
INSTRUCTIONS: **Simplify** and **box** all your answers. Write neatly and **justify all answers**. A correct answer with incorrect work or no justification may receive no credit. Books, notes, and electronic devices are not permitted while taking the exam. The exam is worth 100 points.

Potentially useful formulas:

(i) $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

(ii) $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

(iii) Equation of a circle: $(x - h)^2 + (y - k)^2 = r^2$

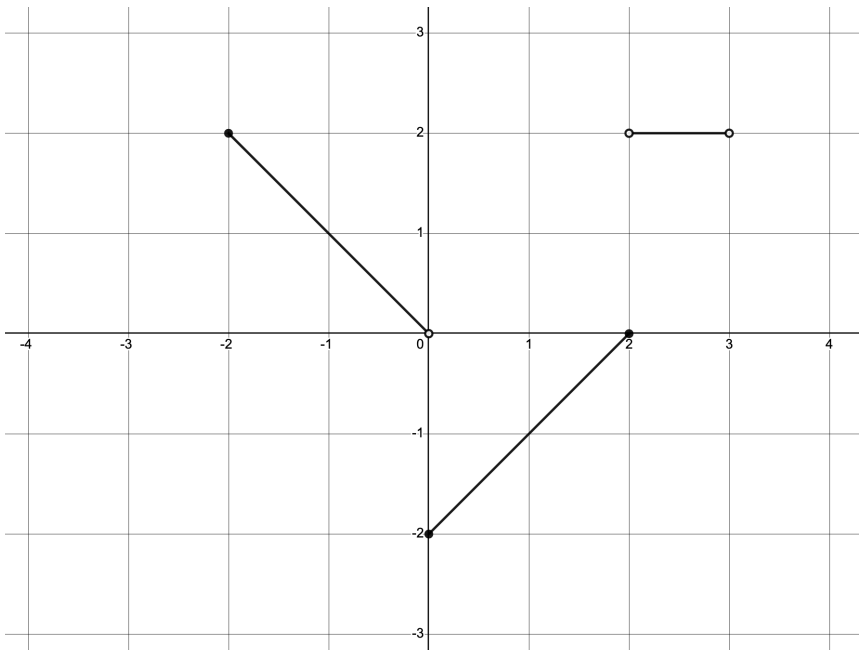
NOTE: YOU MAY TEAR OFF THIS FIRST PAGE AND USE (FRONT AND BACK) AS SCRATCH PAPER.

- i. DO NOT START UNTIL INSTRUCTED BY A PROCTOR.
- ii. THE EXAM IS ON BOTH SIDES OF EACH FOLLOWING EXAM PAGE
- iii. WRITE YOUR NAME ON THE NEXT PAGE. JUST BEFORE YOU UPLOAD TO GRADESCOPE WRITE DOWN YOUR UPLOAD TIME ON THE NEXT PAGE.
- iv. WHEN YOU FINISH (IF BEFORE THE EXAM END TIME) PLEASE QUIETLY COLLECT YOUR THINGS AND MOVE TO THE SUBMISSION AREA TO UPLOAD YOUR ANSWERS WITH SUPPORTING WORK TO GRADESCOPE.

Name: _____

Upload time: _____

1. Answer the following for the given graph of a function f (no justification is needed for this problem) (11 pts):



- (a) Identify the domain of f .
- (b) Identify the range of f .
- (c) Find $f(0)$ if it exists.
- (d) Find $(f \cdot f)(1)$
- (e) Is f odd, even, or neither?
- (f) Find $(f \circ f)(2.5)$.
- (g) f is not one-to-one. Briefly explain why it isn't one-to-one.
- (h) Identify a restriction of the domain so that f is one-to-one and has the same range as in part (b).
- (i) Use your domain restriction to calculate $f^{-1}(2)$.
- (j) Find the x -values where $f(x) < 0$. Give your answer in interval notation.
- (k) Find the average rate of change from $x = -1$ to $x = 0$.

2. The following are unrelated: (9 pts)

(a) Find the equation of the circle centered at $(-3, 1)$ with radius $r = \sqrt{5}$.

(b) Find the equation of the line that crosses through the points $(1, -2)$ and $(4, 3)$.

(c) Find the equation of the vertical line that crosses through the point $(5, 7)$.

3. Suppose a is a constant and you are given two points $(-2, a)$ and $(-1, 1)$. Now suppose you know the midpoint between the two points is $\left(-\frac{3}{2}, \frac{5}{2}\right)$. Find the value for a . (3 pts)

4. Find the domain of the following functions. Express your answers in interval notation. (15 pts)

(a) $m(x) = \frac{x - 4}{x^2 - 16}$

(b) $q(r) = \frac{3\sqrt{r}}{r - 1}$

(c) $r(t) = 5\sqrt[3]{t - 1}$

5. For $f(x) = \sqrt{x-3}$ and $k(x) = x^2 + 3$, find the following: (10 pts)

(a) Find $f(11)$

(b) Find $f(x+12)$

(c) Find $(k \circ f)(x)$.

(d) Find the domain of $(k \circ f)(x)$.

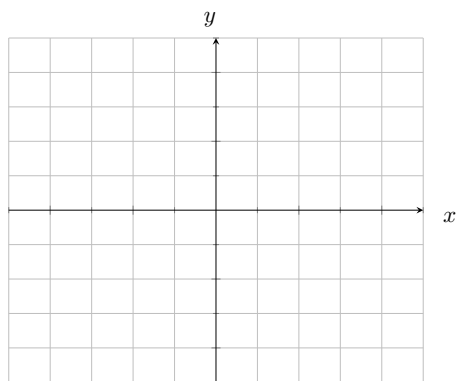
6. Answer the following for the one-to-one function $g(x) = \frac{1}{x-2}$. (5 pts)

(a) Find $g^{-1}(x)$.

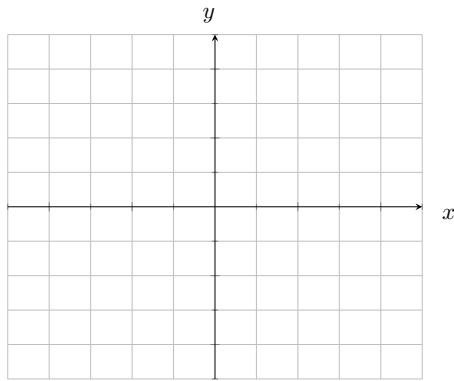
(b) What is the range of $g^{-1}(x)$?

7. Sketch the shape of the graph of each of the following on the provided axes. Make sure to label relevant value(s) on your axe(s) (19 pts)

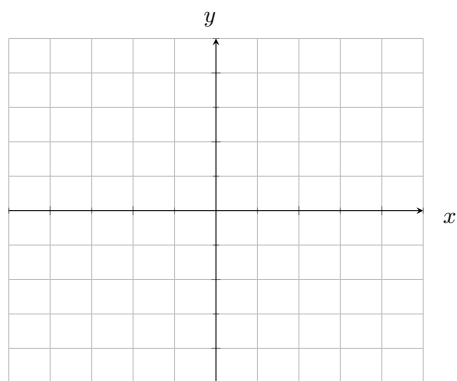
(a) $f(x) = -x^2$



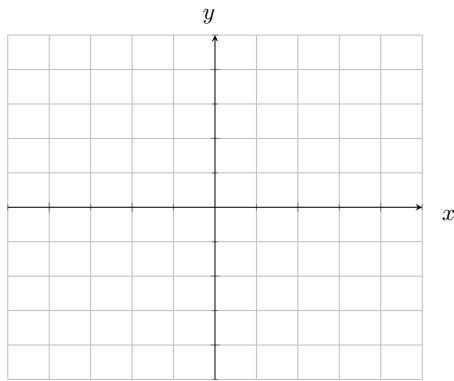
(d) $g(x) = -\sqrt{x}$



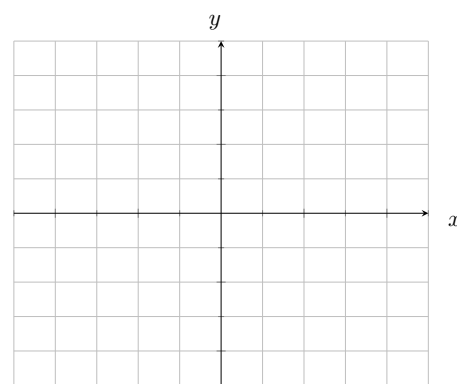
(b) $k(x) = \sqrt[3]{x} - 2$



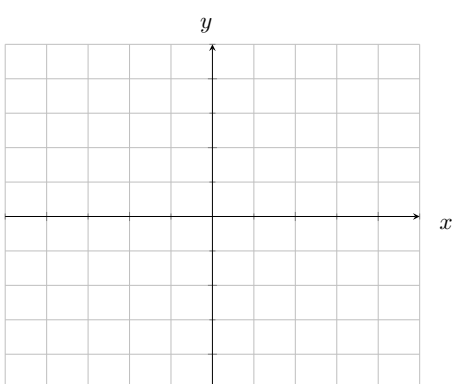
(e) $m(x) = |x + 1|$



(c) $(x + 2)^2 + y^2 = 1$



(f) $q(x) = \begin{cases} -3 & \text{if } x \leq -1 \\ \frac{2}{3}x - 2 & \text{if } x > -1 \end{cases}$



8. For $P(x) = 2x^3 + 8x^2 + 8x$ answer the following. (7 pts)

(a) Indicate on a graph or use arrow notation to indicate the end behavior of $P(x)$.

(b) Find the y -intercept of $P(x)$.

(c) Find all zeros and identify the multiplicity of each zero.

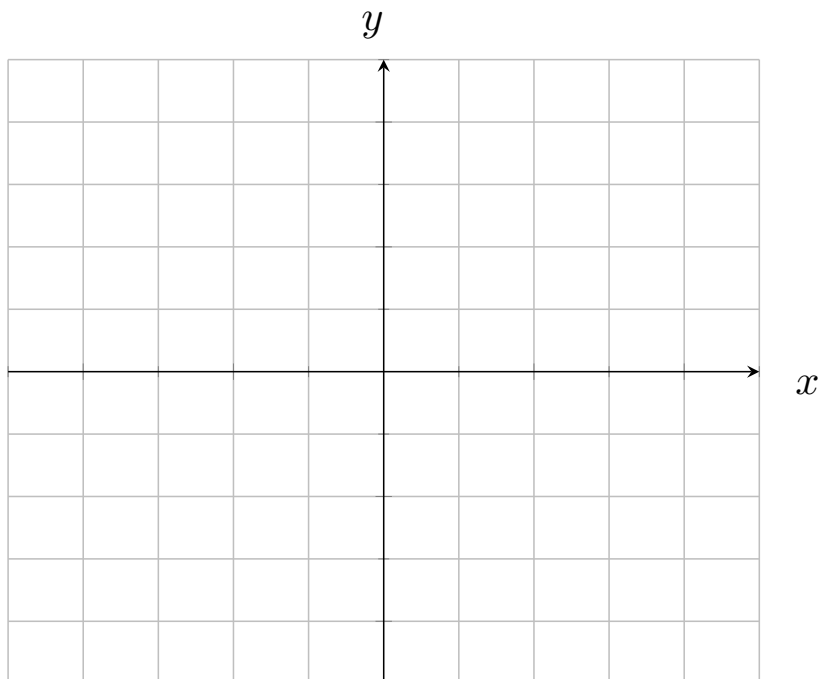
9. Sketch the shape of the graph of a polynomial function, $g(x)$, that satisfies **all** of the information. **Label** all intercepts on the graph. (5 pts)

i. The graph has y -intercept $(0, 3)$.

ii. The graph has end behavior consistent with $y = -\frac{1}{2}x^4$.

iii. The graph crosses at $(-2, 0)$ and $(3, 0)$ and bounces (touches but does not cross) at $(1, 0)$.

iv. The graph has no other x -intercepts.

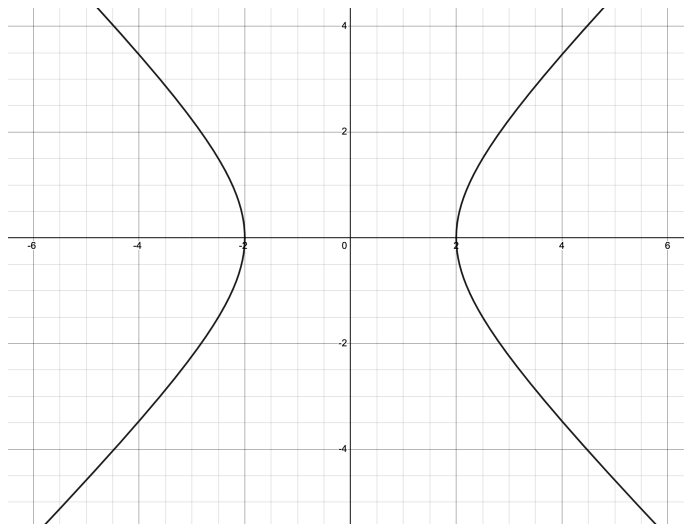


10. Use long division to find the quotient and remainder when $x^3 - 2x^2 + x - 7$ is divided by $x - 2$. (4 pts)

11. The following are unrelated.

(a) Is $f(x) = x^3 - 2x$ odd, even, or neither? Justify your answer for full credit. (4 pts)

(b) Is the graph below that of a function? Briefly explain why or why not. (3 pts)



12. A farmer uses 6 kilometers of fencing to fence in three equal-sized rectangular plots of land (see image below). Find the dimensions of each rectangle that maximizes the total area of all three rectangles. (5 pts)

