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YEAR 1 FINAL EXAM

Part 1 (21 points total):

Kim and Kanye are each starting their own college fund for their three year old daughter North.

Kanye pledges to deposit $10,000 into the fund this year, $12,000 next year, $14,000 the following year *and continue this pattern* until North turns 18.

Kim puts in $10 in to an account this year and promises to deposit *twice as much as she did the previous year* from now until North is 18.

Each parent will end up making 15 total deposits to North's college fund. In the end the funds will be combined and North will be able to go to any University she chooses (assuming she can get in).

1) Using your knowledge of sequences fill in the table below to allow us to better understand North's college savings. Show your work in the space below. (8)

Parent	Function to model the amount deposited during the n^{th} year.	Function to model the total amount in each account after t years.
Kanye West	$W(n) =$	$A_W(t) =$
Kim Kardashian	$K(n) =$	$A_K(t) =$

2) What is *W(10) + K(10)*? What does the answer represent? (2)

3) At first North is mad at her mom for being a cheapskate. Why does she think that? Is she right or wrong? Justify your answer with mathematical evidence. (6)

4) How much money will North have for college when she withdraws everything from both of her parents' funds? Is this a reasonable amount? Justify your answer with mathematical evidence. Use formulas to save time! (4)

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Part 2 (22 points total):

Mr. Tran has built the perfect paper airplane. *He and Mr. Goza are standing on the grate above his classroom window, 20 feet off the ground.* Because the airplane creates air resistance gravity doesn't have its usual effect. As a result, once Mr. Tran throws the plane it's height can be modeled by the function $h(t) = -2t^2 + 12t + 20$ where t is the time, in seconds, since the plane was thrown.

Meanwhile, Mr. Goza has a model helicopter. His goal is to try to keep the helicopter at the same height as the paper airplane as it flies toward the parking lot. When Mr. Tran throws the plane, Mr. Goza flies the helicopter upward at a rate of 8 feet per second for two seconds. Then he keeps the helicopter at a constant height for 3 seconds, then flies it downward at a rate of 12 feet per second. Unfortunately he forgets to slow the helicopter down and it crash lands.

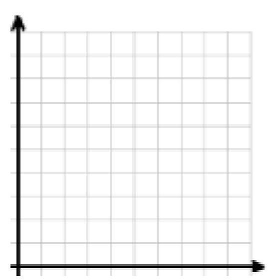
1) What is the maximum height reached by Mr. Tran's airplane? How did you find this answer? (2)

2) Assume $g(t)$ represents the height of the Goza's helicopter after t seconds. Then $G(0) = 20$. Explain what that means, and how it matches the scenario. (2)

3) Which lands first, Goza's helicopter or Tran's airplane? Provide mathematical justification for you answer. (You need to find the landing time of Tran's plane for full credit.) (3)

4) What is the maximum value of g? What does this value tell us? (2)

5) Graph h and g on the same plane below. (6)



6) Write an equation for $g(t)$. (Hint: There are 3 pieces) (4)

7) A which time(s) are the plane and the helicopter at the same height? Justify your answer(s). (3)

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Part 3 (16 points total):

Mr. Tran and Mr. Goza just sold their curriculum for $1,000,000! Unfortunately, they don't know how to manage their money very well. The amount of prize money left **decreases exponentially at a rate of 40%** each week due to their uncontrollable urge to live the fast life.

1) How much money will they have a 4 weeks from now? (2)

2) Write an equation for $R(w)$ the amount of money Mr. Tran and Mr. Goza will have remaining after w weeks of "wasting" it. (2)

3) When will they have less than $100 of the curriculum money left? (Hint: Use Logs!) (2)

4) Explain in words or show mathematical evidence that Tran and Goza spend $400,000 the first week after they win the money. (2)

5) The amount of money they spent weekly matches a geometric sequence. List the first three terms of that sequence and write an equation for $S(n)$ that gives the n[th] term of that sequence. (2)

6) Write an equation $T(w)$ to model the total amount of money Tran and Goza have spent w weeks after they sell the curriculum. (2)

7) Evaluate $T(5)$. What does this answer represent? (2)

8) What is the upper limit of the function T. Explain why this makes sense in terms of the scenario. (2)

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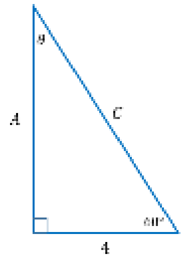
YEAR 2 FINAL EXAM

1) Calculate the lengths of the two missing sides and the measurement of the missing angle.

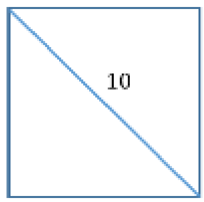


$A =$_________

$C =$_________

$\theta =$_________

2) Calculate the area of the square below:



3) Evaluate each:

a) $\sin\frac{\pi}{2} =$ b) $\cos\frac{\pi}{3} =$ c) $\sin 120°$

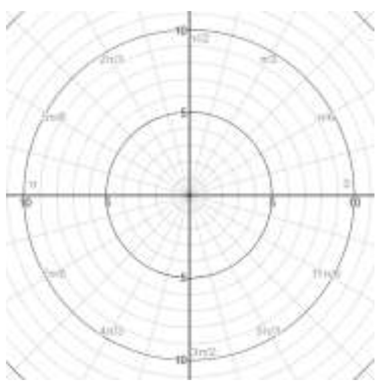
d) $\tan\frac{3\pi}{4}$ e) $\cos\frac{11\pi}{6}$ f) $\sec 225°$

4) Evaluate each. Consider coterminal angles between $[0, 2\pi]$.

a) $\sin\frac{7\pi}{2}$ b) $\cos -150°$ c) $\tan\frac{19\pi}{3}$

5) On the polar plane below, ***plot and label*** the following polar coordinates:

A: $\left(5, \frac{\pi}{4}\right)$ B: $\left(10, \frac{3\pi}{2}\right)$ C: $\left(2, \frac{5\pi}{4}\right)$ D: $(-4, \pi)$



6) What are the rectangular coordinates of the polar coordinates $\left(5, \frac{2\pi}{3}\right)$?

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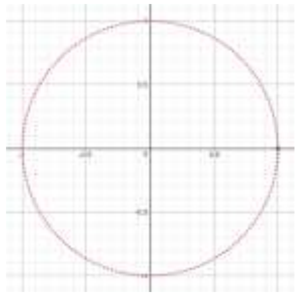
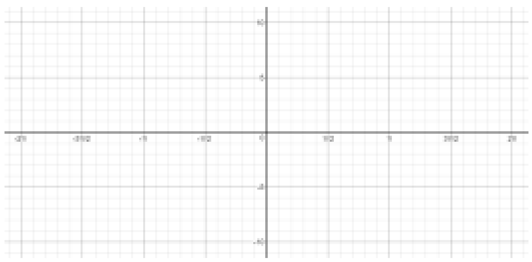
7) The Unit Circle is shown below. On the circle, plot a point that you think is on the terminal side of a 2.5 radian angle (in standard position). In the space next to the graph, explain why you placed you point where you did.

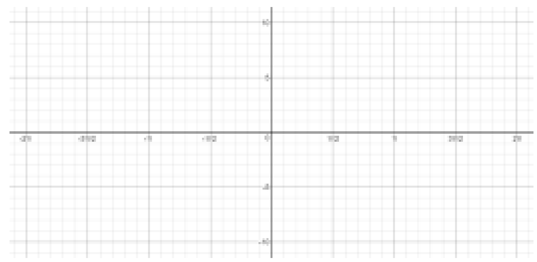


8) Graph two periods of each function:

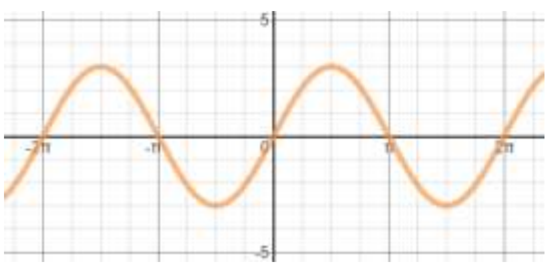
a) $h(x) = 5\cos(x) + 4$

b) $f(\theta) = -\sin(2\theta)$



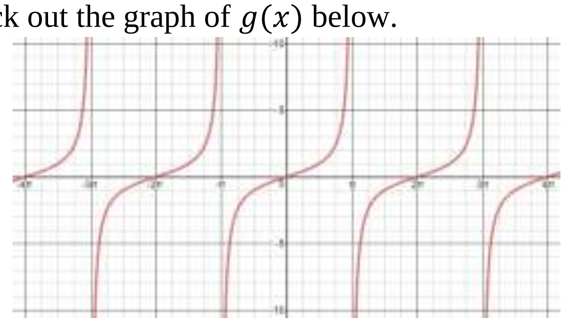


9) Write an equation to match the graph $y = b(x)$ below.



$b(x) =$_______________

10) Check out the graph of $g(x)$ below.



Circle the equation that matches the graph and explain your choice.

$g(x) = \tan x$

$g(x) = \tan(2x)$

$g(x) = \tan\left(\frac{x}{2}\right)$

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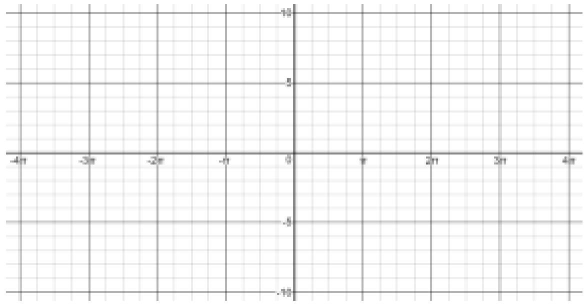
11) On the plane below sketch the graph of $|g(x)|$ assuming g is the function graphed in #10.



Consider the fifth degree polynomial function $\boldsymbol{g(x) = 4(x^3 - 125)(x^2 - 7x + 10)}$.

12) Find all five complex roots of $g(x)$. Use $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$. Include the multiplicity of each root.

13) Calculate the $y - intercept$ of the graph of $y = g(x)$. Show your work!

14) Use your answers from Part b and Part c to complete a sign chart for g.

15) The rational function $Q(x) = \frac{g(x)}{2x^5}$ has a horizontal asymptote of $y =$______ and a vertical asymptote of $x =$ ______.

16) True or False: $Q(x)$ does not have any point discontinuities. ***Explain.***

Consider the functions $\boldsymbol{m(x) = \frac{2x^2+3x+1}{x+2}}$ and $\boldsymbol{n(x) = \frac{2x^2-8}{x-2}}$.

17) Evaluate each:

a) $\lim_{x \to 2} m(x) =$ b) $\lim_{x \to 2} n(x) =$ c) $\lim_{x \to \infty} \frac{m(x)}{n(x)} =$

18) The graph of $y = m(x)$ has one vertical asymptote and one slant asymptote. Write the equation for each. (Hint: Use division for the slant asymptote.)

19) Identify the roots of …

a) $m(x)$ b) $n(x)$

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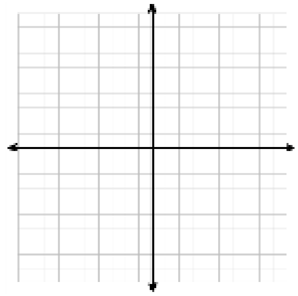
20) The graph of $y = n(x)$ has one discontinuity. Identify the location of this discontinuity and state which type of discontinuity it is.

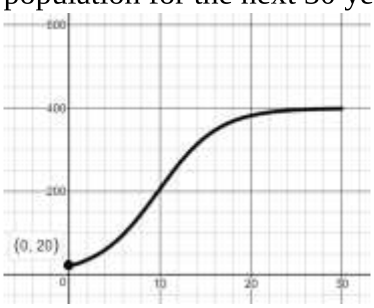
21) Use all the information you have gathered about g to sketch a graph of $y = m(x)$ below.



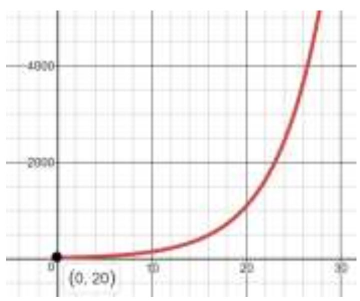
22) Say $S(x) = m(x) + n(x)$.

a) What is the $y - intercept$ of S? b) Evaluate $S(4)$.

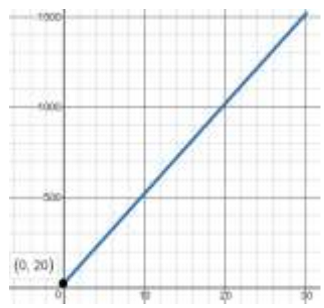
A population of 20 foxes are introduced into a small forest ecosystem where they are expected to flourish. The three graphs below are possible could be used to predict the fox population for the next 30 years.



$F_1(t)$



$F_2(t)$



$F_3(t)$

23) Circle the name of the function you think does the best job of predicting the fox population over the next 30 years and explain your choice below.

24) Circle one: $F_1(t)$ is a

Logarithmic Function Logistic Function Exponential Function

25) Look at the graph of $F_1(t)$.

a) What is the domain? Explain what this means in terms of the scenario.

b) What is the range? Explain what this means in terms of the scenario.

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Liem'nNate Pathway to Calculus Curriculum

Year 1: Algebra 1

0) Numbers (Origins and Number Sense)
1) Sets, Functions & Relations
2) Linear Expressions & Functions (growing by a constant amount)
3) Arithmetic Sequences & Series
4) Exponential Expressions & Functions (growing by a constant factor)
5) Geometric Sequences & Series
6) Bridge to Quadratics (Arithmetic Series) & Quadratic Functions
7) Intro to Statistics
8) Equations & Inequalities (including Absolute Value) &Systems

Year 2: Honors Advanced Math

0) Numbers (Rational, Radical, and Complex)
1) The 12 Basic Functions, Characteristics, Varieties
2) Transformations
3) Operations on Functions (including Inverses and Composition)
4) Polynomials and Polynomial Functions
5) Rational Functions (including some limits)
6) Trigonometry
7) Trigonometric Functions
8) More on Limits and Continuity