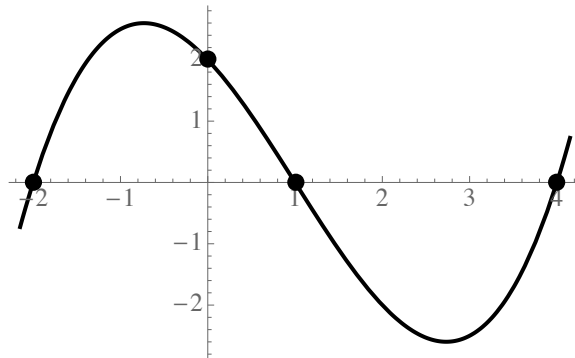


Name: _____ PID: _____

- Print your *NAME* on every page and write your *PID* in the space provided above.
 - Show all of your work in the spaces provided. No credit will be given for unsupported answers, even if correct.
 - No calculators, tablets, phones, or other electronic devices are allowed during this exam. You may use one page of handwritten notes, but no books or other assistance.
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- (1 pt) 0. Follow the instructions on this exam and any additional instructions given during the exam.
- (5 pt) 1. Find a possible formula for the polynomial function graphed below.



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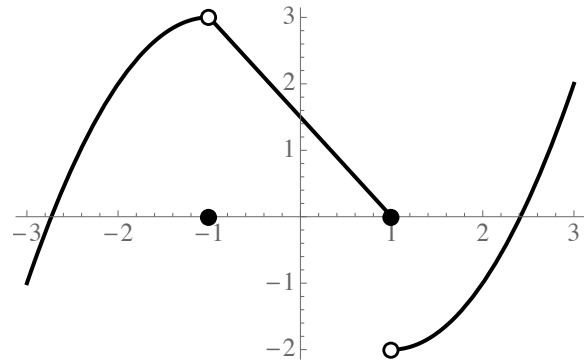
(4 pt) 2. Solve the equation for x . Leave your answer in exact form.

$$9 \cdot (3^x)^2 = 5^{x-4}$$

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(5 pt) 3. The graph given here is for the function

$$f(x) = \begin{cases} 3 - (x + 1)^2 & \text{if } x < -1 \\ 0 & \text{if } x = -1 \\ \frac{3}{2}(1 - x) & \text{if } -1 < x \leq 1 \\ (x - 1)^2 - 2 & \text{if } x \geq 1 \end{cases}$$



- Does $\lim_{x \rightarrow -1} f(x)$ exist? Explain why or why not.
- Is f left-continuous, right-continuous, or continuous at $x = -1$? Justify your answer.
- Is f left-continuous, right-continuous, or continuous at $x = +1$? Justify your answer.
- If $g(x) = 1 + x^2$, then find the formula for $(f \circ g)(x)$. What is the domain of $f \circ g$?

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(5 pt) 4. Find all values of a and b that make the function f continuous:

$$f(x) = \begin{cases} 4 + ax^2 & \text{if } x < -1 \\ ax + b & \text{if } -1 \leq x \leq 1 \\ (x - b)^2 - 3 & \text{if } x > 1 \end{cases}$$

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(5 pt) 5. In the theory of relativity, the mass of a particle with speed v is

$$m = f(v) = \frac{m_0}{\sqrt{1 - v^2/c^2}},$$

where m_0 is the rest mass of the particle and c is the speed of light in a vacuum.

- (a) What is the domain of f ?
- (b) Find a formula for f^{-1} .
- (c) What is the domain of f^{-1} ?