FINAL EXAMINATION

Student's Name: _____ **Total Marks:** ____ /100 **Total Value of Exam**: 30% **Number of pages:** 8	**Teacher:** Mr. Papini **Course:** MHF4U **Room:** N/A (Online) **Time:** 7:00pm – 10:00pm **Date:** Tuesday, June 29, 2021

EXAM RULES

1. Talking to other students during the exam can result in a '0'.
2. Dictionaries are not allowed.
3. Electronic devices or other aids, such as laptops, notes, cell phones, are not allowed during the exam.
4. Read all the exam questions carefully. Only answer what is asked.
5. Your writing should be organized and legible.
6. If you have a question about the exam, raise your hand quietly.
7. Only scientific calculators are to be used, but sharing is not allowed.
8. Leave all answers in exact form where possible, unless stated otherwise.

Final Exam Break Down

	Achievement Chart Category	
K	Knowledge & Understanding	/30
A	Application	/30
T	Thinking & Inquiry	/20
C	Communication	/20

1. Identify the intervals of increase/decrease, the symmetry, and the domain and range of each function. [K – 10]

a) $-x^2 - 4$

b) $-4^x + 3$

2. Given f = {(2, 8), (3, 5), (6, 9), (7, 10)} and g = {(1, 4), (3, 6), (4, 5), (6, 10), (10, 11)}, determine the following: [K – 4]

a) f – g

b) f x g

3. The volume of a balloon is expanding. Consider the following table of data. [A – 4]

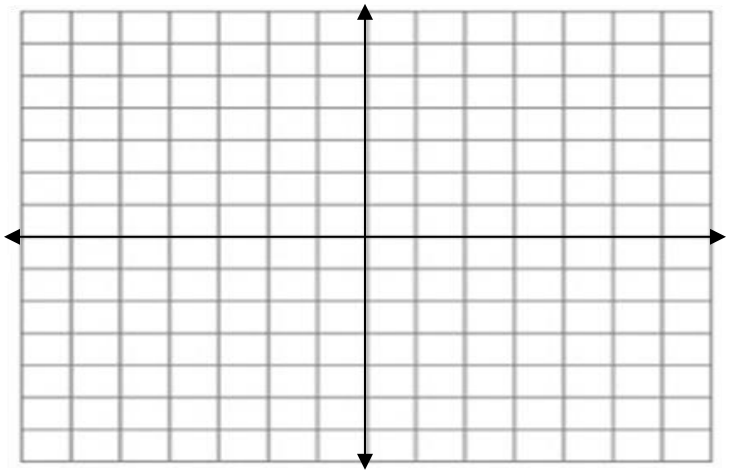
Time, t (s)	1	2	3	4	5	6	7	8	9
Volume, V (cm^3)	6.4	38.0	59.9	89.2	126.9	172.0	227.5	280.3	352.1

a) Use a preceding interval and a following interval separately to determine an estimate of the instantaneous rate of change at $t = 7$ s, then average your results.

b) Use the centred interval method to determine the instantaneous rate of change at $t = 7$ s.

4. For the function $f(x) = -x^3 + 48x + 2$, verify that the point (4, 130) is a turning a point of the function. State whether it is a local maximum or local minimum and how you know. [K – 5]

5. State the degree of the function $g(x) = -(x-4)^2(x)(x+3)^3(x-2)$ and then sketch a possible graph of it. [K – 4]



6. Fully factor the expression $128x^3 + 250$ [K – 4]

7. Solve the inequality $-x^2 - x + 12 \leq 0$ algebraically using an interval chart and also sketch a graph of the function to verify your solution. [T – 5]

8. Solve the equation $-5x^5 + 6x^4 = 0$ [K – 3]

9. Consider the continuous rational function $f(x) = \frac{4x^2-5}{x^2+6}$. State the following characteristics of the function and sketch a graph of it. [C – 6]

Horizontal Asymptote:	x-intercepts: y-intercept:

10. The equation $f(t) = \frac{7t}{t^2-7t+12}$ models the bacteria count, in thousands, for a sample of tap water that is left to sit over time, t, in days. The function $g(t) = \frac{17t}{t^2+11}$ models the bacteria count, in thousands, for a sample of pond water that is also left to sit over several days. Will the bacteria count for the tap water ever exceed the bacteria count for the pond water? Algebraically justify your answer by solving a rational inequality using an interval chart. [A – 10]

11. The point (–14, 7) is on the terminal arm of angle θ in standard position. [C – 7]

a) Find the three primary trigonometric ratios for θ.

b) Find θ in: (i) degrees, to the nearest degree.

(ii) radians, to the nearest hundredth.

12. The position of a particle as it moves horizontally is described by the equation s(t) = $34sin\frac{\pi t}{211} + 37$, where s is the displacement, in metres, and t is the time, in seconds. [A – 4]

a) Calculate the average rate of change of s(t) over the interval 21 s to 32 s.

b) Calculate the instantaneous rate of change of s(t) at t = 7 s.

13. If $cosx = \frac{5}{6}$, and x is an acute angle, determine the values of sin2x, cos2x and tan2x by first finding the other 2 primary trigonometric ratios and then using the double angle formulas. [C – 7]

14. Solve the quadratic trigonometric equation $4\cos^2 x + 9\cos x - 9 = 0$ on the interval $0 \leq x \leq 4\pi$. [A – 8]

15. How long does it take $360 to triple if it is invested in an account that pays 13% interest annually and is compounded monthly? [A – 4]

16. The number of deer in a forest as a function of the number of weeks that have passed can be modelled by the logistic function $D(t) = \frac{600}{1+599(0.7)^t}$. About how many weeks will have passed when there are 33 deer in the forest? [T – 3]

17. Find the pH for a substance with a hydrogen ion concentration of 7.4×10^{-6} mol/L. Is this substance an acid or a base? [T – 2]

18. Solve the following exponential and logarithmic equations using appropriate techniques. [T – 10]

a) $5^{x-3} = 6^{x}$

b) $5^{2x} - 5^{x} = 30$

c) $\log_7 x = 3\log_7 9 - \log_7 9$

d) $\log(x - 4) + \log(4x + 3) = 1$