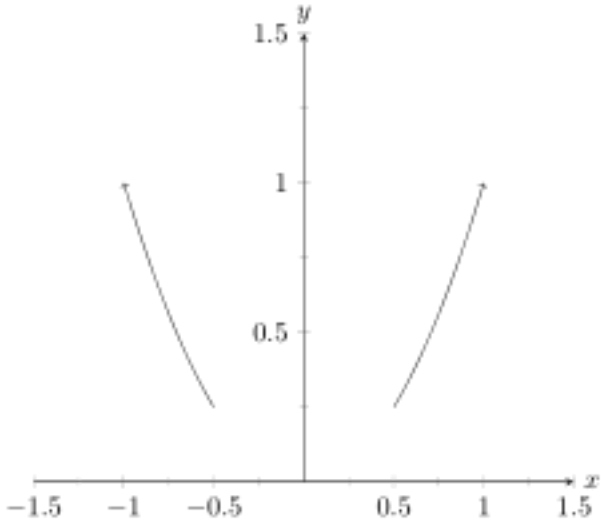
(b)



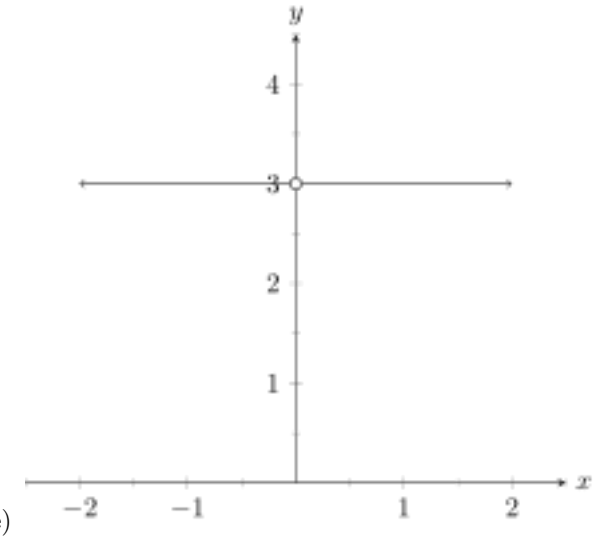
(c)



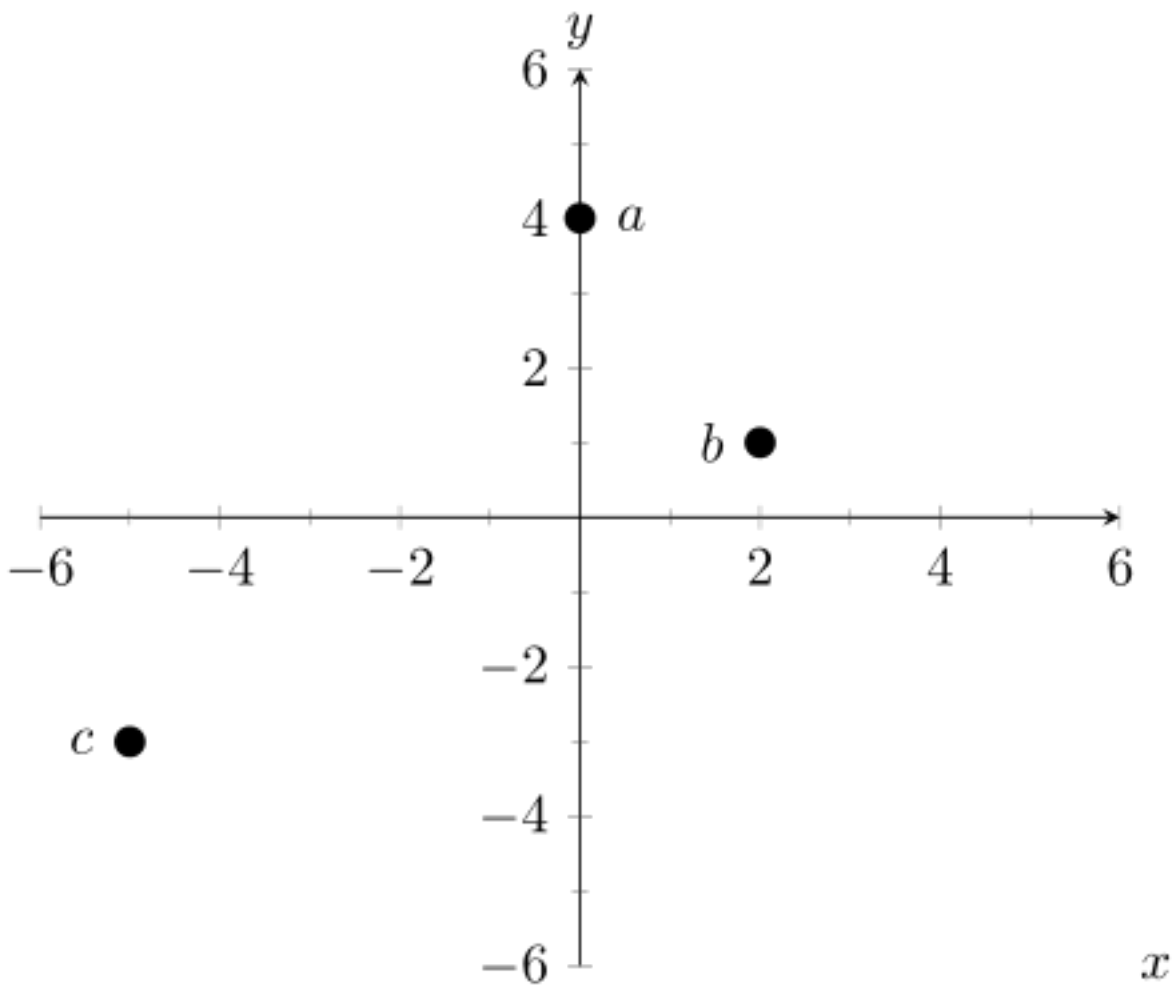
(d)



(e)



Problem 60 *Identify the coordinates of the points shown on the graph.*



Multiple Choice:

(a) *a: (0,4); b: (2,1); c: (-5, -3)* ✓

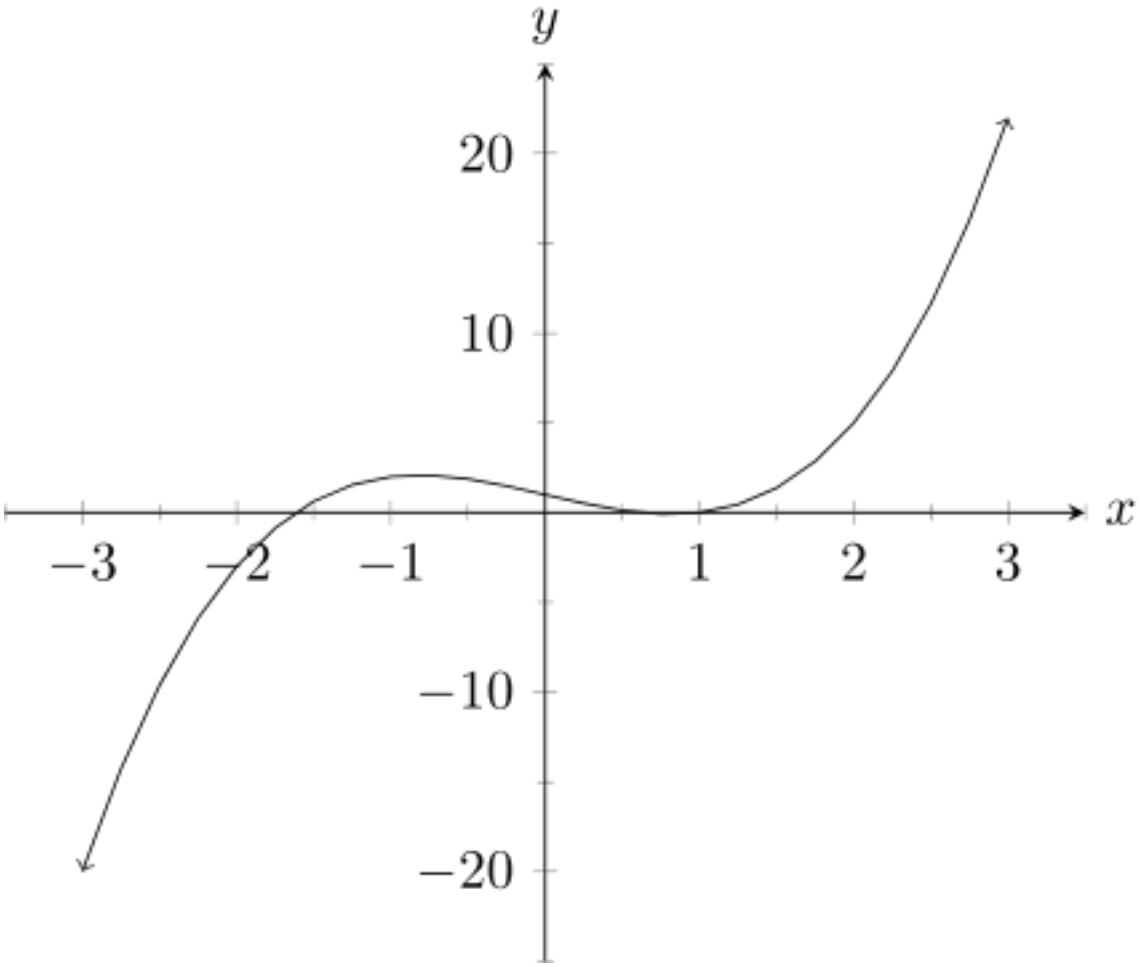
(b) *a: (-4,0); b: (-1,2); c: (-3, 5)*

(c) *a: (0,-4); b: (-2,-1); c: (5, 3)*

(d) *a: (4,0); b: (1,2); c: (-3,-5)*

(e) *a: (0,4); b: (-2,1); c: (5, -3)*

Problem 61 *For the following graph which is the correct parent function?*



Multiple Choice:

(a) $f(x) = x^3$ ✓

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

(c) $f(x) = |x|$

(d) $f(x) = e^x$

(e) $f(x) = \sqrt[3]{x}$