

ALGEBRA  
**II**

**Large-Type Edition**

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

**ALGEBRA II**

**Thursday**, August 16, 2018 — 12:30 to 3:30 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.**



3 If  $f(x) = x^2 + 9$  and  $g(x) = x + 3$ , which operation would *not* result in a polynomial expression?

(1)  $f(x) + g(x)$

(3)  $f(x) \cdot g(x)$

(2)  $f(x) - g(x)$

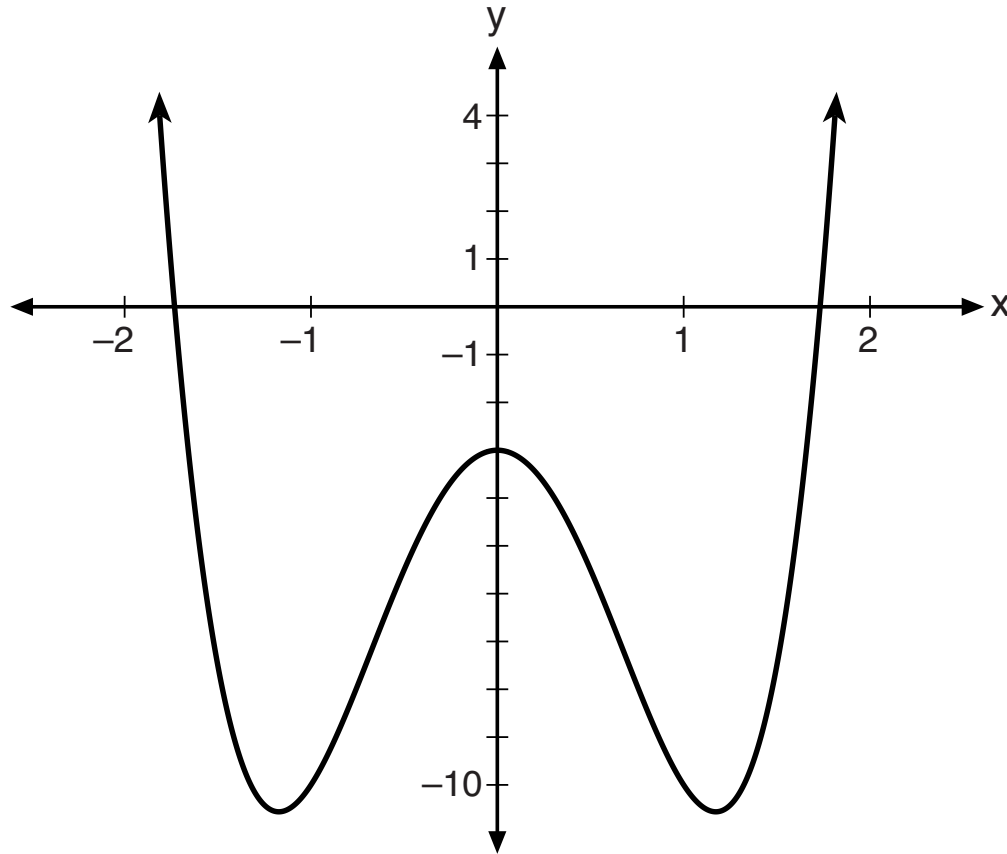
(4)  $f(x) \div g(x)$

**Use this space for computations.**

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Use this space for  
computations.

4 Consider the function  $p(x) = 3x^3 + x^2 - 5x$  and the graph of  $y = m(x)$  below.



Which statement is true?

- (1)  $p(x)$  has three real roots and  $m(x)$  has two real roots.
- (2)  $p(x)$  has one real root and  $m(x)$  has two real roots.
- (3)  $p(x)$  has two real roots and  $m(x)$  has three real roots.
- (4)  $p(x)$  has three real roots and  $m(x)$  has four real roots.

**Use this space for  
computations.**

**5** Which expression is equivalent to  $\frac{2x^4 + 8x^3 - 25x^2 - 6x + 14}{x + 6}$ ?

(1)  $2x^3 + 4x^2 + x - 12 + \frac{86}{x + 6}$

(2)  $2x^3 - 4x^2 - x + 14$

(3)  $2x^3 - 4x^2 - x + \frac{14}{x + 6}$

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

**6** Given  $f(x) = \frac{1}{2}x + 8$ , which equation represents the inverse,  $g(x)$ ?

(1)  $g(x) = 2x - 8$

(3)  $g(x) = -\frac{1}{2}x + 8$

(2)  $g(x) = 2x - 16$

(4)  $g(x) = -\frac{1}{2}x - 16$

**7** The value(s) of  $x$  that satisfy  $\sqrt{x^2 - 4x - 5} = 2x - 10$  are

(1) {5}

(3) {5, 7}

(2) {7}

(4) {3, 5, 7}

**Use this space for  
computations.**

**8** Stephanie found that the number of white-winged crossbills in an area can be represented by the formula  $C = 550(1.08)^t$ , where  $t$  represents the number of years since 2010. Which equation correctly represents the number of white-winged crossbills in terms of the monthly rate of population growth?

- (1)  $C = 550(1.00643)^t$       (3)  $C = 550(1.00643)^{\frac{t}{12}}$   
(2)  $C = 550(1.00643)^{12t}$       (4)  $C = 550(1.00643)^{t + 12}$

**9** The roots of the equation  $3x^2 + 2x = -7$  are

- (1)  $-2, -\frac{1}{3}$       (3)  $-\frac{1}{3} \pm \frac{2i\sqrt{5}}{3}$   
(2)  $-\frac{7}{3}, 1$       (4)  $-\frac{1}{3} \pm \frac{\sqrt{11}}{3}$



**Use this space for  
computations.**

**10** The average depreciation rate of a new boat is approximately 8% per year. If a new boat is purchased at a price of \$75,000, which model is a recursive formula representing the value of the boat  $n$  years after it was purchased?

(1)  $a_n = 75,000(0.08)^n$

(3)  $a_n = 75,000(1.08)^n$

(2)  $a_0 = 75,000$   
 $a_n = (0.92)^n$

(4)  $a_0 = 75,000$   
 $a_n = 0.92(a_n - 1)$

**11** Given  $\cos \theta = \frac{7}{25}$ , where  $\theta$  is an angle in standard position terminating in quadrant IV, and  $\sin^2 \theta + \cos^2 \theta = 1$ , what is the value of  $\tan \theta$ ?

(1)  $-\frac{24}{25}$

(3)  $\frac{24}{25}$

(2)  $-\frac{24}{7}$

(4)  $\frac{24}{7}$

Use this space for  
computations.

12 For  $x > 0$ , which expression is equivalent to  $\frac{\sqrt[3]{x^2} \cdot \sqrt{x^5}}{\sqrt[6]{x}}$ ?

(1)  $x$

(3)  $x^3$

(2)  $x^{\frac{3}{2}}$

(4)  $x^{10}$

13 Jake wants to buy a car and hopes to save at least \$5000 for a down payment. The table below summarizes the amount of money he plans to save each week.

Week	1	2	3	4	5
Money Saved, in Dollars	2	5	12.5	31.25	...

Based on this plan, which expression should he use to determine how much he has saved in  $n$  weeks?

(1)  $\frac{2 - 2(2.5^n)}{1 - 2.5}$

(3)  $\frac{1 - 2.5^n}{1 - 2.5}$

(2)  $\frac{2 - 2(2.5^{n-1})}{1 - 2.5}$

(4)  $\frac{1 - 2.5^{n-1}}{1 - 2.5}$

**Use this space for  
computations.**

**14** Which expression is equivalent to  $x^6y^4(x^4 - 16) - 9(x^4 - 16)$ ?

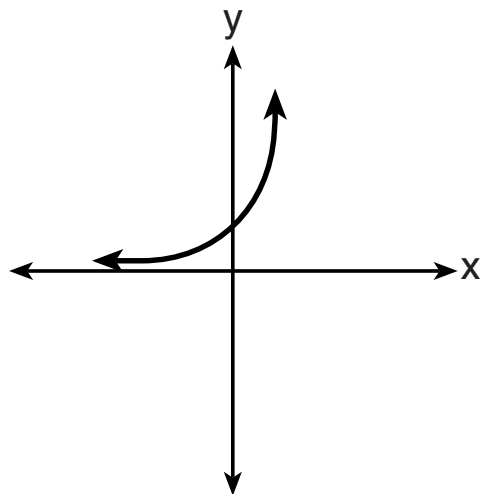
- (1)  $x^{10}y^4 - 16x^6y^4 - 9x^4 - 144$
- (2)  $(x^6y^4 - 9)(x + 2)^3(x - 2)$
- (3)  $(x^3y^2 + 3)(x^3y^2 - 3)(x + 2)^2(x - 2)^2$
- (4)  $(x^3y^2 + 3)(x^3y^2 - 3)(x^2 + 4)(x^2 - 4)$

**15** If  $A = -3 + 5i$ ,  $B = 4 - 2i$ , and  $C = 1 + 6i$ , where  $i$  is the imaginary unit, then  $A - BC$  equals

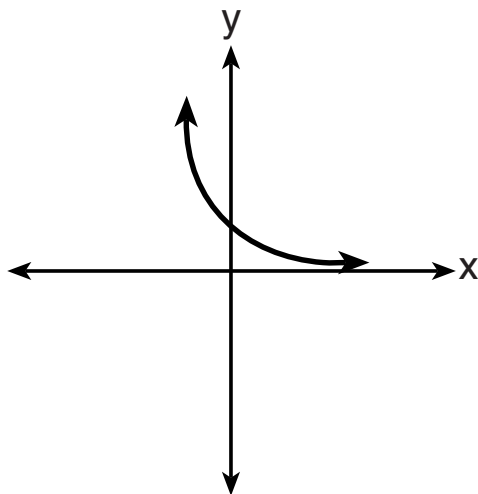
- (1)  $5 - 17i$
- (2)  $5 + 27i$
- (3)  $-19 - 17i$
- (4)  $-19 + 27i$

16 Which sketch best represents the graph of  $x = 3^y$ ?

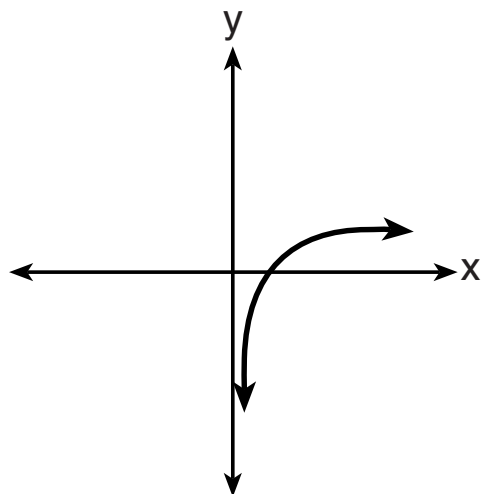
Use this space for computations.



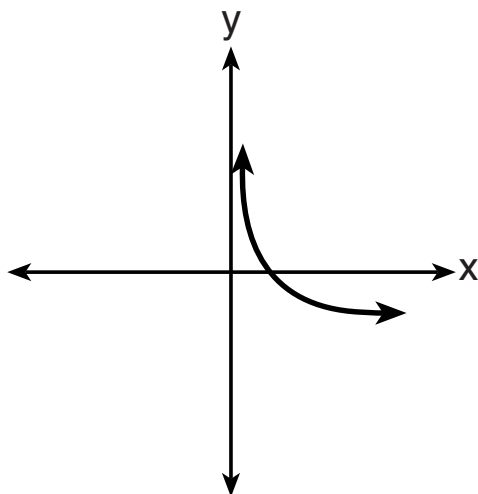
(1)



(3)



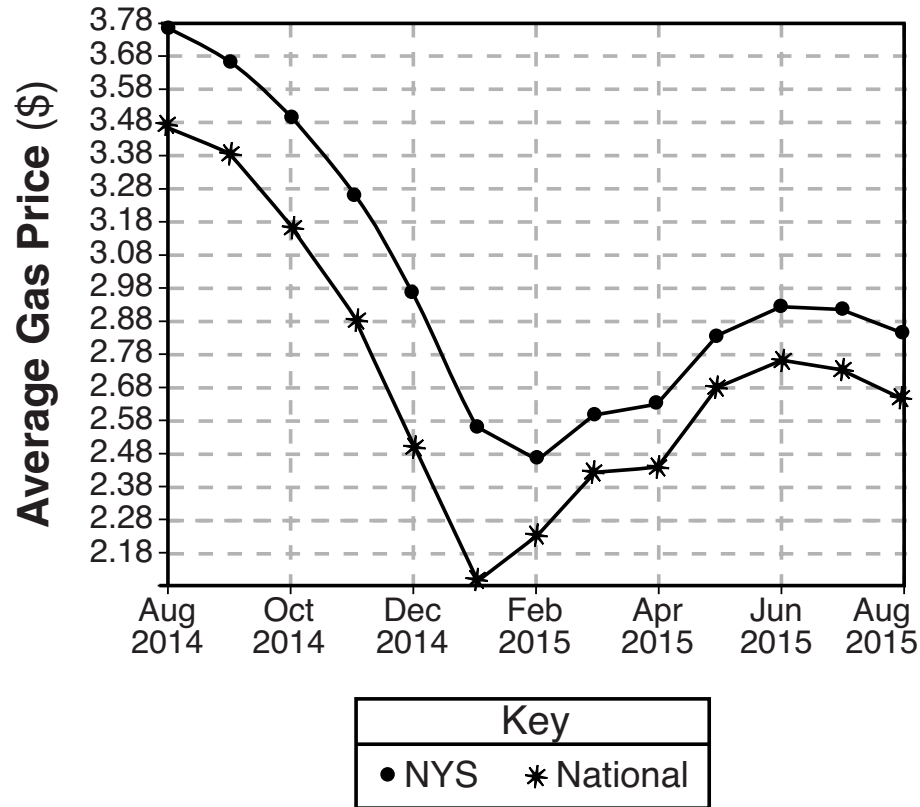
(2)



(4)

Use this space for  
computations.

17 The graph below represents national and New York State average gas prices.

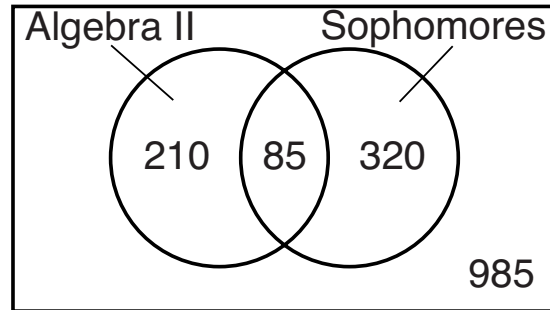


If New York State's gas prices are modeled by  $G(x)$  and  $C > 0$ , which expression best approximates the national average  $x$  months from August 2014?

- (1)  $G(x + C)$                       (3)  $G(x - C)$   
(2)  $G(x) + C$                         (4)  $G(x) - C$

**Use this space for computations.**

**18** Data for the students enrolled in a local high school are shown in the Venn diagram below.



If a student from the high school is selected at random, what is the probability that the student is a sophomore given that the student is enrolled in Algebra II?

(1)  $\frac{85}{210}$

(3)  $\frac{85}{405}$

(2)  $\frac{85}{295}$

(4)  $\frac{85}{1600}$

**Use this space for  
computations.**

**19** If  $p(x) = 2\ln(x) - 1$  and  $m(x) = \ln(x + 6)$ , then what is the solution for  $p(x) = m(x)$ ?

(1) 1.65

(3) 5.62

(2) 3.14

(4) no solution

**20** Which function's graph has a period of 8 and reaches a maximum height of 1 if at least one full period is graphed?

(1)  $y = -4\cos\left(\frac{\pi}{4}x\right) - 3$

(3)  $y = -4\cos(8x) - 3$

(2)  $y = -4\cos\left(\frac{\pi}{4}x\right) + 5$

(4)  $y = -4\cos(8x) + 5$

**21** Given  $c(m) = m^3 - 2m^2 + 4m - 8$ , the solution of  $c(m) = 0$  is

(1)  $\pm 2$

(3)  $2i, 2$

(2) 2, only

(4)  $\pm 2i, 2$

**Use this space for  
computations.**

**22** The height above ground for a person riding a Ferris wheel after  $t$  seconds is modeled by  $h(t) = 150\sin\left(\frac{\pi}{45}t + 67.5\right) + 160$  feet.

How many seconds does it take to go from the bottom of the wheel to the top of the wheel?

(1) 10

(3) 90

(2) 45

(4) 150

**23** The parabola described by the equation  $y = \frac{1}{12}(x - 2)^2 + 2$  has the directrix at  $y = -1$ . The focus of the parabola is

(1)  $(2, -1)$

(3)  $(2, 3)$

(2)  $(2, 2)$

(4)  $(2, 5)$



**Use this space for  
computations.**

**24** A fast-food restaurant analyzes data to better serve its customers. After its analysis, it discovers that the events  $D$ , that a customer uses the drive-thru, and  $F$ , that a customer orders French fries, are independent. The following data are given in a report:

$$P(F) = 0.8$$

$$P(F \cap D) = 0.456$$

Given this information,  $P(F|D)$  is

(1) 0.344

(3) 0.57

(2) 0.3648

(4) 0.8

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## 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 Over the set of integers, factor the expression  $x^4 - 4x^2 - 12$ .

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

**Question 25 continued**

**26** Express the fraction  $\frac{2x^{\frac{3}{2}}}{(16x^4)^{\frac{1}{4}}}$  in simplest radical form.

**Work space for question 26 is continued on the next page.**

**Question 26 continued**

**27** The world population was 2560 million people in 1950 and 3040 million in 1960 and can be modeled by the function  $p(t) = 2560e^{0.017185t}$ , where  $t$  is time in years after 1950 and  $p(t)$  is the population in millions. Determine the average rate of change of  $p(t)$  in *millions of people per year*, from  $4 \leq t \leq 8$ . Round your answer to the *nearest hundredth*.

**Work space for question 27 is continued on the next page.**

**Question 27 continued**

**28** The scores of a recent test taken by 1200 students had an approximately normal distribution with a mean of 225 and a standard deviation of 18. Determine the number of students who scored between 200 and 245.

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



**Question 28 continued**

**29** Algebraically solve for  $x$ :

$$\frac{-3}{x+3} + \frac{1}{2} = \frac{x}{6} - \frac{1}{2}$$

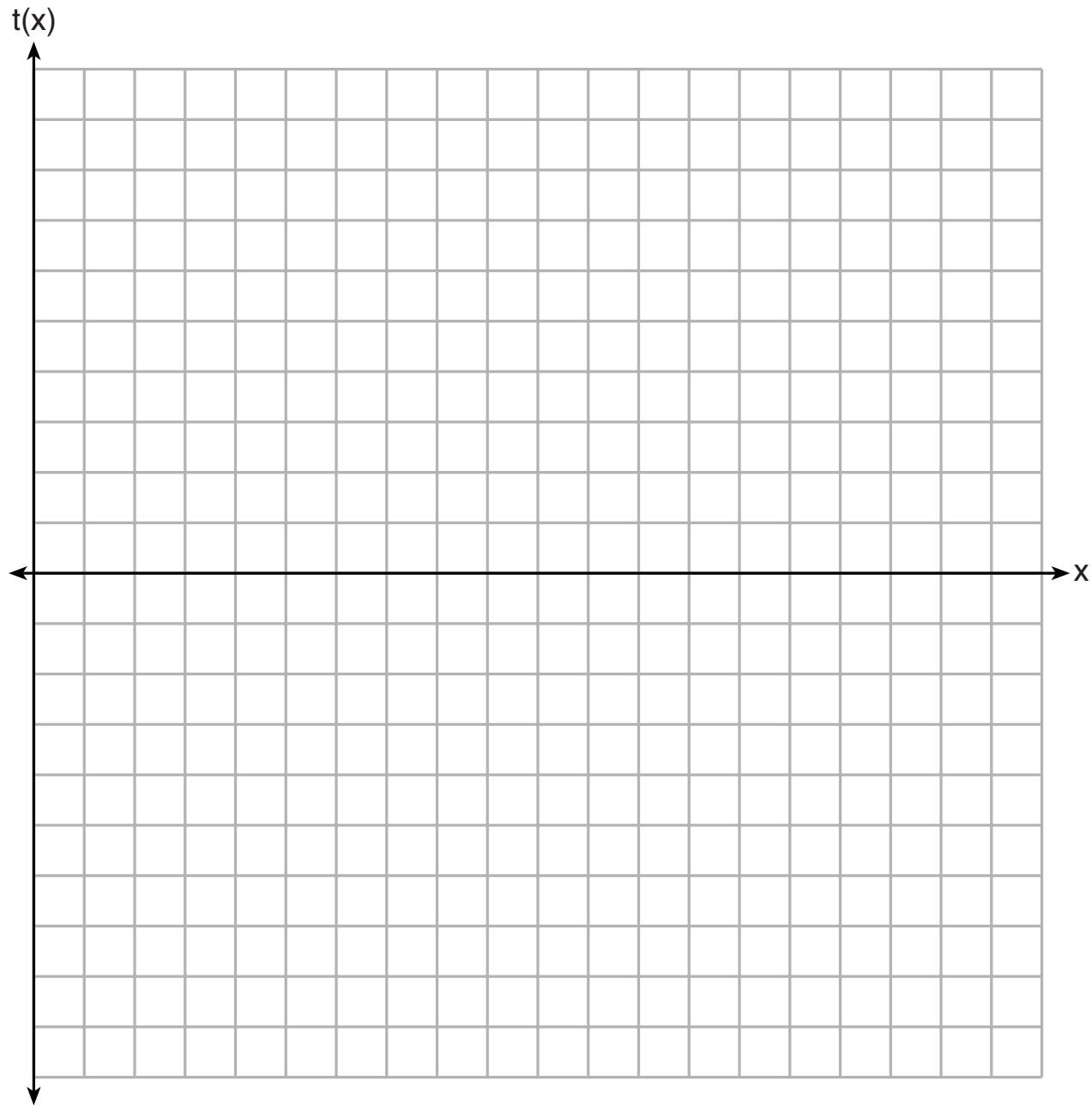
**Work space for question 29 is continued on the next page.**

**Question 29 continued**

**30** Graph  $t(x) = 3\sin(2x) + 2$  over the domain  $[0, 2\pi]$  on the set of axes below.

**The grid for question 30 is on the next page.**

**Question 30 continued**



**31** Solve the following system of equations algebraically.

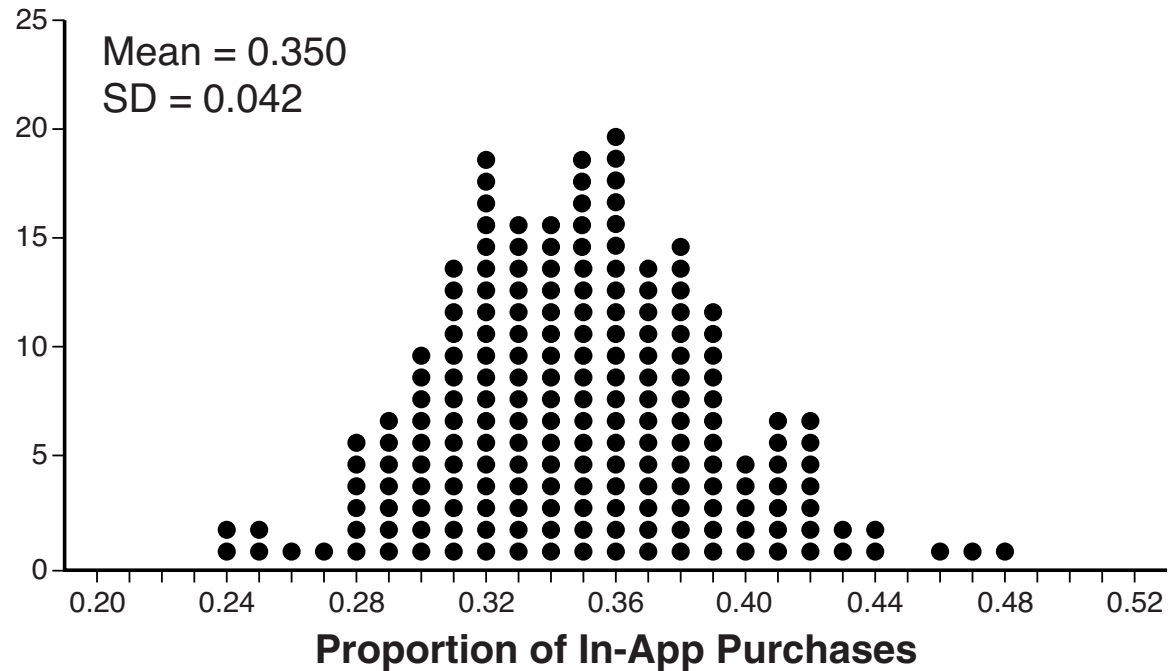
$$x^2 + y^2 = 400$$

$$y = x - 28$$

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

**Question 31 continued**

**32** Some smart-phone applications contain “in-app” purchases, which allow users to purchase special content within the application. A random sample of 140 users found that 35 percent made in-app purchases. A simulation was conducted with 200 samples of 140 users assuming 35 percent of the samples make in-app purchases. The approximately normal results are shown below.



Question 32 is continued on the next page.



**Question 32 continued**

Considering the middle 95% of the data, determine the margin of error, to the *nearest hundredth*, for the simulated results. In the given context, explain what this value represents.

### 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** Solve the following system of equations algebraically for all values of  $x$ ,  $y$ , and  $z$ .

$$2x + 3y - 4z = -1$$

$$x - 2y + 5z = 3$$

$$-4x + y + z = 16$$

Work space for question 33 is continued on the next page.

**Question 33 continued**

**34** Evaluate  $j(-1)$  given  $j(x) = 2x^4 - x^3 - 35x^2 + 16x + 48$ . Explain what your answer tells you about  $x + 1$  as a factor.

Algebraically find the remaining zeros of  $j(x)$ .

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

**Question 34 continued**

**35** Determine, to the *nearest tenth of a year*, how long it would take an investment to double at a  $3\frac{3}{4}\%$  interest rate, compounded continuously.

**Work space for question 35 is continued on the next page.**

**Question 35 continued**

**36** To determine if the type of music played while taking a quiz has a relationship to results, 16 students were randomly assigned to either a room softly playing classical music or a room softly playing rap music. The results on the quiz were as follows:

Classical: 74, 83, 77, 77, 84, 82, 90, 89

Rap: 77, 80, 78, 74, 69, 72, 78, 69

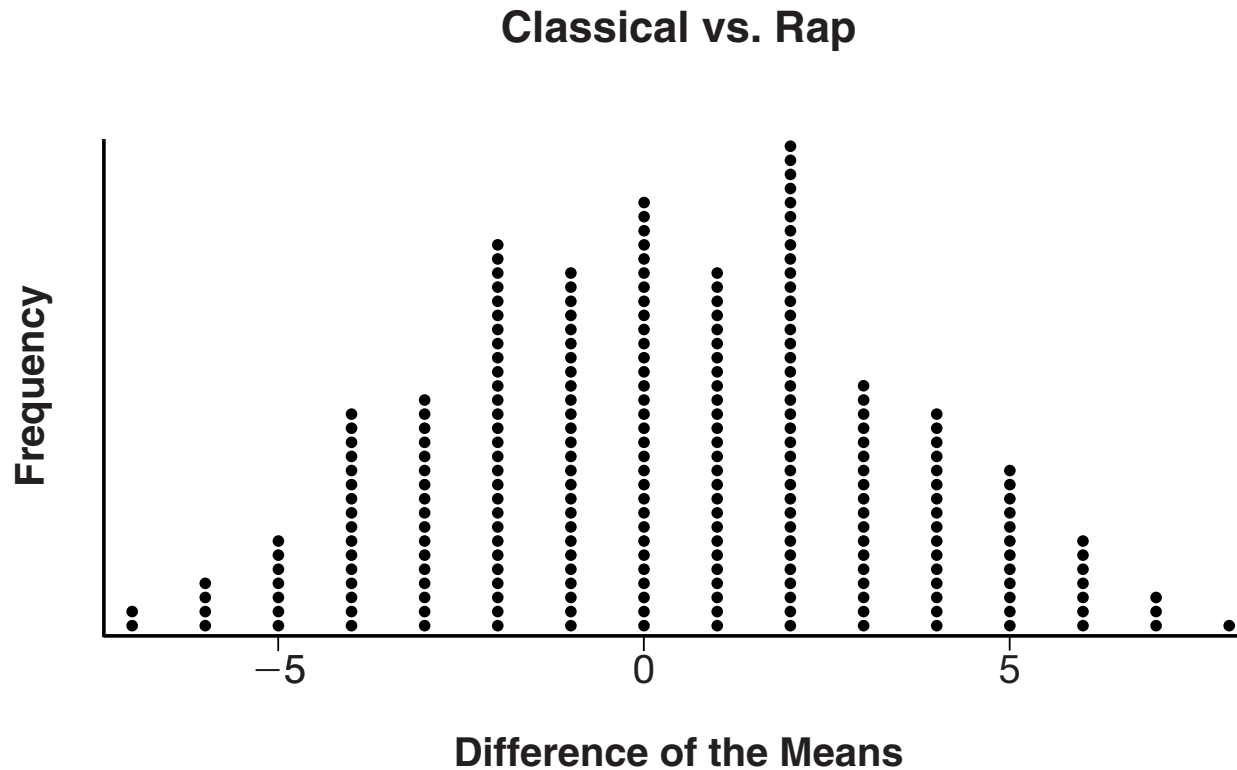
John correctly rounded the difference of the means of his experimental groups as 7. How did John obtain this value and what does it represent in the given context? Justify your answer.

**Question 36 is continued on the next page.**



### Question 36 continued

To determine if there is any significance in this value, John rerandomized the 16 scores into two groups of 8, calculated the difference of the means, and simulated this process 250 times as shown below.



Question 36 is continued on the next page.

**Question 36 continued**

Does the simulation support the theory that there may be a significant difference in quiz scores?  
Explain.

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## 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** A major car company analyzes its revenue,  $R(x)$ , and costs  $C(x)$ , in millions of dollars over a fifteen-year period. The company represents its revenue and costs as a function of time, in years,  $x$ , using the given functions.

$$R(x) = 550x^3 - 12,000x^2 + 83,000x + 7000$$

$$C(x) = 880x^3 - 21,000x^2 + 150,000x - 160,000$$

Question 37 is continued on the next page.

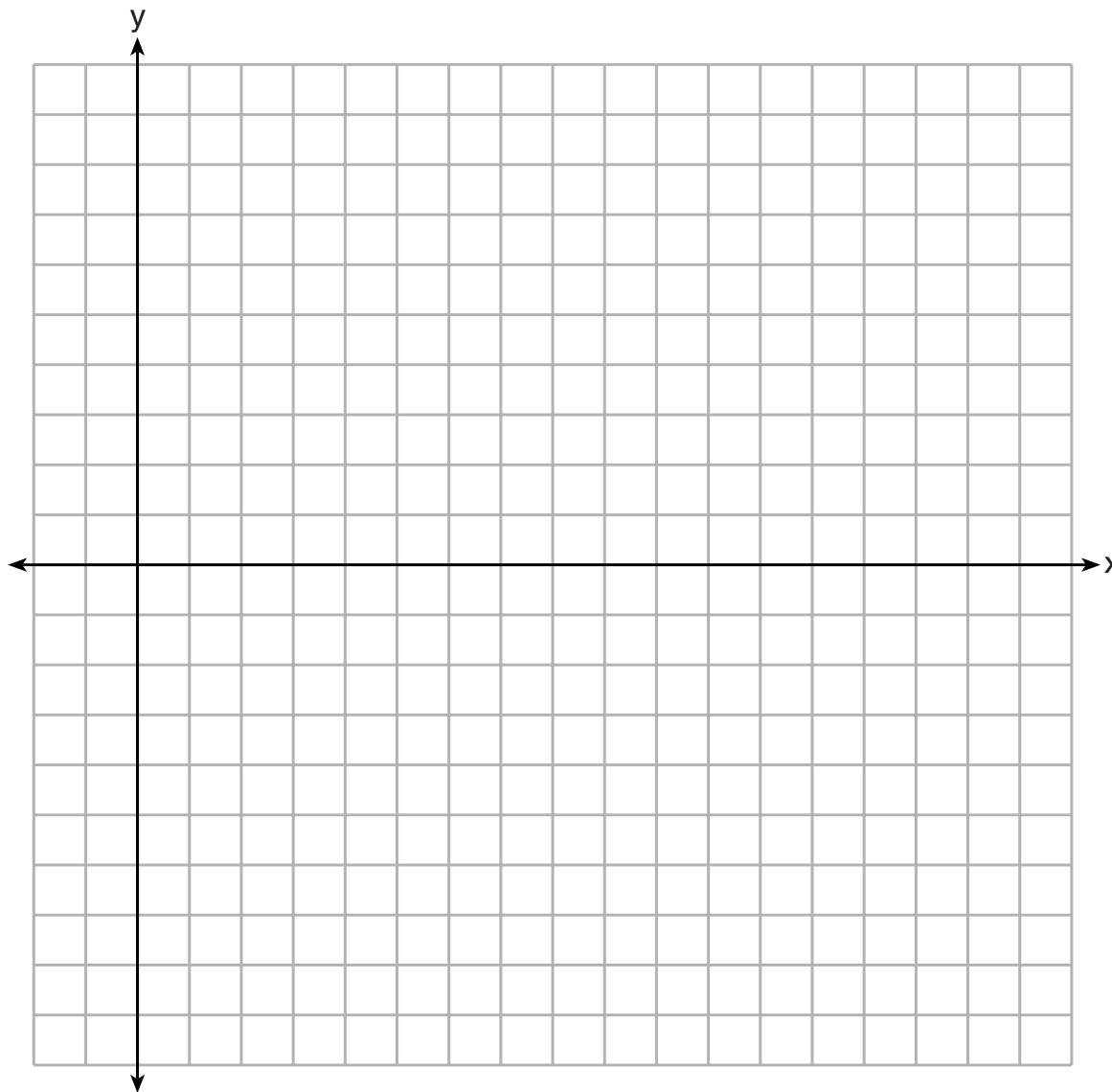
**Question 37 continued**

The company's profits can be represented as the difference between its revenue and costs. Write the profit function,  $P(x)$ , as a polynomial in standard form.

**Question 37 is continued on the next page.**

**Question 37 continued**

Graph  $y = P(x)$  on the set of axes below over the domain  $2 \leq x \leq 16$ .



**Question 37 is continued on the next page.**

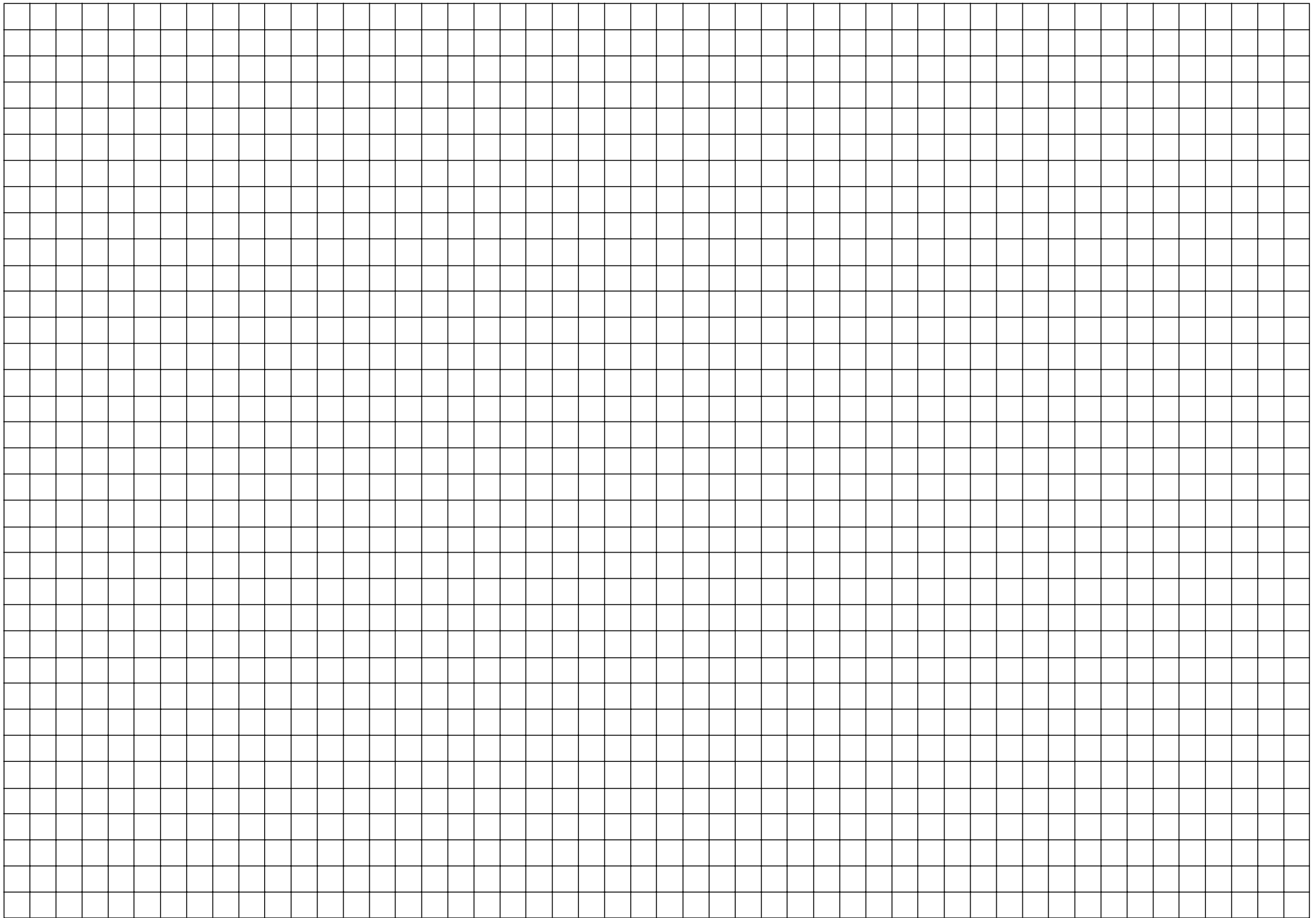
**Question 37 continued**

Over the given domain, state when the company was the least profitable and the most profitable, to the *nearest year*. Explain how you determined your answer.

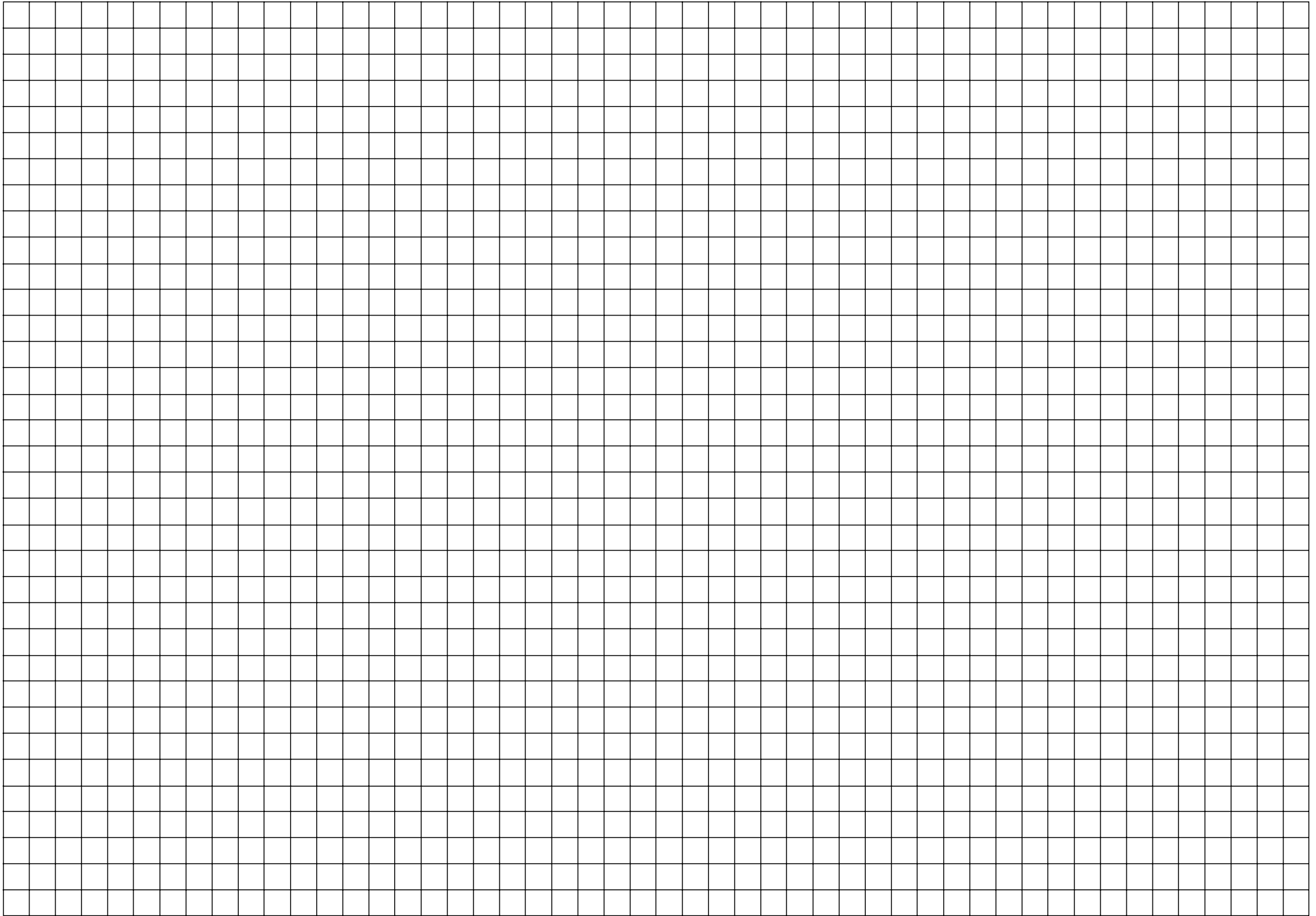
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Scrap Graph Paper — This sheet will *not* be scored.



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



## High School Math Reference Sheet

1 inch = 2.54 centimeters	1 kilometer = 0.62 mile	1 cup = 8 fluid ounces
1 meter = 39.37 inches	1 pound = 16 ounces	1 pint = 2 cups
1 mile = 5280 feet	1 pound = 0.454 kilogram	1 quart = 2 pints
1 mile = 1760 yards	1 kilogram = 2.2 pounds	1 gallon = 4 quarts
1 mile = 1.609 kilometers	1 ton = 2000 pounds	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	$V = \frac{1}{3} B h$

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