

AP Calculus

Mr. Konstantinidis

Summer Take Home Exam – CALCULATOR PART.

Note: Be sure to read the enclosed instructions before beginning work on this exam.

Part 1: Multiple Choice Questions WITH A CALCULATOR.

- (1) What is the range of $3 - \ln(x + 2)$?
- (A) $(-\infty, \infty)$
(B) $(-\infty, 0)$
(C) $(-2, \infty)$
(D) $(0, \infty)$
(E) $(0, 5.322)$
- (2) How many local minima does $f(x) = -2 \sin(2x - 3) - 1$ have in the interval $[0, 10]$?
- (A) 2
(B) 3
(C) 4
(D) 5
(E) 7
- (3) What is the location of the local maximum of $g(x) = x^3 - 6x^2 + 2x - 4$?
- (A) $x = 3.826$
(B) $y = -28.172$
(C) $y = -3.828$
(D) $x = 0$
(E) $x = 0.174$
- (4) At what point do the graphs of $f(x) = x^2 + 2x - 5$ and $y = 2 \cos(2x)$ intersect on the interval $[0, 2\pi]$?
- (A) $(-3.653, 1.041)$
(B) $(2.991, 3.560)$
(C) $(1.156, -1.351)$
(D) $(-1.919, 2.809)$
(E) $(3.144, 4.126)$
- (5) If you invest \$1500 in a retirement account that earns 8% interest, compounded continuously, how long will it take for you to double your money?
- (A) 2 years
(B) 4.332 years
(C) 4 years
(D) 8.664 years
(E) 8 years

(6) Use a graphing calculator to determine if the function $f(x) = 1 - \sin x$ is even, odd, or neither.

- (A) even
- (B) odd
- (C) neither
- (D) both
- (E) cannot be determined from the graph

(7) The population of Silver Run, Nevada was 6250 in the year 1890. Assuming the population increased at a rate of 2.75% per year, estimate the population in 1915.

- (A) 14207
- (B) 13118
- (C) 16115
- (D) 8992
- (E) 12429

(8) What is the result when $\ln(y - 1) - \ln 2 = x + \ln x$ is solved for y ?

- (A) $y = xe^x + 1$
- (B) $y = 2xe^x + 1$
- (C) $y = \frac{1}{2}xe^x + \frac{1}{2}$
- (D) $y = 2xe^x - 1$
- (E) $y = xe^x - 1$

(9) What is the location of the vertex of the parabola $ax^2 + bx + c$?

- (A) $(\frac{b}{2a}, \frac{ab^2 + b^2 + 2ac}{2a})$
- (B) $(-\frac{b}{2a}, \frac{-b^2 + 4ac}{4a})$
- (C) $(\frac{b}{2a}, \frac{ab^2 + b^2 + 2ac}{4a})$
- (D) $(-\frac{b}{2a}, \frac{b^2 - 4ac}{2a})$
- (E) $(\frac{b}{2a}, \frac{ab^2 + 2b^2 + 2ac}{4a})$

(10) What is the location of the point of intersection of the lines $4x + 2y = 7$ and $-3x - 3y = 11$?

- (A) $x = 7.167$
- (B) $y = -10.833$
- (C) $x = -7.167$
- (D) $x = 2.933$
- (E) $y = 10.833$

Part 2: Free Response Questions WITH A CALCULATOR. Each question is worth 9 points.

Question #1: Use the table below to answer the following questions.

Population of New York State

Year	Population (thousands)
1980	17558
1990	17991
1995	18524
1998	18756
1999	18883
2000	18977

- (A) Find the cubic regression equation for the data in the table above.
- (B) Use the regression equation to predict the population in 2003.
- (C) How close is the estimate to the actual population of 19,190,000?
- (D) Find the exponential regression equation for the data and use it to estimate the annual growth rate for the population of New York.

Question #2: The number of guppies in Joumana's aquarium doubles every day. There are four guppies initially.

(A) Give a model for the exponential growth of the guppy population.

(B) How many guppies are present after 4 days? After 1 week?

(C) When will there be 2000 guppies?

(D) Explain why this might not be a good model for the growth of the guppy population.

Question #3: This question investigates how to find the distance from the point $P : (a, b)$ to a line

$$L : Ax + By = C.$$

(A) Write an equation for the line M through point P perpendicular to L .

(B) Find the coordinates for the point Q at which M and L intersect.

(C) Find the distance from P to Q .

Question #4: Let $f(x) = 1 - 3 \cos(2x)$.

(A) What is the domain of $f(x)$?

(B) What is the range of $f(x)$?

(C) What is the period of $f(x)$?

(D) Is $f(x)$ even, odd, or neither. Justify your answer.

(E) Find all zeros of $f(x)$ in the interval $\left[\frac{\pi}{2}, 3\pi\right]$. Round all answers to 3 decimal places.

(F) Find all solutions to the equation $f(x) = g(x)$, where $g(x) = 4x^3 + 2x + 1$.

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Summer Take Home Exam – NO CALCULATOR PART.

Note: Be sure to read the enclosed instructions before beginning work on this exam.

Part 1: Multiple Choice Questions WITHOUT A CALCULATOR.

- (1) What is the domain of $f(x) = \sqrt{\frac{x^2}{x-1}}$?
- (A) $(-\infty, \infty)$
(B) $(-\infty, 1) \cup (1, \infty)$
(C) $(1, \infty)$
(D) $(-\infty, 0) \cup (0, 1) \cup (1, \infty)$
(E) $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$
- (2) If $f(x) = 2x^2 - 2x + 1$ and $g(x) = -2 - x$, what is the value of $\frac{f(2)}{g(2)}$?
- (A) 1.25
(B) -2.25
(C) -1.25
(D) 2.25
(E) 0
- (3) How many local minima does $f(x) = -\sin x$ have in the interval $[0, 4\pi]$?
- (A) 2
(B) 3
(C) 4
(D) 5
(E) 6
- (4) Find the equation of a line parallel to the line $4x + 2y = 10$ that passes through the point $(2, 5)$.
- (A) $y = 2x - 1$
(B) $y = -2x - 9$
(C) $y = -2x + 1$
(D) $y = 2x + 1$
(E) $y = -2x + 9$
- (5) Which of the following is the location of the x-intercept of the line $4x + 6y = 12$?
- (A) $x = 3$ (D) $y = 12$
(B) $y = 2$ (E) $x = 2$
(C) $x = 6$

(6) Which of the following gives the range of $f(x) = 1 + \frac{1}{x-1}$?

(A) $(-\infty, 1) \cup (1, \infty)$

(B) $x \neq 1$

(C) $(-\infty, \infty)$

(D) $(-\infty, 0) \cup (0, \infty)$

(E) $x \neq 0$

(7) Which of the following is a solution of the equation $2 - 3^{-x} = -1$?

(A) $x = -2$

(B) $x = -1$

(C) $x = 0$

(D) $x = 1$

(E) This equation has no solutions.

(8) Which of the following is the inverse of $f(x) = 3x - 2$?

(A) $g(x) = \frac{1}{3x-2}$

(B) $g(x) = x$

(C) $g(x) = 3x - 2$

(D) $g(x) = \frac{x-2}{3}$

(E) $g(x) = \frac{x+2}{3}$

(9) The length L of a rectangle is twice as long as its width W . Which of the following gives the area A of the rectangle as a function of its width?

(A) $A(W) = 3W$

(B) $A(W) = \frac{1}{2}W^2$

(C) $A(W) = 2W^2$

(D) $A(W) = W^2 + 2W$

(E) $A(W) = W^2 - 2W$

(10) A certain mutual fund returns a interest rate of 6.24%, compounded continuously. Which of the following is a model for the value v of this mutual fund with initial investment A invested for t years?

(A) $v(t) = Ae^{6.24t}$

(B) $v(t) = A6.24^t$

(C) $v(t) = Ae^{.0624t}$

(D) $v(t) = A(.0624)^t$

(E) $v(t) = 6.24At$

Part 2: Free Response Questions WITHOUT A CALCULATOR. Each question is worth 9 points.

Question #1: Consider the point $P(-2, 1)$ and the line $L: x + y = 2$.

(A) Find the slope of the line L .

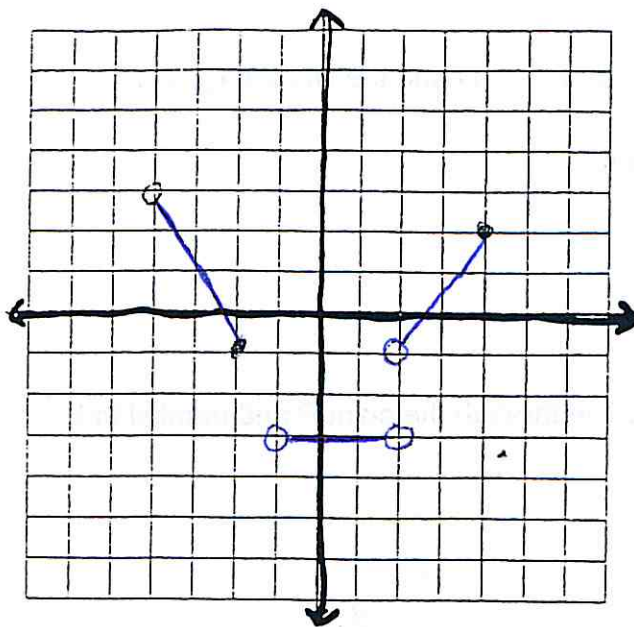
(B) Write an equation for the line through the point P and parallel to L .

(C) Write an equation for the line through the point P and perpendicular to L .

(D) What is the x -intercept of the line L ?

(E) Consider the line $M: 4x - 2y = 11$. At what point do the lines L and M intersect?

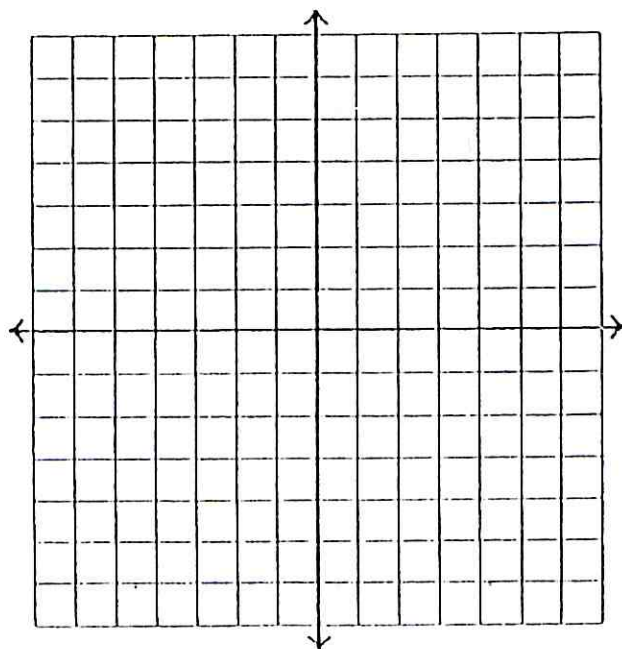
Question #2: Use the piecewise graph shown below to answer the following questions.



- (A) What is the explicit formula for this function, $f(x)$?
- (B) What is the domain of $f(x)$?
- (C) What is the range of $f(x)$?
- (D) What is the absolute minimum value of $f(x)$? The absolute maximum value?

Question #3: Consider the function $f(x) = x^2 + 3x - 4$.

- (A) What is the equation of the line of symmetry of this parabola?
- (B) What is the location of the vertex of this parabola?
- (C) What is the location of the y-intercept of this parabola?
- (D) What are the locations of the x-intercepts of this parabola?
- (E) On the axes below, sketch the graph of this parabola, making note of any significant points.



Question #4: Parallel and perpendicular lines.

(A) For what value of k are the two lines $2x + ky = 3$ and $x + y = 1$ parallel?

(B) For what value of k are the two lines $2x + ky = 3$ and $x + y = 1$ perpendicular?

(C) Explain why c and d are the x-intercept and y-intercept of the line $\frac{x}{c} + \frac{y}{d} = 1$.