ALGEBRA

II

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA II

Thursday, January 22, 2026 — 1:15 to 4:15 p.m., only

Student Name Mr. Sibol

School Name JMAP

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Print your name and the name of your school on the lines above.

A separate answer sheet for **Part I** has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 37 questions. You must answer all questions in this examination. Record your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in **Parts II, III,** and **IV** directly in this booklet. All work should be written in pen, except graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale.

The formulas that you may need to answer some questions in this examination are found at the end of the examination. This sheet is perforated so you may remove it from this booklet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A perforated sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will not be scored.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice ...

A graphing calculator and a straightedge (ruler) must be available for you to use while taking this examination.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers on your separate answer sheet. [48]

Use this space for computations.

1 The value of t in the equation $27^{6-t} = 9^{t-1}$ is

(1) $\frac{7}{2}$

(2) $\frac{19}{5}$

(3) 8

(4) 4

$(3^3)^{6-t} = (3^2)^{t-1}$

$18 - 3t = 2t - 2$

$20 = 5t$

$4 = t$

2 Which expression is equivalent to $(x-4)^2 - 5(x-4) + 6$?

(1) $(x-2)(x-1)$

(2) $(x+2)(x-3)$

(3) $(x-10)(x-5)$

(4) $(x-6)(x-7)$

$u = x - 4$

$u^2 - 5u + 6$

$(u-3)(u-2)$

$(x-4-3)(x-4-2)$

$(x-7)(x-6)$

Use this space for computations.

3 Researchers wanted to determine if listening to classical music can reduce math anxiety. They divided 100 students randomly into two groups and put them in identical rooms. Both groups completed a math test and a survey rating their level of math anxiety. One group then listened to classical music for 10 minutes while the other group sat quietly. Both groups then took another math test, rated their level of math anxiety, and the researchers compared their results. Is this an observational study or an experiment?

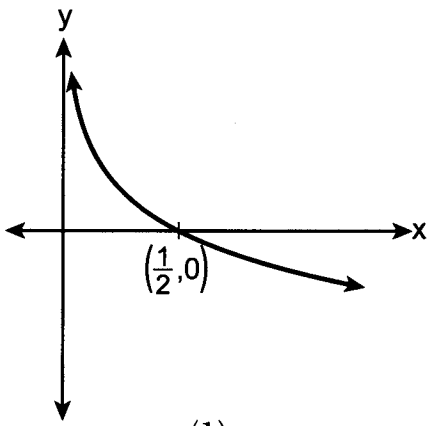
(1) It is an observational study because the participants completed a survey about math anxiety.

(2) It is an observational study because the researchers watched the participants take math tests.

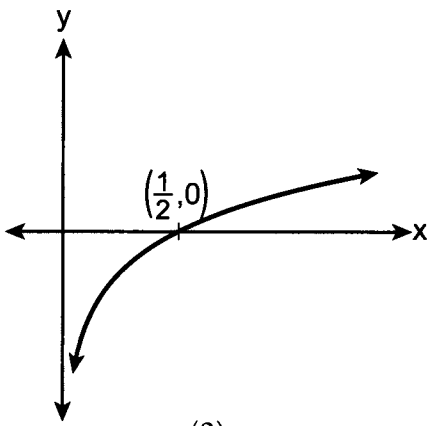
(3) It is an experiment because one group was randomly assigned to listen to classical music while the other group was not.

(4) It is an experiment because the participants took a math test.

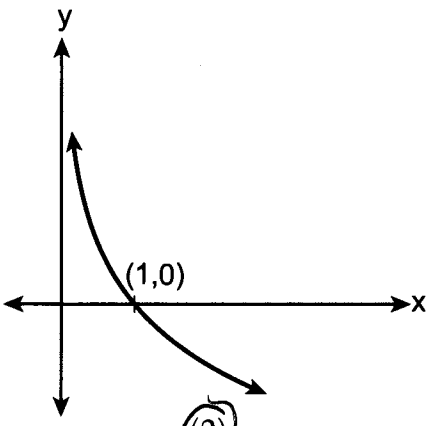
4 Which graph represents the function $y = \log_{\frac{1}{2}}(x)$?



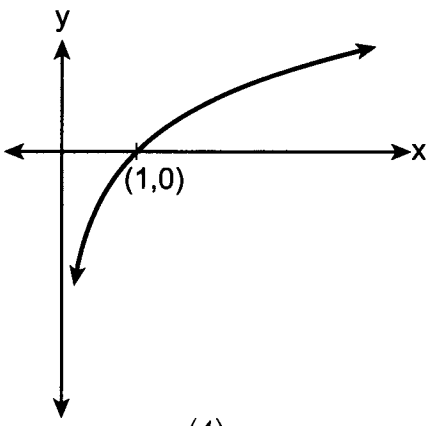
(1)



(3)



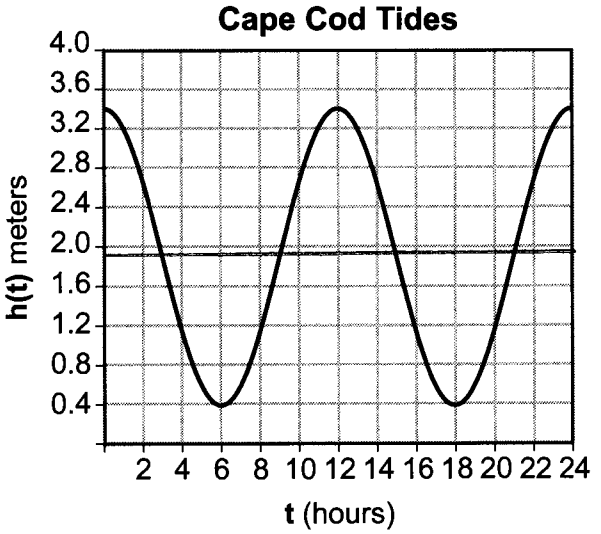
(2)



(4)

Use this space for computations.

5 The height of the water at Cape Cod, Massachusetts, is shown on the graph below.



1.9

If the height of the water, $h(t)$, is measured in meters and time, t, is measured in hours since high tide, what is an equation for the height of the water?

(1) $h(t) = 1.9\cos\left(\frac{\pi}{6}t\right) + 1.5$ (3) $h(t) = 1.9\cos\left(\frac{\pi}{12}t\right) + 1.5$

(2) $h(t) = 1.5\cos\left(\frac{\pi}{6}t\right) + 1.9$ (4) $h(t) = 1.5\cos\left(\frac{\pi}{12}t\right) + 1.9$

$12 = \frac{2\pi}{b}$

$b = \frac{\pi}{6}$

6 The solutions to $3x^2 - 4x + 2 = 0$ are

(1) $x = \frac{2}{3} \pm \frac{\sqrt{2}}{3}i$ (3) $x = \frac{2}{3} \pm \frac{\sqrt{2}}{3}$

(2) $x = \frac{2}{3} \pm \frac{\sqrt{10}}{3}$ (4) $x = \frac{2}{3} \pm \frac{\sqrt{10}}{3}i$

$x = \frac{4 \pm \sqrt{(-4)^2 - 4(3)(2)}}{2(3)}$

$= \frac{4 \pm \sqrt{16 - 24}}{6}$

$= \frac{4 \pm \sqrt{-8}}{6}$

$= \frac{4 \pm 2i\sqrt{2}}{6}$

$\sqrt{3}/2$

Use this space for computations.

7 The value of $\sin\left(\frac{2\pi}{3}\right)$ is equivalent to

(1) $\sin\left(\frac{4\pi}{3}\right)$ $-\frac{\sqrt{3}}{2}$

(2) $\cos\left(\frac{\pi}{6}\right)$ $\frac{\sqrt{3}}{2}$

(3) $\tan\left(\frac{\pi}{3}\right)$ $\sqrt{3}$

(4) $\csc\left(\frac{2\pi}{3}\right)$ $\frac{2\sqrt{3}}{3}$

8 Given $f^{-1}(x) = \sqrt[3]{4x + 1}$, which function represents $f(x)$?

(1) $f(x) = \sqrt[3]{\frac{1}{4}x - 1}$

(2) $f(x) = (4x + 1)^3$

(3) $f(x) = \frac{1}{4}(x^3 - 1)$

(4) $f(x) = \frac{x^3}{4} - 1$

$x = \sqrt[3]{4y+1}$

$x^3 = 4y+1$

$\frac{x^3-1}{4} = \frac{4y}{4}$

9 In order for a school to purchase graduation gowns, the heights of all of the high school seniors are recorded. The heights are approximately normally distributed with a mean of 64.7 inches and a standard deviation of 4.267 inches. If a senior is selected at random, what is the probability that this student has a height that falls between 65 and 68 inches?

(1) 0.085

(2) 0.177

(3) 0.252

(4) 0.271

Use this space for computations.

10 Consider the system of equations below.

$$(x + 1)^2 + (y - 4)^2 = 9$$
$$x = 2$$

The x-value and y-value of the solution of the system are

(1) one rational and one imaginary

(2) both rational

(3) one rational and one irrational

(4) both irrational

$(2+1)^2 + (y-4)^2 = 9$

$9 + (y-4)^2 = 9$

$(y-4)^2 = 0$

$y - 4 = 0$

$y = 4$

$(2, 4)$

11 Which expressions are equivalent to $36x^4 - 9x^2$?

I. $x^2(6x + 3)(6x - 3)$

II. $36\left(x^2 - \frac{1}{2}\right)\left(x^2 + \frac{1}{2}\right)$

III. $9(2x^2 + x)(2x^2 - x)$

IV. $36x^2\left(x - \frac{1}{2}\right)\left(x + \frac{1}{2}\right)$

(1) I and II, only

(2) I and III, only

(3) I, II, and III, only

(4) I, III, and IV, only

I $36x^4 - 9x^2 = x^2(36x^2 - 9) = x^2(6x+3)(6x-3)$

II $36x^4 - 9x^2 = 36\left(x^4 - \frac{x^2}{4}\right) = 36\left(x^2 + \frac{x}{2}\right)\left(x^2 - \frac{x}{2}\right)$

III $36x^4 - 9x^2 = 9(4x^4 - x^2) = 9(2x^2 + x)(2x^2 - x)$

IV $36x^4 - 9x^2 = 36x^2\left(x^2 - \frac{1}{4}\right) = 36x^2\left(x + \frac{1}{2}\right)\left(x - \frac{1}{2}\right)$

12 A deposit of \$1250 is made into a savings account that earns 1.86% annual interest. The amount in this account at any time, t, in years, is modeled by $A(t) = 1250(1.0186)^t$. Which expression best models the equivalent monthly growth of the account?

(1) $1250(0.001550)^t$

(2) $1250(0.001550)^{\frac{t}{12}}$

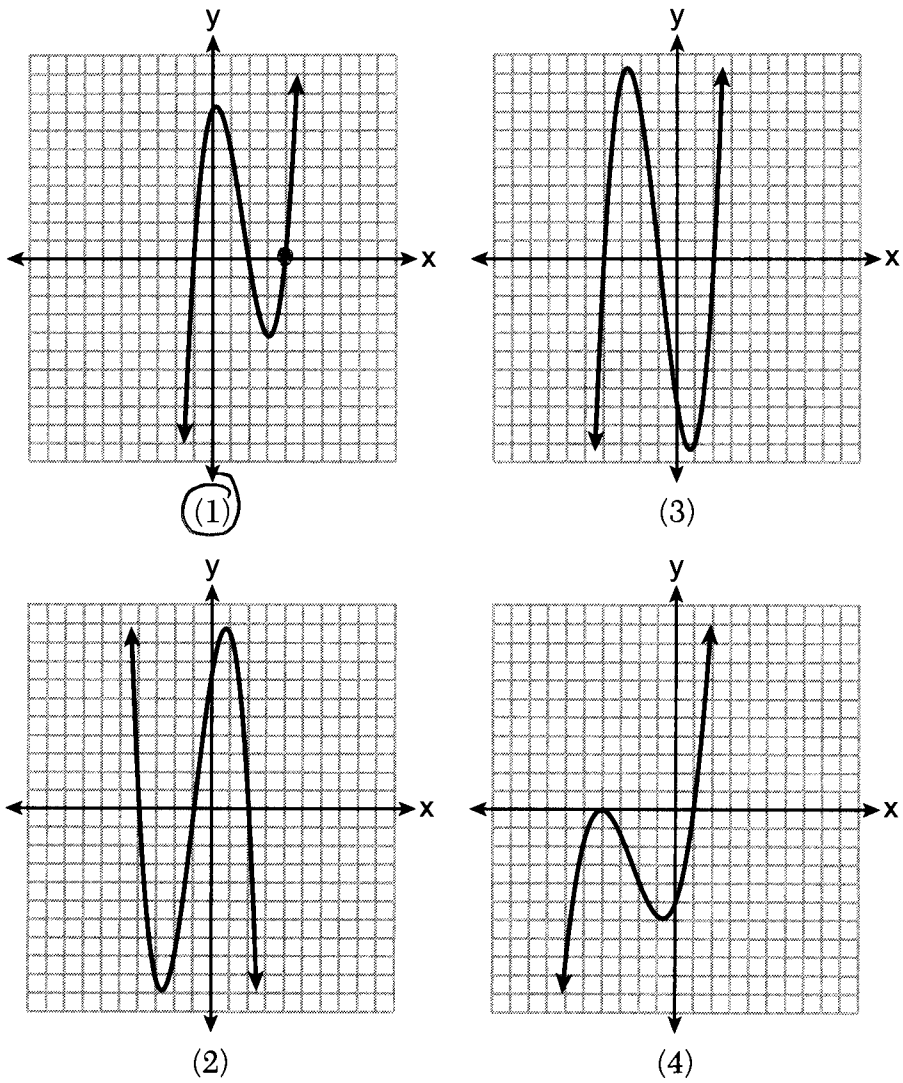
(3) $1250(1.001537)^{12t}$

(4) $1250(1.001537)^{\frac{t}{12}}$

$1.0186^{\frac{t}{12}} \approx 1.001537$

Use this space for computations.

13 Which graph represents a function that has a remainder of zero when divided by $(x - 4)$?



14 Given $a > 0$, which expression is equivalent to $\frac{\sqrt[3]{a} \cdot \sqrt[5]{a^2}}{\sqrt{a}}$?

(1) $a^{\frac{2}{13}}$

(2) $a^{\frac{7}{30}}$

(3) $a^{\frac{4}{15}}$

(4) $a^{\frac{7}{3}}$

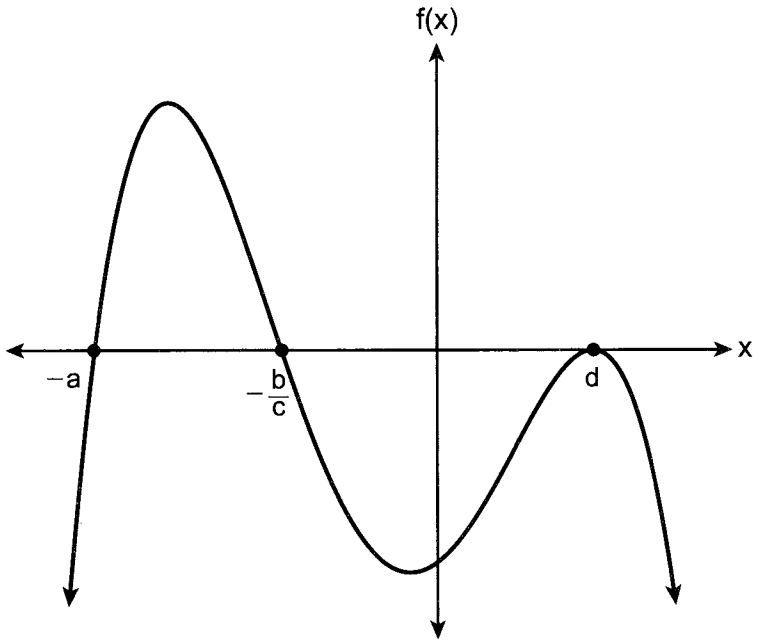
$\frac{a^{\frac{1}{3}} \cdot a^{\frac{2}{5}}}{a^{\frac{1}{2}}}$

$\frac{a^{\frac{10}{30}} \cdot a^{\frac{12}{30}}}{a^{\frac{15}{30}}}$

$a^{\frac{7}{30}}$

Use this space for computations.

15 Which function could represent the sketch below, where a, b, c, and d are all greater than zero?



(1) $f(x) = -(x + a)(cx + b)(x - d)^2$

(2) $f(x) = -(x + a)(bx + c)(2x - d)$

(3) $f(x) = -(x - a)(cx - b)(x + d)^2$

(4) $f(x) = -(x - a)(bx - c)(2x + d)$

16 Before leaving for summer vacation, 447 students at a high school were asked whether or not they had a job for the summer. The results of the survey, broken down by the students' averages, are shown in the table below.

	Below 70%	70%–79%	80%–89%	90%–100%
Has a Job	35	73	78	52
Does Not Have a Job	42	62	70	35

The probability that a student has a job, given that the student's average is between 90% and 100%, rounded to the *nearest hundredth*, is

(1) 0.11

(2) 0.12

(3) 0.59

(4) 0.60

$\frac{52}{52+35} \approx .60$

17 The expression $\frac{3x^3 - 4x^2 - 17x + 6}{3x - 1}$, where $x \neq \frac{1}{3}$, is equivalent to

(1) $(x + 3)(x - 2)$

(2) $(x - 3)(x + 2)$

(3) $(x - 3)(x - 2)$

(4) $x^2 - x - 6 + \frac{12}{3x - 1}$

Use this space for computations.

$x^2 - x - 6$

$3x-1 \overline{)3x^3 - 4x^2 - 17x + 6}$

$3x^3 - x^2$

$-3x^2 - 17x$

$-3x^2 + x$

$-18x + 6$

$-18x + 6$

18 Three students put their first steps to solve the equation $x^2 - 4x = 9$ on the board at school.

Max	Gus	Rosie
$\sqrt{x^2 - 4x} = \sqrt{9}$	$x^2 - 4x$ ___ $= 9$ ___	$x(x - 4) = 9$
$x - 2x = 3$	$x^2 - 4x + 4 = 9 + 4$	$x = 9 \quad x - 4 = 9$

Correct steps are shown for

(1) Max, only

(2) Gus, only

(3) Max and Rosie, only

(4) Gus and Rosie, only

19 The average depreciation rate of a laptop is approximately 33.3% each year. If Garrett purchased a new laptop for \$700, which recursive formula represents the value of his laptop n years after it was purchased?

(1) $a_0 = 700$
$a_n = a_{n-1}(0.667)$

(2) $a_0 = 700$
$a_n = a_{n-1}(0.333)$

(3) $a_n = 700(0.667)^{n-1}$

(4) $a_n = 700(0.333)^{n-1}$

20 Given that the directrix of a parabola is $y = 7$ and its focus is 6 units vertically away from it, the vertex of this parabola could be the point

(1) (5,13)
(3) (3,10)
(2) (2,1)
(4) (4,6)

Use this space for computations.

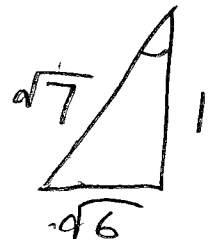
$y = 7 + \frac{1}{2}(6) = 10$

21 How many values of x satisfy the equation $\frac{x}{x-1} = -|2x - 3| + 5$?

(1) 1
(3) 3
(2) 2
(4) 0

22 The tangent of an angle in standard position that terminates in Quadrant II is $-\sqrt{6}$. What is the cosine of this angle?

(1) $\frac{1}{\sqrt{6}}$
(3) $-\frac{1}{37}$
(2) $-\sqrt{7}$
(4) $-\frac{1}{\sqrt{7}}$



23 Miranda joins a gym and pays an annual membership of \$400. Due to rising costs, the gym operator has told her the membership will increase 8% each year after the first year. How much will Miranda have paid in total, to the *nearest dollar*, if she is a member for 6 years?

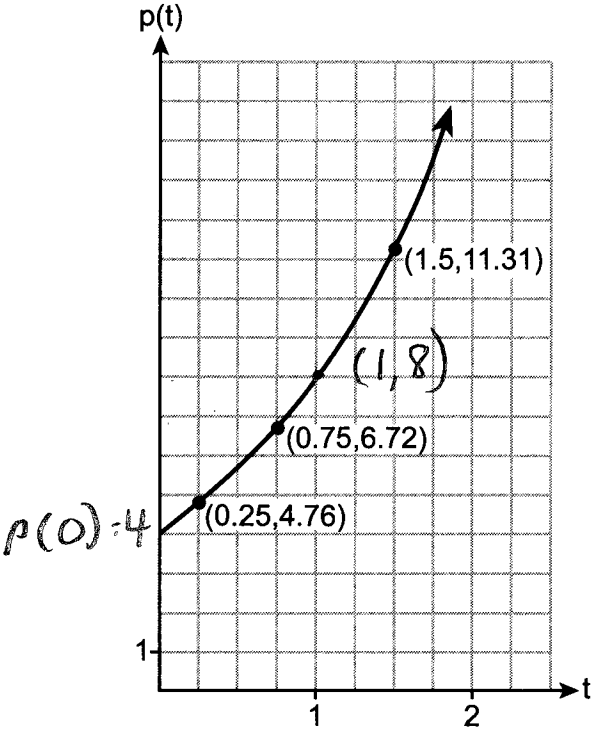
Use this space for computations.

(1) 635
(3) 2934
(2) 2592
(4) 4320

$S_6 = \frac{400(1-1.08^6)}{1-1.08}$

≈ 2934

24 Ms. Miles observed slides of bacteria under a microscope. She found that over a specific amount of time, t, in hours, the population was growing. She graphed the results of the population, $p(t)$, in thousands, of the bacteria over time on the graph below.



$p(t) = 4(2^t)$

Assuming exponential growth, which statement is true?

(1) The population can be modeled by $p(t) = 2(4)^t$. $p(0) = 2$
(2) The population can be modeled by $p(t) = 3.92t + 3.78$. linear
(3) The population approximately doubled every hour.
(4) The population approximately doubled every half hour.

Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25 The number of people at a concert t hours after the doors open can be modeled by the equation $B(t) = 250(1.8)^t$. Determine how much time, to the *nearest hundredth of an hour*, must pass before the number of people reaches 2000.

$2000 = 250 \cdot 1.8^t$

$\log 8 = \log 1.8^t$

$\log 8 = t \cdot \log 1.8$

$\frac{\log 8}{\log 1.8} = t$

$3.54 \approx t$

26 On a day in June 2017 on Staten Island, the function $T(h) = 8\sin\left(\frac{\pi}{12}h\right) + 82$ was used to model the temperature, T, in degrees Fahrenheit, h hours after 9 a.m.

State the value of $T(6)$ and explain its meaning in this context.

The temperature at 3pm is 90°

27 Use properties of exponents to show why $(-64)^{\frac{2}{3}} = 16$.

Justify your answer.

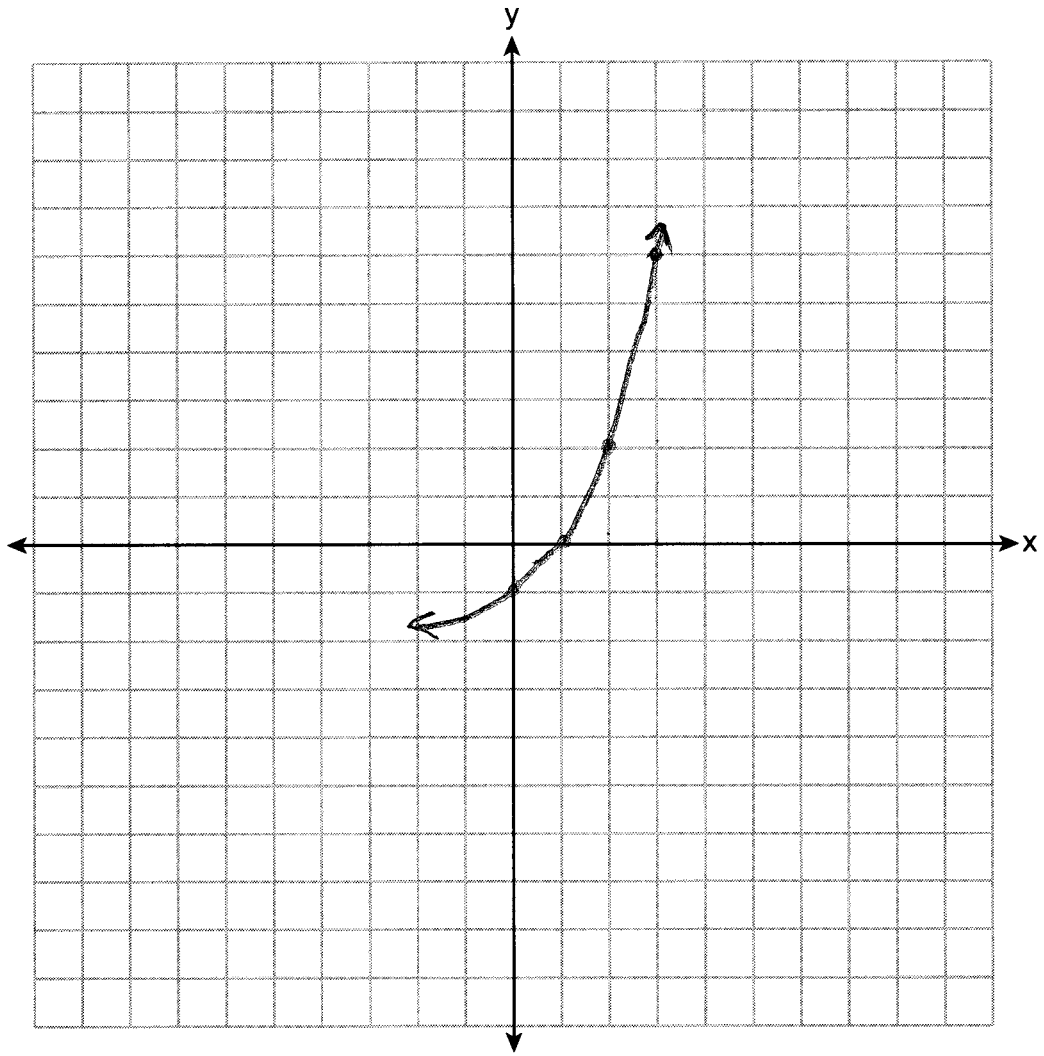
$(-64)^{\frac{2}{3}} = 16$

$((-64)^{\frac{1}{3}})^2 = 16$

$(-4)^2 = 16$

$16 = 16$

28 Graph $y = 2^x - 2$ on the axes below.



State the equation of the asymptote.

$y = -2$

29 In a survey of students at a large high school, 58% speak English fluently, 24% speak Mandarin fluently, and 16% speak English and Mandarin fluently. Determine the percentage of students at the school who speak English or Mandarin fluently.

58% + 24% - 16% = 66%

30 The following table represents the number of years after 1980, x, and the median value of a home in the United States in thousands of dollars, y.

x	1	10	20	30	40
y	59.07	97.02	131.6	180.7	269.2

Based on these data, write an exponential regression equation to model the median home value, in thousands of dollars, x years after 1980. Round all coefficients to the *nearest hundredth*.

$y = 61.14(1.04)^x$

31 Solve algebraically for all values of x that satisfy the equation below.

$$\frac{24}{x^2+4x}+\frac{x}{x+4}=\frac{5}{x}$$

$\frac{24}{x^2+4x} + \frac{x^2}{x(x+4)} = \frac{5(x+4)}{x(x+4)}$

$24 + x^2 = 5x + 20$

$x^2 - 5x + 4 = 0$

$(x-4)(x-1) = 0$

$x = 4, 1$

32 Express $i(x + i) - (x - i)^2$ in simplest $a + bi$ form.

$ix + i^2 - (x^2 - 2ix + i^2)$

$ix - 1 - x^2 + 2ix + 1$

$-x^2 + 3xi$

Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33 On a high school basketball team, Alex typically makes 60% of his free throws. In the last four minutes of the game, Alex took 10 free throws and made 30% of them. Fans were saying he missed on purpose. A simulation was run of sample size 10, simulated 200 times, based on the premise that 60% of the free throws were made. The approximately normal results are shown below.

Based on the simulation, determine an interval containing the middle 95% of simulated values. State your answer to three decimal places.

$.607 \mp 2(.157)$

$.293 - .921$

Do the fans have a valid argument? Explain using statistical evidence.

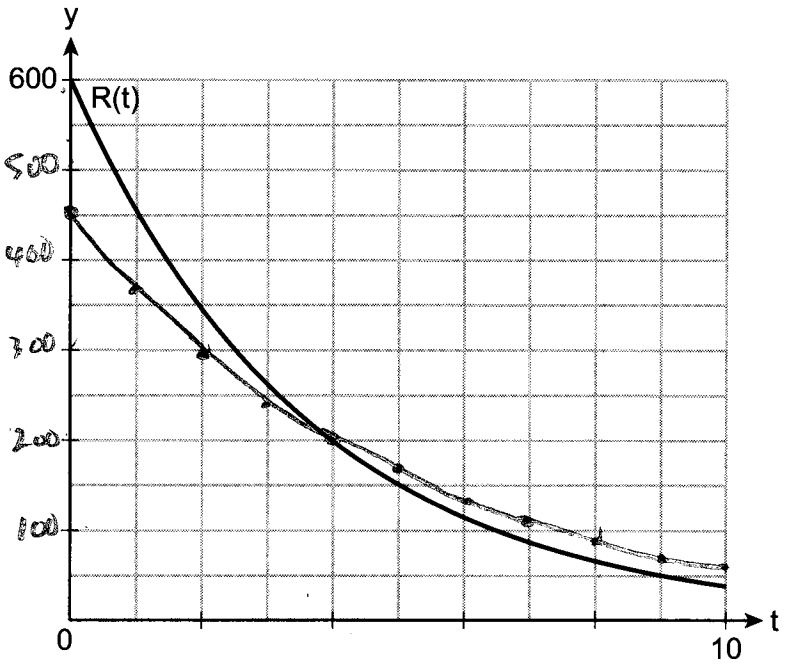
No, because .30 falls within the confidence interval

34 The breakdown of a drug is modeled by $A(t) = A_0e^{-rt}$, where $A(t)$ is the amount of the drug in the body, A_0 is the initial dosage, r is the rate of decay, and t is the time in hours. A patient is given 450 mg of a drug that has a decay rate of 0.205. Write a function, $A(t)$, to model the amount of the drug remaining in the body after t hours.

$A(t) = 450e^{-.205t}$

The sketch below shows the function $R(t)$, which models the breakdown of a different drug administered to the same patient.

Graph $A(t)$ on the grid below.



Using the graph, approximate to the *nearest hour* when the patient has the same amount of both drugs remaining.

4

35 Consider the sinusoidal function below.

$$d(t) = 6800\cos\left(\frac{4}{3}\pi t\right) + 6400$$

State the maximum value of $d(t)$.

$6800(1) + 6400 = 13{,}200$

State the period of $d(t)$.

$\frac{2\pi}{\frac{4}{3}\pi} = 1.5$

Determine the average rate of change from $\frac{3}{4} \leq t \leq 2$.

$\frac{d(2) - d(\frac{3}{4})}{2 - \frac{3}{4}} = 2720$

36 Solve algebraically for all values of m:

$$m - 2\sqrt{4m - 3} = 3$$

$m - 3 = 2\sqrt{4m-3}$

$m^2 - 6m + 9 = 4(4m-3)$

$m^2 - 6m + 9 = 16m - 12$

$m^2 - 22m + 21 = 0$

$(m-1)(m-21) = 0$

$m = 1, 21$

$1 - 2\sqrt{4(1)-3} \neq 3$

$1 - 2 \neq 3$

extraneous

$21 - 2\sqrt{4(21)-3} = 3$

$21 - 2(9) = 3$

$21 - 18 = 3$

Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. A correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

37 Xander and Yvette are each practicing for their road tests. Xander decides to drive for 15 minutes the first day and plans to increase the amount of time he spends driving by five minutes each day leading up to the day of his test. Yvette decides to drive for 10 minutes the first day, and she plans to increase the amount of time she spends driving by 15% each day leading up to the day of her test.

State whose plan for the amount of time driving per day can be modeled by an arithmetic sequence, and whose plan can be modeled by a geometric sequence. Explain your reasoning.

Xander's plan is arithmetic because it increases by 5 minutes every day

Yvette's plan is geometric because it increases by 15% every day

Write an equation for x_n that represents the amount of time spent driving on the nth day for Xander's plan and an equation for y_n that represents the amount of time spent driving on the nth day for Yvette's plan.

$x_n = 15 + (n-1)5$

$y_n = 10(1.15)^{n-1}$

Who will spend more time driving on the 19th day of practicing? Justify your answer.

$x_{19} = 15 + (19-1)5 = 105$

$y_{19} = 10(1.15)^{19-1} \approx 124$

Yvette