

ALGEBRA

II

Large-Type Edition

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

ALGEBRA II

Thursday, January 23, 2025 — 1:15 to 4:15 p.m., only

Student Name _____

School Name _____

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. You may remove this sheet 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 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 exact value of $\sin\left(\frac{8\pi}{3}\right)$ is

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

(3) $-\frac{\sqrt{3}}{2}$

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

(4) $\frac{\sqrt{3}}{2}$

2 A teacher randomly divides all of her students into two groups. She grades the homework for one group but does not grade the homework for the other group. All homework is returned to the students. She then compares test scores for each of the groups to see if grading homework has an effect on the test scores.

This method of data collection is best described as

(1) an experiment

(3) a simulation

(2) an unbiased survey

(4) an observational study

**Use this space for
computations.**

3 Which expression is equivalent to $(x - 2)^2 + 27(x - 2) - 90$?

(1) $(x + 30)(x - 3)$

(3) $(x - 30)(x + 3)$

(2) $(x + 28)(x - 5)$

(4) $(x - 2)(x + 25)(x - 90)$

4 Given the functions $f(x) = 2x + \frac{5}{2}$ and $g(x) = \frac{3}{x}$, what are the solutions to $f(x) = g(x)$?

(1) $(0.75, 4)$ or $(-2, -1.5)$

(3) $y = -1.5$ or $y = 4$

(2) $x = 0.75$ or $x = -2$

(4) $(-2, 0.75)$

Use this space for computations.

5 Given $f(x) = 2x^3 - 3x^2 - 5x - 12$ and $g(x) = x - 3$, the quotient of

$$\frac{f(x)}{g(x)} \text{ is}$$

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

(3) $2x^2 - 9x + 22 - \frac{78}{x - 3}$

(2) $2x^3 + 3x^2 + 4x$

(4) $2x^3 - 9x^2 + 22x - 78$

6 Abby is told that each day there is a 50% chance it will rain. Which simulation can Abby perform to determine the likelihood of it raining for the next seven days?

(1) Flip a coin seven times, count how many heads, and repeat 50 times.

(2) Roll a die seven times, count how many twos, and repeat 50 times.

(3) Roll a pair of dice, count totals of seven, and repeat 50 times.

(4) Flip a coin 50 times and count how many heads.

**Use this space for
computations.**

7 What are the solutions to $4x^2 - 7x - 2 = -10$?

(1) $-\frac{1}{4}, 2$

(3) $\frac{7}{8} \pm \frac{\sqrt{241}}{8}$

(2) $\frac{7}{8} \pm \frac{\sqrt{79}}{8}i$

(4) $\frac{7}{8} \pm \frac{\sqrt{143}}{8}i$

8 If $x - 5$ is a factor of $p(x) = ax^4 + bx^3 + cx^2 + dx + e$, then which statement must be true?

(1) $p(-5) = 0$

(3) $p(5) = 0$

(2) $p(-5) \neq 0$

(4) $p(5) \neq 0$

**Use this space for
computations.**

9 In a small city, there are 22 gas stations. The mean price for a gallon of regular gas was \$2.12 with a standard deviation of \$0.05. The distribution of the data was approximately normal. Given this information, the middle 95% of the gas stations in this small city likely charge

- (1) \$1.90 to \$2.34 for a gallon of gas
- (2) \$1.97 to \$2.27 for a gallon of gas
- (3) \$2.02 to \$2.22 for a gallon of gas
- (4) \$2.07 to \$2.17 for a gallon of gas

10 The expression $\frac{4x^2 - 5}{x^2 - 1}$ is equivalent to

- (1) $4 - \frac{1}{x^2 - 1}$
- (2) $4 + \frac{1}{x^2 - 1}$
- (3) $4 - \frac{9}{x^2 - 1}$
- (4) $4 - \frac{4}{x^2 - 1}$

**Use this space for
computations.**

11 For all positive values of x , which expression is equivalent to

$$\sqrt{x} \cdot \sqrt[4]{x^{11}}?$$

(1) $x^{\frac{19}{22}}$

(3) $x^{\frac{13}{4}}$

(2) $x^{\frac{11}{8}}$

(4) $x^{\frac{2}{11}}$

12 The expression $i^2(5x - 2i)^2$ is equivalent to

(1) $-25x^2 + 20xi - 4$

(3) $25x^2 + 20xi + 4$

(2) $-25x^2 + 20xi + 4$

(4) $25x^2 + 4$

**Use this space for
computations.**

13 Functions f and g are given below.

$$f(x) = \frac{7}{2}x^2 - 5x + 11$$

$$g(x) = 3x^2 - 7x + 25$$

When $2f(x)$ is subtracted from $g(x)$, the result is

(1) $4x^2 - 3x - 3$

(3) $4x^2 - 17x - 47$

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

(4) $-4x^2 - 17x + 47$

14 A manufacturer claims that the number of ounces of a beverage dispensed by one of its automatic dispensers is normally distributed with a mean of 8.0 ounces and a standard deviation of 0.04 ounces. To the *nearest tenth of a percent*, what percent of the cups filled by this company's dispenser will contain between 7.9 and 8.11 ounces?

(1) 99.5

(3) 99.1

(2) 99.4

(4) 97.6

15 What is the value of x in the solution of the system of equations below?

$$5x + 2y - z = -14$$

$$7y - z = 31$$

$$5y + 4z - 5x = -23$$

(1) -17

(3) $-\frac{1}{5}$

(2) 2

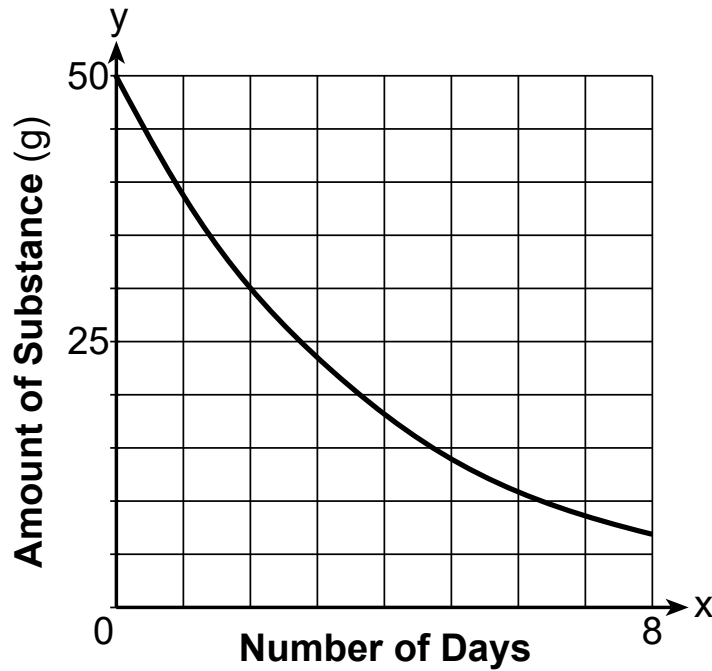
(4) -7

**Use this space for
computations.**

GO RIGHT ON TO THE NEXT PAGE \Rightarrow

16 The graph below shows the amount of a radioactive substance left over time.

Use this space for computations.



The daily rate of decay over an 8-day interval is approximately

- (1) 23%
- (2) 95%
- (3) 5%
- (4) 77%

17 If $4(10^{5x-2}) = 12$, then x equals

(1) $\frac{2.3}{5}$

(3) $\frac{\log(3) + 2}{5}$

(2) $\frac{1}{3}\left(\frac{\log 12}{\log 40} + 5\right)$

(4) $\frac{1}{5}\left(\frac{\log 12}{\log 4} + 2\right)$

**Use this space for
computations.**

GO RIGHT ON TO THE NEXT PAGE \Rightarrow

**Use this space for
computations.**

- 18** A random sample of 152 students was surveyed on a particular day about how they got to school. The survey results are summarized in the table below.

		Attendance Status	
		Late	On-Time
Method of Transportation	Car	6	24
	Bus	20	80
	Walk	4	18

Which statement is best supported by the data?

- (1) The probability of being late given that a student walked is greater than the probability that a student walked given that the student was late.
- (2) The probability of being late given that a student walked is less than the probability that a student walked given that the student was late.
- (3) The probability of being late given that a student walked is equal to the probability that a student walked given that the student was late.
- (4) The probability of being late given that a student walked cannot be determined.

**Use this space for
computations.**

19 If $f(x) = \sqrt[3]{x} + 4$, then $f^{-1}(x)$ equals

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

(3) $x^3 + \frac{1}{4}$

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

(4) $-\sqrt[3]{x} - 4$

20 Given the equation $S(x) = 1.7\sin(bx) + 12$, where the period of $S(x)$ is 12, what is the value of b ?

(1) $\frac{\pi}{6}$

(3) $\frac{\pi}{12}$

(2) 24π

(4) 6π

**Use this space for
computations.**

21 Jin solved the equation $\sqrt{4 - x} = x + 8$ by squaring both sides. What extraneous solution did he find?

(1) -5

(3) 3

(2) -12

(4) 4

22 The expression $(x^2 + y^2)^2$ is *not* equivalent to

(1) $(x^2 - y^2)^2 + (2xy)^2$

(2) $(x + y)^4 + 2(xy)^2$

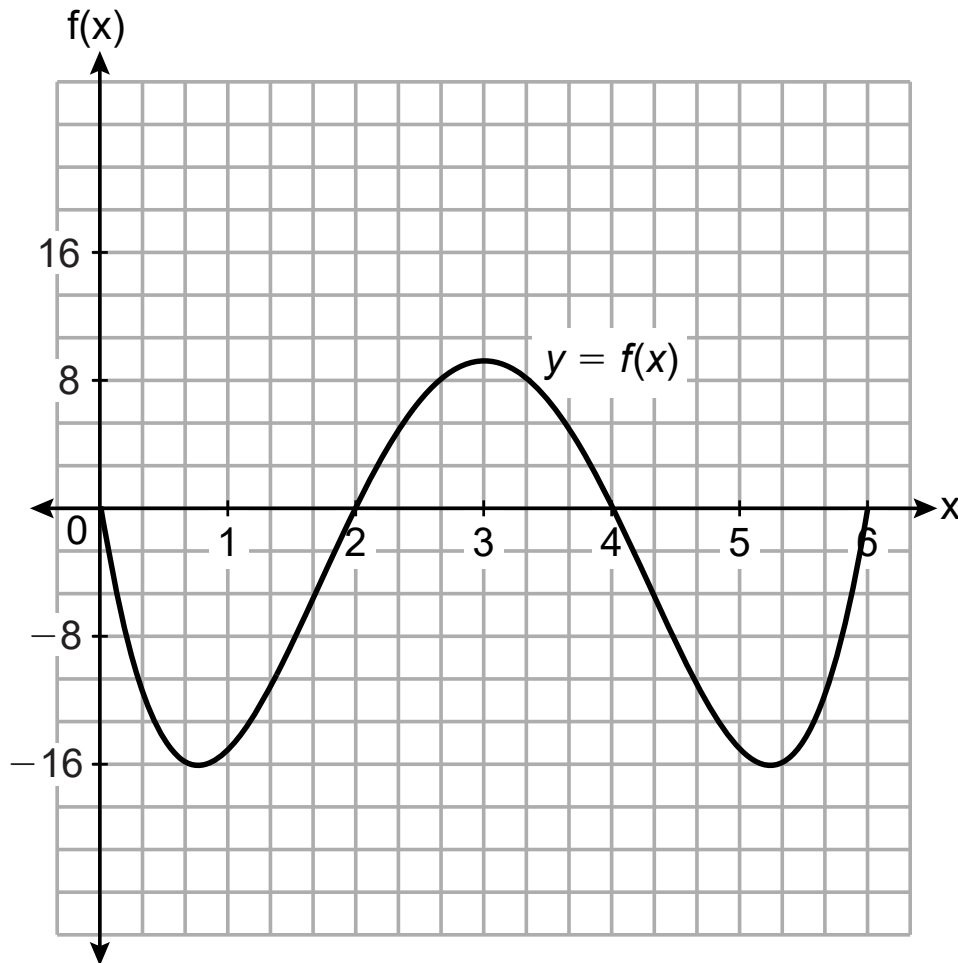
(3) $x^2(x^2 + 2y^2) + (y^2)^2$

(4) $(2x^2 + y^2)^2 - (3x^4 + 2x^2y^2)$

GO RIGHT ON TO THE NEXT PAGE ⇒

- 23 The height of a running trail is modeled by the quartic function $y = f(x)$ shown below, where x is the distance in miles from the start of the trail and y is the height in feet relative to sea level.

Use this space for
computations.



Question 23 is continued on the next page.

Question 23 continued**Use this space for
computations.**

If this trail has a minimum height of 16 feet below sea level, which function(s) could represent a running trail whose minimum height is half of the minimum height of the original trail?

I. $y = f\left(\frac{1}{2}x\right)$ II. $y = f(x) + 8$ III. $y = \frac{1}{2}f(x)$

(1) I, only

(3) I and III

(2) II, only

(4) II and III

24 The crew aboard a small fishing boat caught 350 pounds of fish on Monday. From that Monday through the end of the week on Friday, the weight of the fish caught increased 15% per day. The total weight, in pounds, of fish caught is approximately

(1) 411

(3) 1748

(2) 612

(4) 2360

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 Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

Work space for question 25 is continued on the next page.

Question 25 continued

26 Solve algebraically for x : $\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$

27 Given $\cos \theta = -\frac{2}{7}$ with θ in Quadrant II, find the exact value of $\sin \theta$.

28 Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = a^x$$

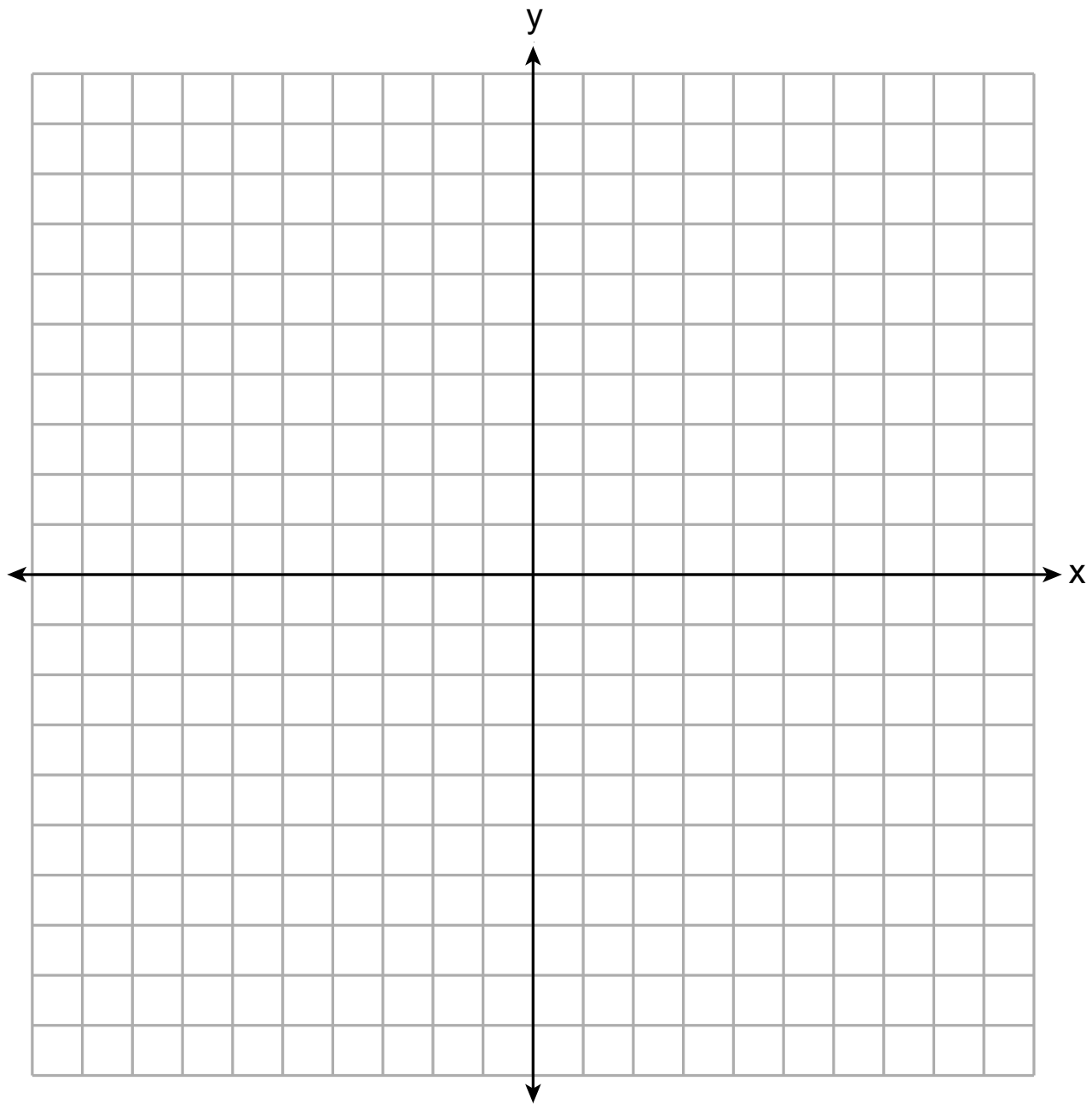
Work space for question 28 is continued on the next page.

Question 28 continued

29 Graph *at least one* cycle of $y = 5\sin(4x) - 3$ on the set of axes on the next page.

The set of axes for question 29 is continued on the next page.

Question 29 continued



30 The cost of a brand-new electric-hybrid vehicle is listed at \$33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function $V(x) = 33,400(0.85)^x$, where x represents the years since purchase.

Julia and Jacob have each written a function that is equivalent to the original.

$$\text{Jacob's function: } V(x) = 33,400(0.1422)^{\frac{1}{12}x}$$

$$\text{Julia's function: } V(x) = 33,400(0.9865)^{12x}$$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate?
Justify your answer.

Work space for question 30 is continued on the next page.

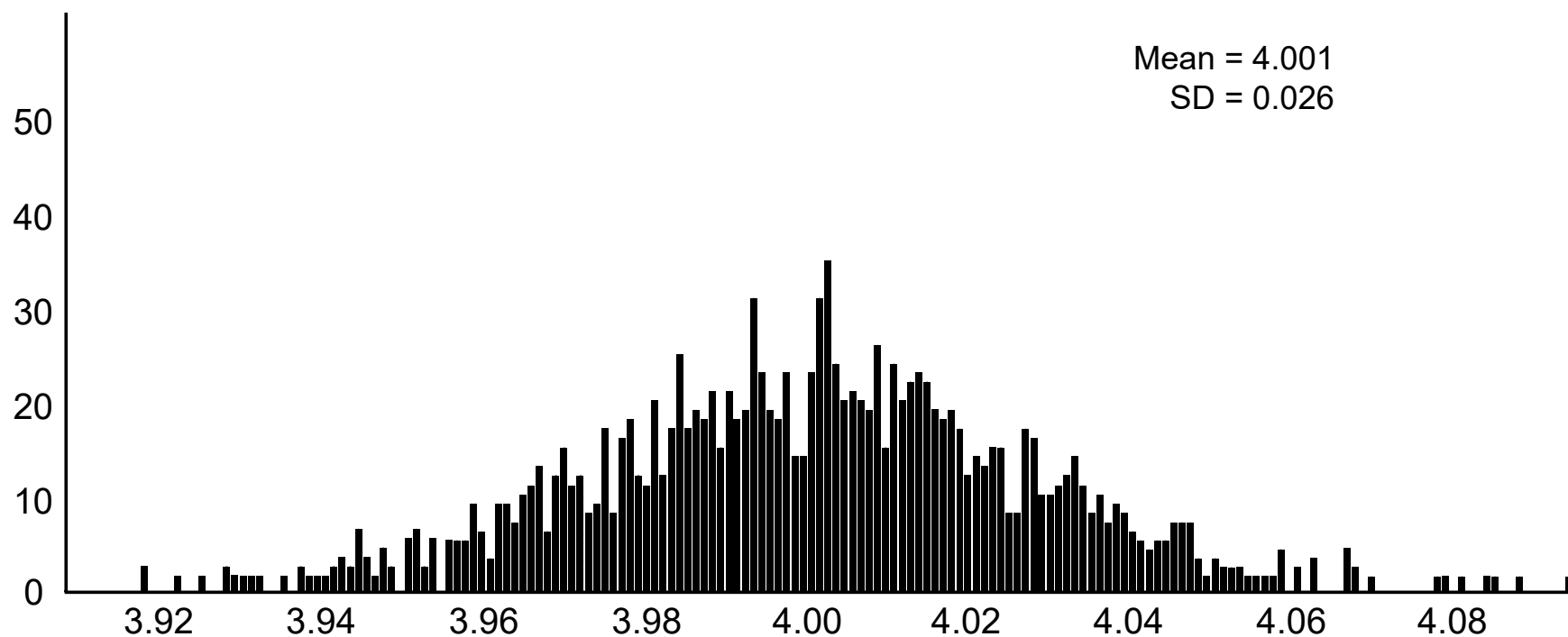
Question 30 continued

31 Write a recursive formula for the sequence 8, 20, 50, 125, 312.5,...

Work space for question 31 is continued on the next page.

Question 31 continued

32 A grocery store orders 50 bags of oranges from a company's distribution center. The bags have a mean weight of 3.85 pounds per bag. The company claims that their bags of oranges have a mean weight of 4 pounds. The grocery store ran a simulation of 50 bags, 2500 times, assuming a mean of 4 pounds. The results are shown below.



Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

Work space for question 32 is continued on the next page.

Question 32 continued

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 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let A be the event that the guest room has a view of the lake, and let B be the event that the guest room has a queen-size bed. Events A and B are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

Question 33 is continued on the next page.

Question 33 continued

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

34 Which function has a greater average rate of change on the interval $[-1,4]$? Justify your answer.

x	m(x)
-2	-3
-1	1
0	1
1	3
2	13
3	37
4	81
5	151

$$p(x) = 3^x + 1$$

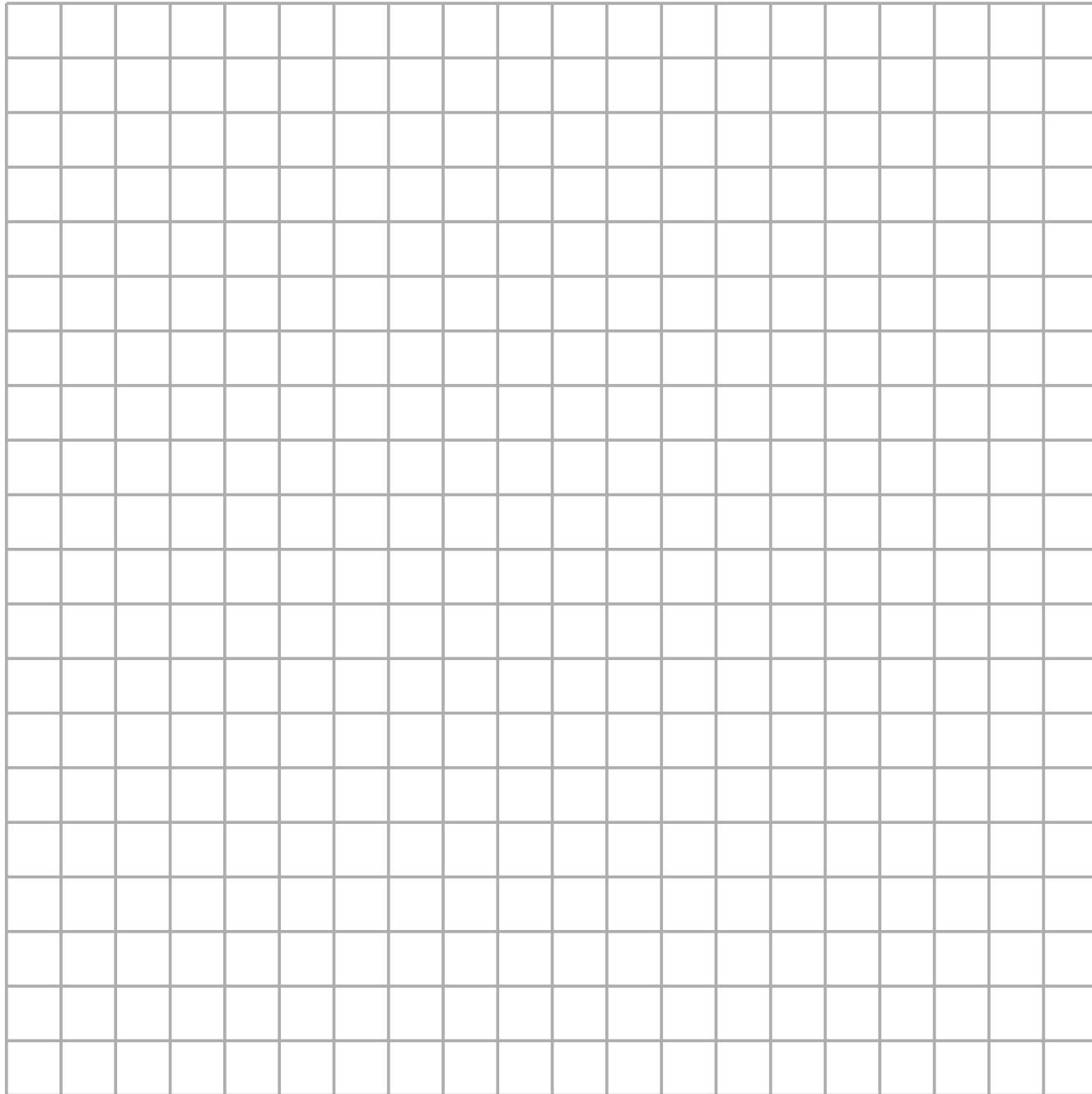
Work space for question 34 is continued on the next page.

Question 34 continued

35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$.
(The use of the grid on the next page is optional.)

Question 35 is continued on the next page.

Question 35 continued

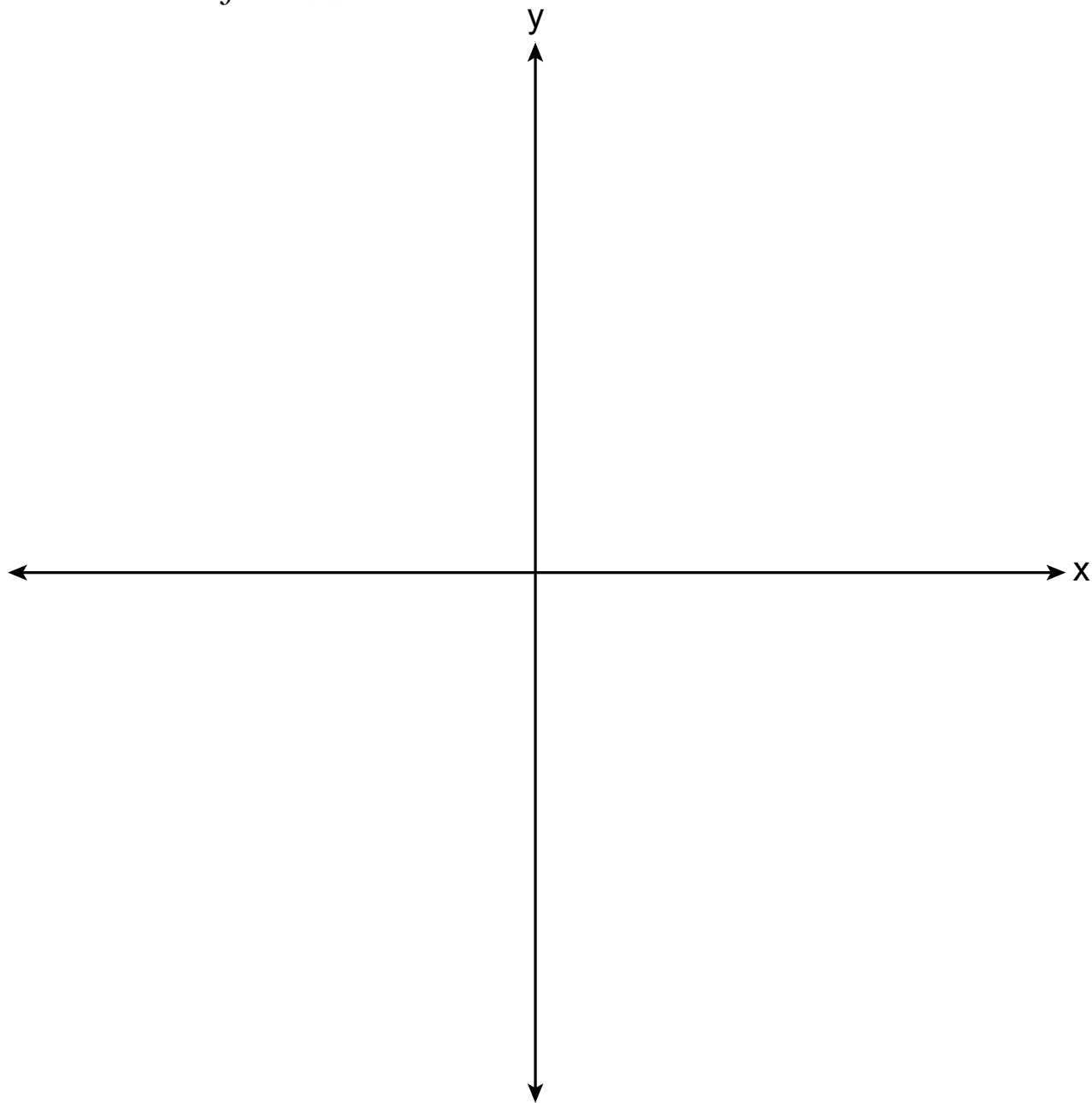


36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

Question 36 is continued on the next page.

Question 36 continued

On the axes below, sketch $y = c(x)$.



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]

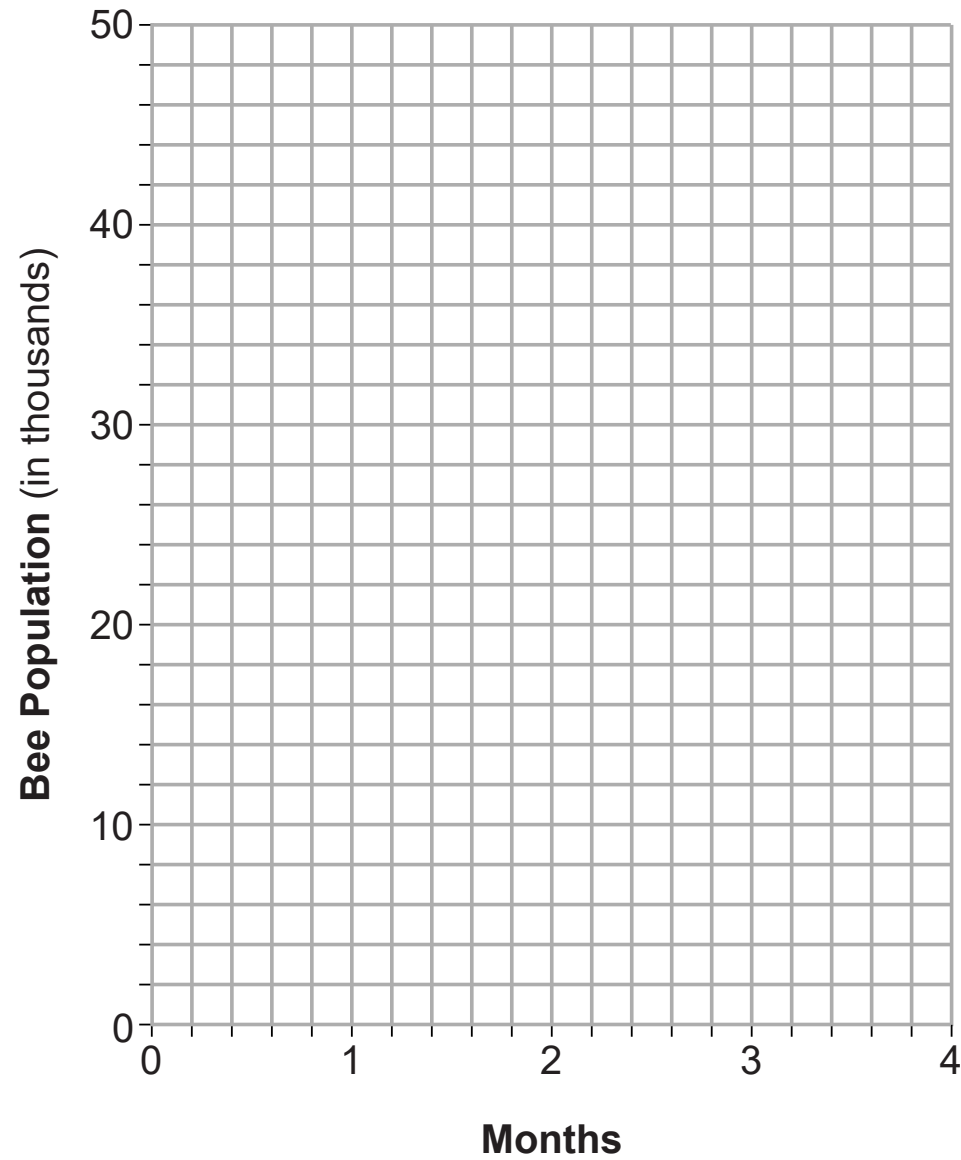
37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

Question 37 is continued on the next page.

Question 37 continued

Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.



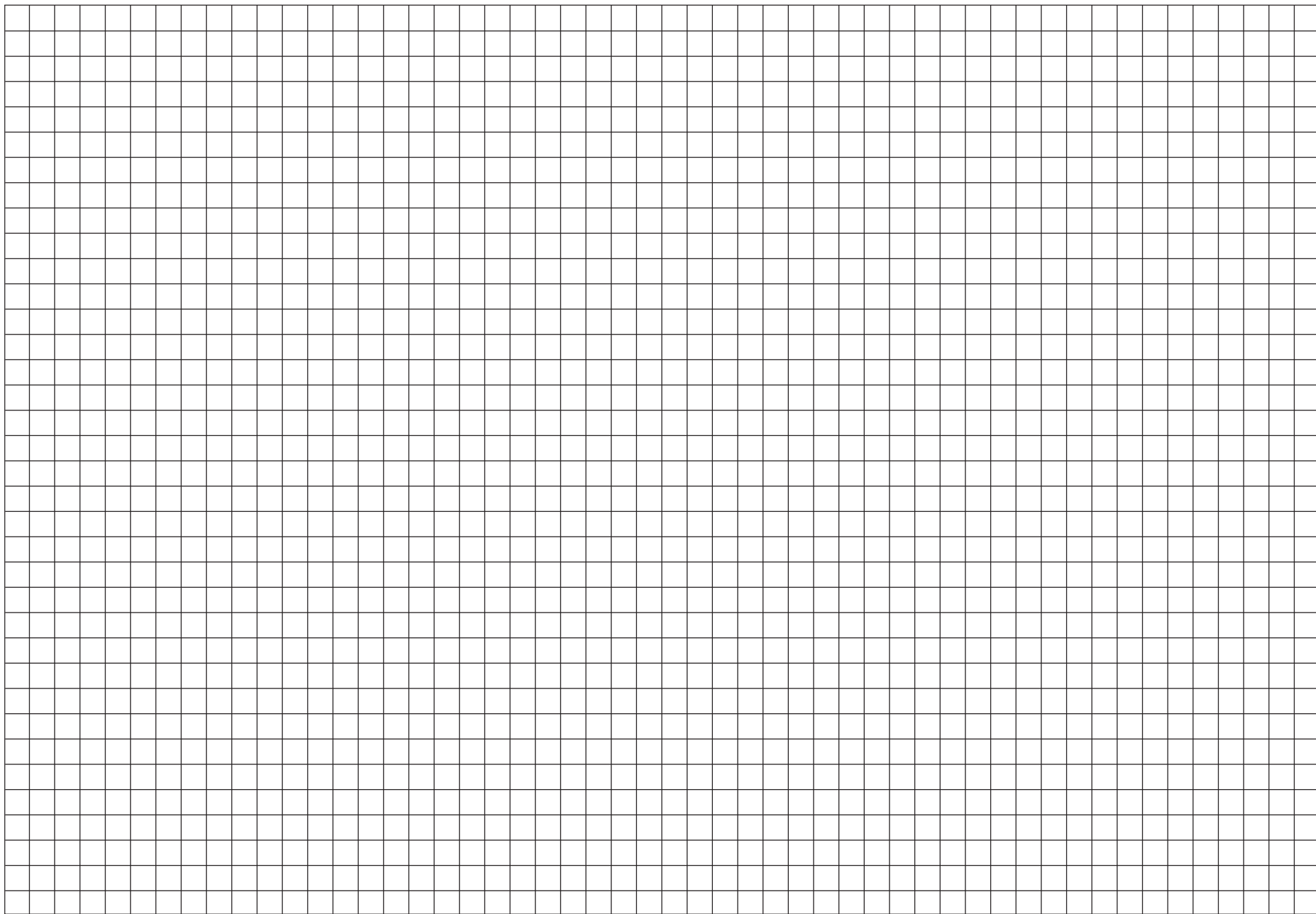
Question 37 is continued on the next page.

Question 37 continued

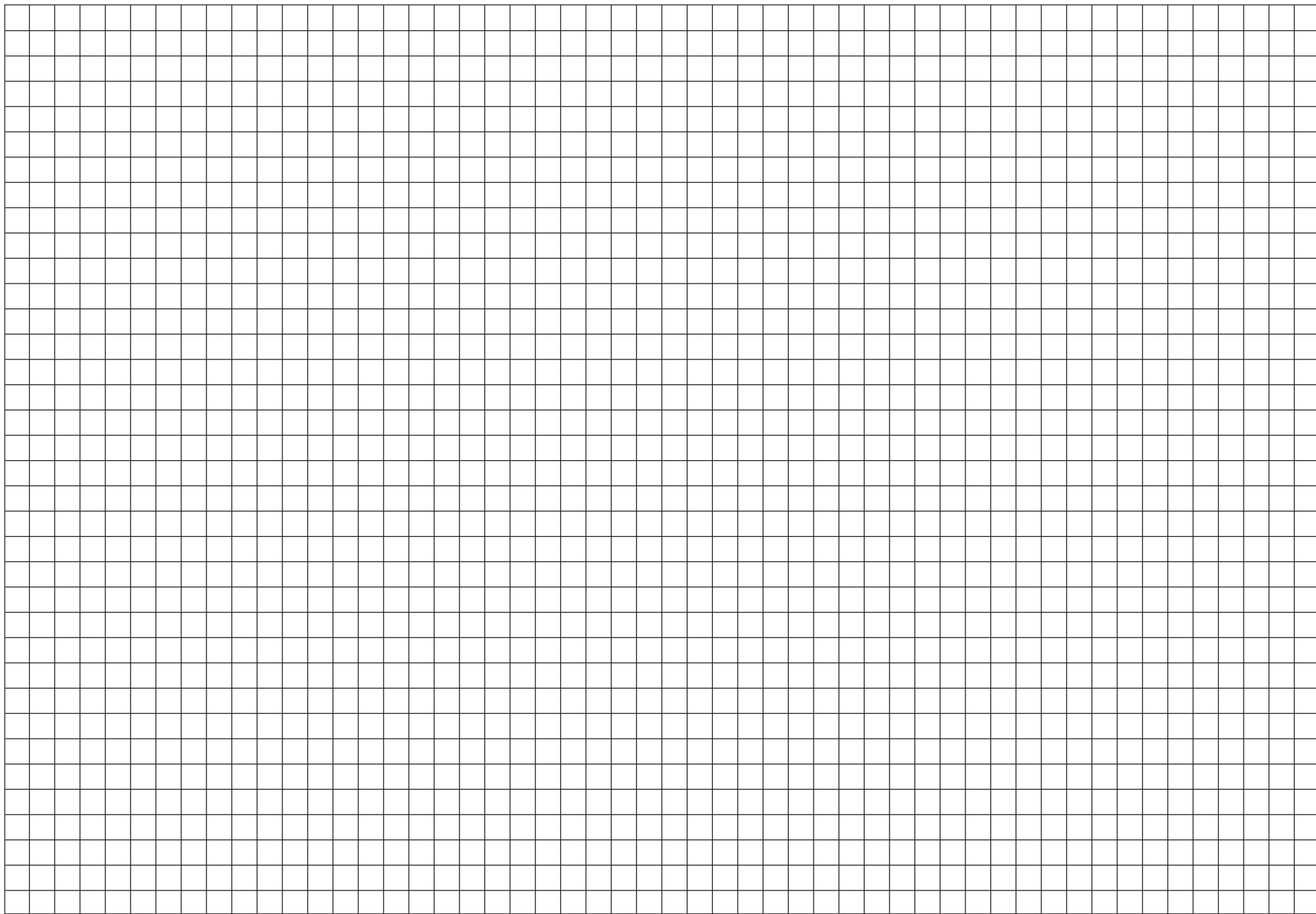
State, to the *nearest tenth of a month*, when the colonies will have the same population.

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony A to triple.

Scrap Graph Paper — this sheet will *not* be scored.



Scrap Graph Paper — this sheet will *not* be scored.



High School Math Reference Sheet

1 inch = 2.54 centimeters

1 meter = 39.37 inches

1 mile = 5280 feet

1 mile = 1760 yards

1 mile = 1.609 kilometers

1 kilometer = 0.62 mile

1 pound = 16 ounces

1 pound = 0.454 kilogram

1 kilogram = 2.2 pounds

1 ton = 2000 pounds

1 cup = 8 fluid ounces

1 pint = 2 cups

1 quart = 2 pints

1 gallon = 4 quarts

1 gallon = 3.785 liters

1 liter = 0.264 gallon

1 liter = 1000 cubic centimeters

Triangle	$A = \frac{1}{2}bh$
Parallelogram	$A = bh$
Circle	$A = \pi r^2$
Circle	$C = \pi d$ or $C = 2\pi r$
General Prisms	$V = Bh$

Pythagorean Theorem	$a^2 + b^2 = c^2$
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Geometric Sequence	$a_n = a_1 r^{n - 1}$
Geometric Series	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$

The Reference Sheet is continued on the next page.

Reference Sheet — concluded

Cylinder	$V = \pi r^2 h$
Sphere	$V = \frac{4}{3}\pi r^3$
Cone	$V = \frac{1}{3}\pi r^2 h$
Pyramid	$V = \frac{1}{3}Bh$

Radians	1 radian = $\frac{180}{\pi}$ degrees
Degrees	1 degree = $\frac{\pi}{180}$ radians
Exponential Growth/Decay	$A = A_0 e^{k(t - t_0)} + B_0$