

Answer all of the following questions. Use the backs of the question papers for scratch paper. Additional sheets are available if necessary. No books or notes may be used. When answering these questions, please be sure to 1) check answers when possible, 2) clearly indicate your answer and the reasoning used to arrive at that answer (**unsupported answers may receive NO credit**).

If you use your calculator to solve an equation or produce a graph, please indicate this on your test paper. Otherwise the answer may receive no credit.

Name _____

Section _____

Question	Score	Total
1		5
2		5
3		5
4		5
5		15
6		15
7		20
8		15
9		15
Total		100

1. If $f(x) = x + 1$ and $g(x) = \sqrt{x}$, find a formula for $g \circ f$. Give the domain of $g \circ f$.

2. Solve the equation

$$2^{x^2+1} = 8.$$

3. Give a parametric curve $x(t), y(t)$ which traces out the circle centered at $(0, 0)$ and with radius 2.

4. Give the definition of odd function. For each of the following two functions, determine if the function is odd.

$$f(x) = x^3 + \cos x, \quad g(x) = x^3 + \sin x.$$

5. Consider the parametric curve:

$$\begin{aligned}x(t) &= 2t \\y(t) &= t^2 - 4t, \quad -2 \leq t \leq 6.\end{aligned}$$

- (a) What are the values of t when the curve is on the x -axis?
- (b) What is the value of t when the y coordinate attains its smallest value?
- (c) Eliminate t to find an equation in x and y which is satisfied by all points on the curve.

6. A population of critters doubles every 4 hours. At $t = 0$, there are 200 critters.
- (a) How many critters are there after 12 hours?
 - (b) Write a function $N(t)$ which gives the population after t hours.
 - (c) What is the population after 13 hours?
 - (d) When does the population contain 500 critters? You must explain how to answer this question algebraically. Do not use the **Solve** feature on your calculator.

7. Below is the graph of a function $f(x)$. Use the graph to answer the following questions.

- (a) What is $f(0)$? What is the domain of f ?
- (b) On the same axes, sketch the graph of $f(x + 2)$. Label the coordinates of the corner on the graph of $f(x + 2)$.
- (c) On the same axes, sketch the graph of $f(2x + 2)$. Label the coordinates of the corner on the graph of $f(2x + 2)$.
- (d) On the second set of axes, sketch the graph of $f^{-1}(x)$.

8. Let

$$f(x) = 2 + \frac{1}{x}.$$

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

9. (a) State the principle of mathematical induction.
(b) Prove that for $n = 1, 2, \dots$,

$$\sum_{k=1}^n (2k - 1) = n^2.$$