
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, electronic devices, other unauthorized devices, and help from another person are not permitted while taking the exam. The exam is worth 100 points.

Potentially useful formulas:

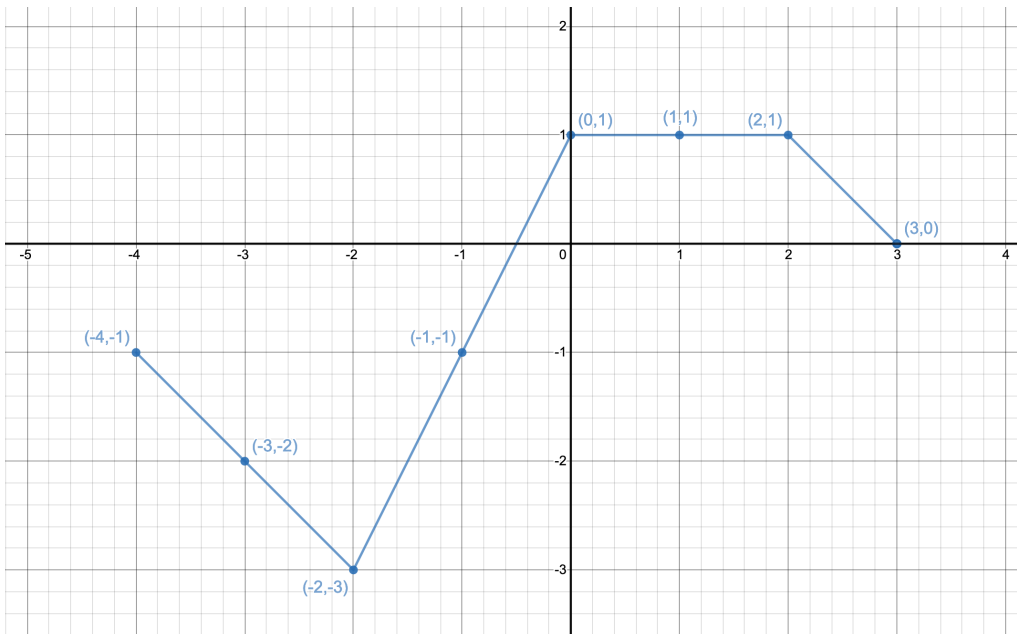
(i) Equation of a circle: $(x - h)^2 + (y - k)^2 = r^2$

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.
- iv. WHEN YOU FINISH (IF BEFORE THE EXAM END TIME) PLEASE QUIETLY COLLECT YOUR THINGS AND FOLLOW PROCTOR INSTRUCTIONS IN UPLOADING YOUR EXAM WITH SUPPORTING WORK TO GRADESCOPE. ONLY WORK THAT'S SUBMITTED TO GRADESCOPE WILL BE GRADED.

Name: _____

1. Refer to the given graph of $f(x)$ to answer the following: (9 pts)



(a) Find the domain of $f(x)$. Express your answer in interval notation

(b) Find the range of $f(x)$. Express your answer in interval notation

(c) Find $(f + f)(-2)$

(d) Find $(f \circ f)(3)$

(e) Find $|f(-4)|$

(f) Solve $f(x) = -3$

(g) Find x -values for which $f(x) \leq -1$

(h) Find the net change of $f(x)$ from $x = 0$ to $x = 3$

(i) Is $f(x)$ one-to-one? Briefly justify your answer

2. Find the domain of the following functions: (15 pts)

(a) $f(x) = \sqrt{x^2 - x - 12}$

(b) $g(x) = x^2 + \sqrt[3]{-x}$

(c) $h(x) = \frac{x-1}{x\sqrt{9-x}}$

3. Consider $f(x) = \sqrt{x}$ and $g(x) = x^2 + 1$ and answer the following: (6 pts)

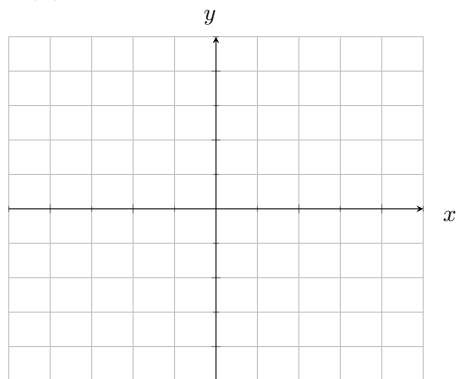
(a) Find $(f \circ g)(x)$.

(b) Find the domain of $(f \circ g)(x)$.

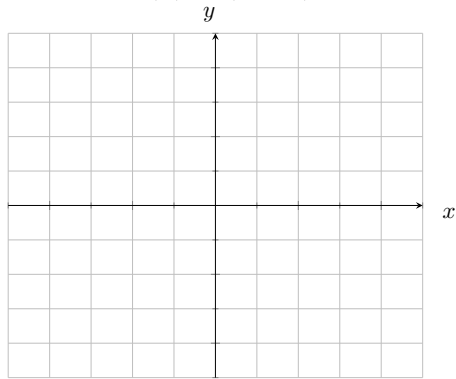
4. Find the equation of a parabola which has vertex at $(-2, 5)$ and passes through the point $(0, 7)$: (4 pts)

5. Sketch the graph of the following (graph each function on a **separate** set of axes). Label values on your axes: (19 pts)

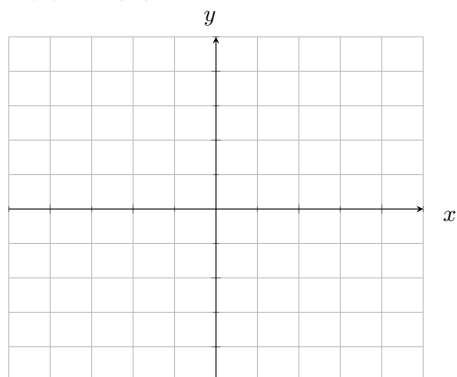
(a) $f(x) = -x^2 + 1$



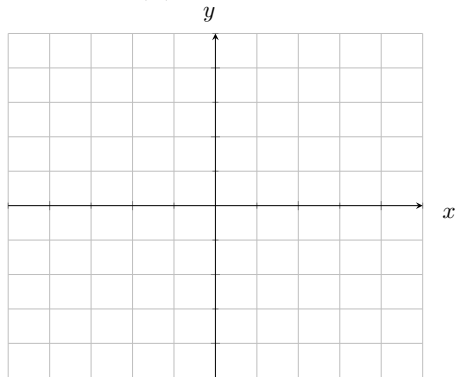
(b) $g(x) = (x - 1)^3$



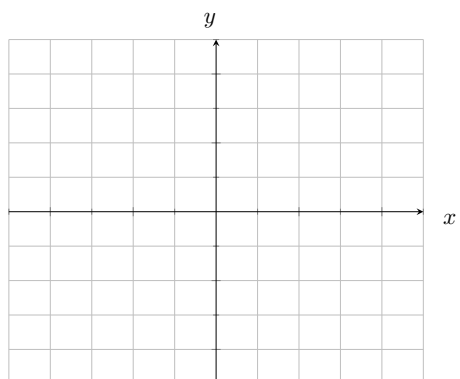
(c) $h(x) = 2|x| + 1$



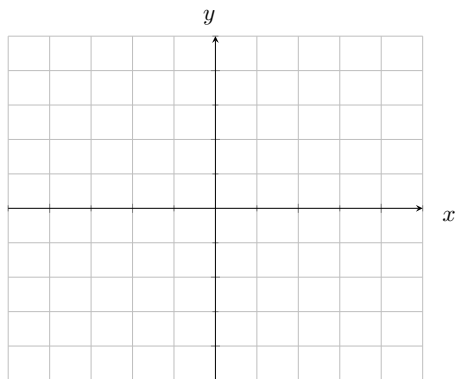
(d) $i(x) = \sqrt{-x}$



(e) $j(x) = \sqrt[3]{x} + 1$



(f) $k(x) = \begin{cases} 2 & x \leq 1 \\ x - 2 & x > 1 \end{cases}$



6. Write the equation of a straight line that is perpendicular to the line $y = \frac{1}{3}x + 96$ and passes thru the point $(1, -4)$. (4 points)

7. The following are unrelated: (6 pts)

(a) Find the equation of the line that is parallel to the x -axis and passes through the point $(-2, 5)$.

(b) $f(x)$ is an even function with domain $(-\infty, \infty)$. Suppose the point $(3, 5)$ lies on the graph of f . Out of the following choices, Which point must also lie on the graph? (choose one)

(i) $(-3, 5)$ (ii) $(-3, -5)$ (iii) $(3, -5)$

(c) $g(x)$ is a function that is symmetric about the origin with domain $(-\infty, \infty)$. Suppose the point $(3, 5)$ lies on the graph of f . Out of the following choices, Which point must also lie on the graph? (choose one)

(i) $(-3, 5)$ (ii) $(-3, -5)$ (iii) $(3, -5)$

8. A bored pre-calculus student stands on a 3 ft high stool, and throws a stone vertically upwards with an initial speed of 32 ft/s. The height of that stone above the ground, in ft, is given as a function of time, in seconds, by $y(t) = 32t - 16t^2 + 7$. Answer the following: (6 pts)

(a) At what time is the stone at its maximum height?

(b) What is the maximum height of the stone, measured from the ground?

9. The points $(-1, 2)$ and $(1, 4)$ lie directly opposite each other on a circle such that the distance between the two points gives the diameter of the circle. Answer the following: (9 pts)

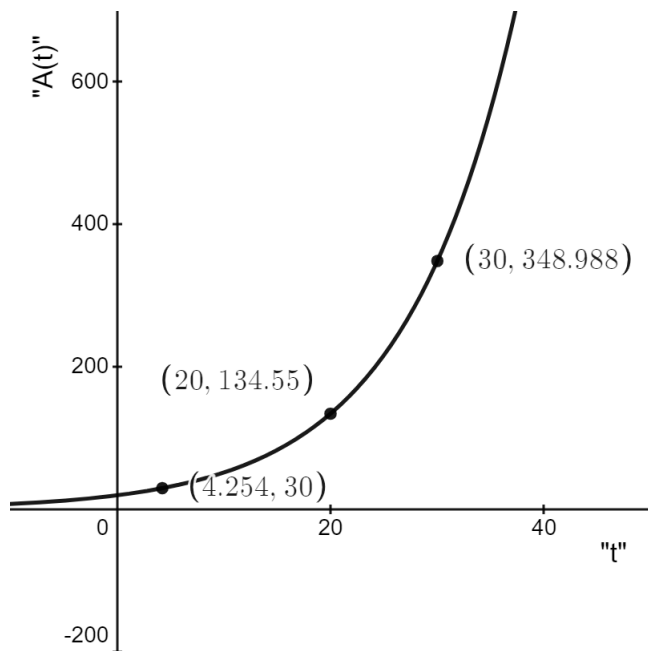
(a) What is the radius of the circle?

(b) Where is the center of the circle?

(c) Using the above, write down the equation of the circle in standard form

10. Find the inverse of the function $f(x) = \frac{1}{2x^3} + 7$ (4 pts)

11. The small amount you put in your savings account a few years ago is growing rapidly(Yay!). Below is a graph of your balance $A(t)$ in dollars, as a function of time t in years. Use the graph to answer the parts below: (5 pts)



- (a) Find $A^{-1}(30)$.
- (b) Use a short sentence to interpret the meaning of your answer to part (a).

12. For $f(x) = -x + 5$ find the following: (5 pts)

(a) $f(a)$

(b) $f(a + h)$

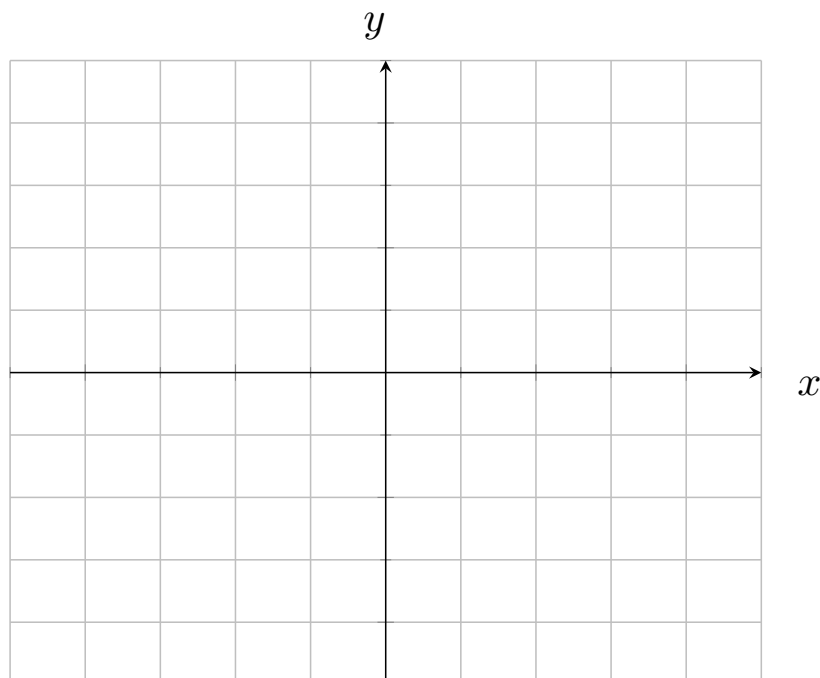
(c) $\frac{f(a + h) - f(a)}{h}$

13. The graph of a polynomial, $P(x)$, has the following properties: (8 pts)

- The graph has end behavior that is consistent with the end behavior of $y = -x^3$ (In arrow notation: $P(x) \rightarrow -\infty$ as $x \rightarrow \infty$ and $P(x) \rightarrow \infty$ as $x \rightarrow -\infty$).
- The graph crosses at x -intercept $(-2, 0)$.
- The graph bounces (touches but does not cross) at x -intercept $(1, 0)$.
- The graph has no other x -intercepts.
- The graph has y -intercept $(0, -4)$.

Answer the following for $P(x)$:

- (a) Sketch a graph of $P(x)$ that satisfies **all** of the given information.



- (b) Find an equation of a polynomial $P(x)$ that satisfies **all** of the given information. You may leave your answer in factored form.