MATHEMATICS B
REGENTS EXAMINATION

TEST SAMPLER DRAFT

Fall 1999

The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Office of Curriculum, Instruction, and Assessment
Albany, New York 12234

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Dear Colleagues:

As Promised, we are continuing to develop new Regents examinations to assess our learning standards. In June, we administered the new Mathematics A Regents Examination for the first time. That examination will replace the Sequential Mathematics, Courses I and II Regents Examinations. All students will have to take and pass the Mathematics A Regents Examination in order to receive a Regents. Diploma.

STudents seeking an Advanced Regents diploma will be required to pass the new Mathematics B Regents Examination. This examination will b based on the content included on pages 137-66 of the *Mathematics Resource Guide with Core CUrriculum* recently published by the Department. In preparation for this examination, which will be administered for the first time in June 2001, I am pleased to provide the enclosed ***Mathematics B Regents Examination Test Sampler Draft.*** A copy is being sent to each high school in the State. The ***Test Sampler*** provides examples of the types of questions, the formatting, and the scoring that are being developed for the actual test. It also includes examples of student work from the May 1999 pilot tests. We anticipate making additional refinements to the examination as a result of the field tests scheduled for May 2000. The sample test provided may be duplicated for use in your classroom.

We are interested in receiving your feedback on these preliminary materials. A Comment Sheet is included on the inside back cover of this ***Test Sampler*** so that you may forward your response to us. The COmment Sheet may be faxed to (518) 486-1385 or mailed to:

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Sincerely
Roseanne DeFabio

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Introduction

The New York State Board of Regents has changed the diploma requirements for students entering ninth grade in September of 2001. Those students will be required to obtain three credits in mathematics and will have two types of diploma options. All students will have to pass the Mathematics A Regents Examination in order to obtain a Regents Diploma. Those students wishing to pursue an Advanced Regents Diploma will also have to pass the Mathematics B Regents Examination.

This Test Sampler for Mathematics B Regents provides examples of the format and types of questions that will occur on the first administration of the actual test in June 2001. The full content for the Mathematics B Regents Examination may be found in the *Mathematics Resource Guide with Core Curriculum.* A panel of mathematics experts at the high school and collegiate level, along with a representative from business and the community, developed the Mathematics B section of the core curriculum from portions of the commencement and four year sequence level of the state's mathematics learning standards. Schools volunteered to pilot eight tests in May of 1999. This sampler reflects those items and the responses by students on those items.

Similar to the Mathematics A Regents Examination, the Mathematics B Regents Examination requires the student to answer all the questions on the test and over 50% of the items will be in context or an application. Students will have access to a formula page, somewhat similar to that provided on the Sequential Course III Regents Examination. Students will need a ruler, a compass and a graphing calculator for this test. Some details on the use of graphing calculators follow.

Use of Graphing Calculators on the Mathematics B Regents Examination

Students will be required to use a graphing calculator for the Mathematics B Regents Examination, as noted on page 117 of the *Mathematics Resource Guide with Core Curriculum.* The calculator used **cannot** have a CAS system that does symbolic manipulation. Calculators that communicate with other calculators are likewise **prohibited.**

It is expected that students using these utilities are capable of performing the following tasks:

1) Performing basic arithmetic and algebraic operations as found on a scientific calculator
2) Graphing algebraic, trigonometric, exponential and logarithmic functions in an appropriate viewing window
3) Determining roots of functions and the point(s) of intersection(s) of curves
4) Determining an equation of the lines of best fit: linear, logarithmic, exponential, or power
5) Determining a linear correlation coefficient.

For further detail of what students, using a graphing calculator, must show on the examination, please see the general directions to the student.

THE UNIVERSITY OF THE STATE OF NEW YORK

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS B

TEST SAMPLER FALL 1999

GENERAL DIRECTIONS TO THE STUDENT

Answer all questions in this examination. Each correct answer will receive the credits noted for that part. A formula sheet, which you may need to answer some questions in this examination, is included.

No partial credit will be allowed on the multiple-choice section, Part I. Record your answers in the spaces provided on the separate answer sheet for Part I.

For Parts II, III and IV, clearly indicate the necessary steps, including formula substitutions, diagrams, graphs, charts, etc. For all questions in these parts, a correct numerical answer with no work shown will receive only 1 credit.

If a graphing calculator is used to answer a graphing question, you are expected to show each of the following:
1) A sketch of the viewing window
2) Scales indicated on the x and y axis
3) Clearly labeled x and y intercepts and points of intersections, if needed for the solution.

When answering statistics questions using the graphing calculator, you are expected to show the following:
1) For standard deviation questions, indicate the number of scores, the mean, and the population standard deviation
2) For regression lines, write the regression equation and, if needed, show the substitution in that equation for interpolations or extrapolations
3) For linear correlation coefficient items include the equation of the regression line and specify how you used the linear correlation coefficient in your solution.

Formulas

Area of Triangle

$K = \frac{1}{2}ab \sin C$

Functions of the Sum of Two Angles

$\sin (A + B) = \sin A \cos B + \cos A \sin B$
$\cos (A + B) = \cos A \cos B - \sin A \sin B$

Functions of the Difference of Two Angles

$\sin (A - B) = \sin A \cos B - \cos A \sin B$
$\cos (A - B) = \cos A \cos B + \sin A \sin B$

Law of Sines

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Law of Cosines

$a^2 = b^2 + c^2 - 2bc \cos A$

Functions of the Double Angle

$\sin 2A = 2 \sin A \cos A$
$\cos 2A = \cos^2 A - \sin^2 A$
$\cos 2A = 2 \cos^2 A - 1$
$\cos 2A = 1 - 2 \sin^2 A$

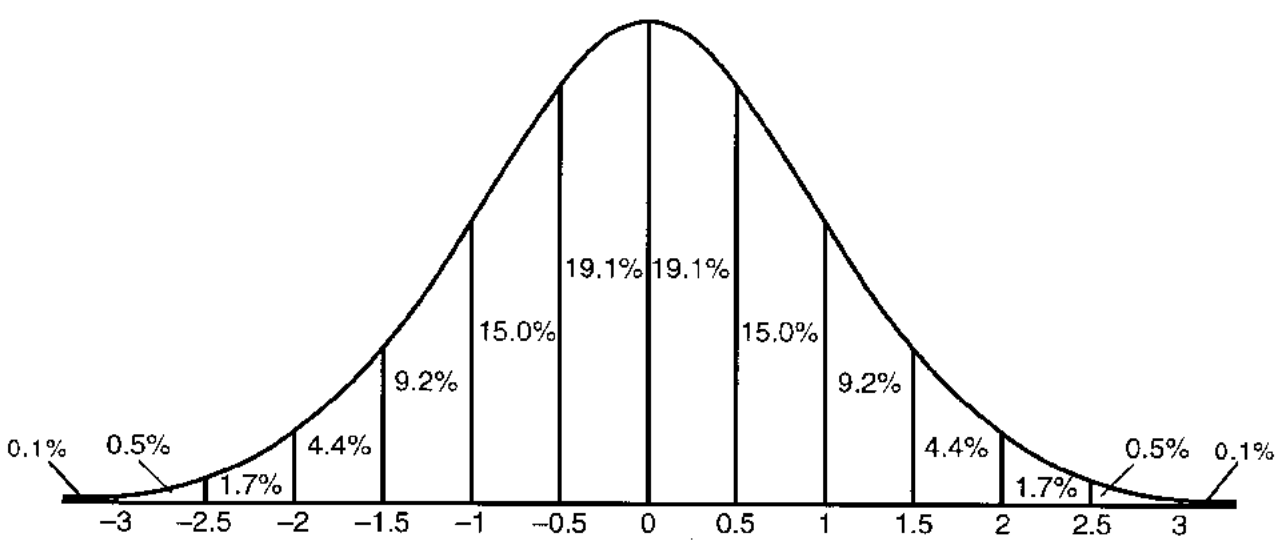
Functions of the Half Angle

$$\sin \tfrac{1}{2}A = \pm\sqrt{\frac{1 - \cos A}{2}}$$

$$\cos \tfrac{1}{2}A = \pm\sqrt{\frac{1 + \cos A}{2}}$$

Normal Curve

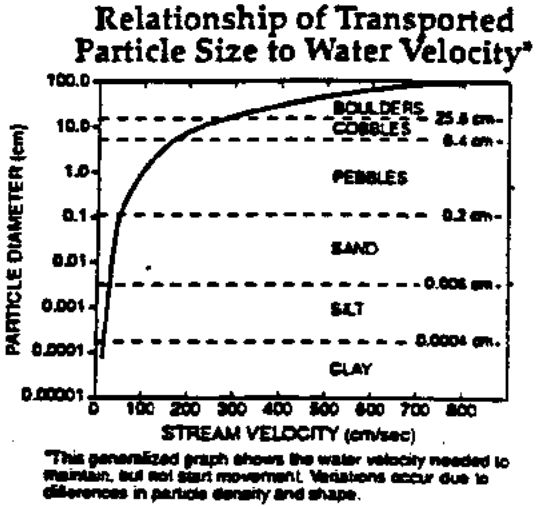
Standard Deviation



Part I

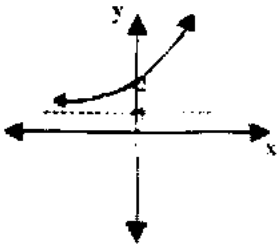
Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Record your answers in the spaces provided on the separate answer sheet [40]

1. The graph below represents the relationship of transported particle size to water velocity? The graph best models which type of function?

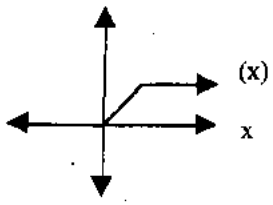


(1) linear
(2) quadratic
(3) logarithmic
(4) trigonometric

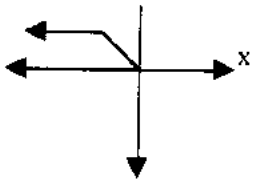
2. The graph below can be represented by which equation?

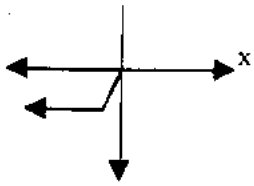


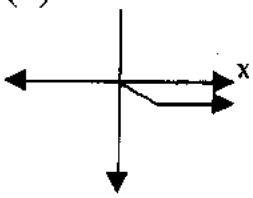
(1) $y = 2^x$
(2) $y = x^2 + 2$
(3) $y = 2^{x+1}$
(4) $y = 2^x + 1$

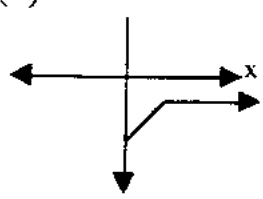
3. If the graph of f(x) is 

which of the following is the graph of –f(x)?

(1) 

(2) 

(3) 

(4) 

4. The expression $\log_2(x-4)$ is undefined for all values of x such that

(1) $x > 1$
(2) $x > 0$
(3) $x \leq 4$
(4) $x \leq 0$

5. If x is an acute angle, and $\cos x = \frac{4}{5}$, then $\cos 2x$ is equal to

(1) $\frac{6}{25}$
(2) $\frac{-1}{25}$
(3) $\frac{2}{25}$
(4) $\frac{7}{25}$

6. Which expression is equivalent to $\frac{\sqrt{7}+\sqrt{2}}{\sqrt{7}-\sqrt{2}}$?

(1) $\frac{9}{5}$
(2) -1
(3) $\frac{9+2\sqrt{14}}{5}$
(4) $\frac{11+\sqrt{2}}{14}$

7. Solve for x: $64^{x-2} = 256^{2x}$

(1) $\frac{-6}{11}$ (3) $\frac{-1}{5}$

(2) $\frac{-6}{5}$ (4) 0

8. If $y = 2^x$ and $y = \left(\frac{1}{2}\right)^x$ are graphed on the same set of coordinate axes, which transformation would map one of these curves onto the other?

(1) reflection in the y-axis
(2) reflection in the x-axis
(3) reflection in the line y = x
(4) reflection in the origin

9. Which is the correct arrangement of these terms in order of value, from smallest to greatest?

(1) $3\sqrt{2}$, $4\frac{1}{8}$, $|-4.24|$, $\sqrt[3]{75}$

(2) $\sqrt[3]{75}$, $|-4.24|$, $4\frac{1}{8}$, $3\sqrt{2}$

(3) $4\frac{1}{8}$, $\sqrt[3]{75}$, $|-4.24|$, $3\sqrt{2}$

(4) $4\frac{1}{8}$, $|-4.24|$, $\sqrt[3]{75}$, $3\sqrt{2}$

10. The points in the scatter plot below represent the ages of automobiles and their values. Based on this scatter plot, it would be reasonable to conclude:

(1) Age and value have a coefficient of correlation that is less than zero.
(2) Age and value have a coefficient of correlation that is equal to zero.
(3) Age and value have a coefficient of correlation that is between zero and 0.5.
(4) Age and value have a coefficient of correlation that is greater than 0.5.

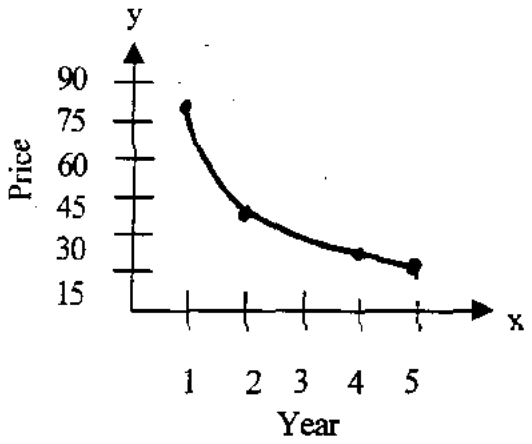
11. Written in simplest form, the expression $\frac{x^2y - 4}{4 - x^2y}$ is:

(1) 1
(2) 0
(3) $\frac{x^2y - 4}{4 - x^2y}$
(4) -1

12. The scores on a 100 point exam are normally distributed with a mean of 80 and a standard deviation of 6. A student's score places him between the 69th and 70th percentile. Which of the following best represents his score?

(1) 66
(2) 81
(3) 84
(4) 86

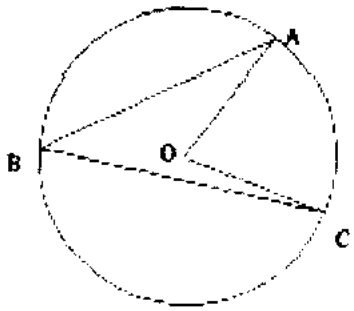
13. The price of a certain stock has decreased over 5 years, as shown in the graph below. Which of the following equations best represents this graph?



(1) $y = 60x^2$ (3) $y = 63 \log x$

(2) $y = \frac{80}{x}$ (4) $y = -25x$

14. In the diagram below, circle O has m $\angle ABC = z$. What is m $\angle AOC$?



(1) z (3) $\frac{1}{2}z$

(2) 2z (4) z^2

15. A model rocket is launched from ground level. Its height, h meters above the ground, is a function of time t seconds after launch and is given by the equation $h = -4.9t^2 + 68.6t$. What would be the maximum height, to the nearest meter, attained by the model?

(1) 243 (3) 241
(2) 242 (4) 240

16. The population of Henderson City was 3,381,000 in 1994, and is growing at an annual rate of 1.8%. If this growth rate continues, what will the approximate population of Henderson City be in the year 2000?

(1) 3,696,000
(2) 3,763,000
(3) 3,798,000
(4) 3,831,000

17. The center and radius of the given circle $(x - 3)^2 + (y + 8)^2 = 39$ are:

(1) $(3, -8)$, $r = 39$
(2) $(-3, -8)$, $r = \sqrt{39}$
(3) $(-3, 8)$, $r = \sqrt{39}$
(4) $(3, -8)$, $r = \sqrt{39}$

18. A fair coin is tossed 5 times. What is the probability that it lands tails up exactly 3 times?

(1) $\left(\frac{1}{2}\right)^3$
(2) $\frac{3}{5}$
(3) $10\left(\frac{1}{2}\right)^5$
(4) $10\left(\frac{1}{2}\right)^3$

19. If $f(x) = 2 \sin 3x + C$, then the maximum value of $f(x)$ is:

(1) C
(2) C + 2
(3) C + 3
(4) C + 6

20. The origin of a coordinate grid is labeled A. Line segment AB forms an angle of 30° with the x-axis. If AB=8, the coordinates of B are:

(1) (6, 4)
(2) $(8 \cos 30^\circ, 8 \sin 30^\circ)$
(3) $(8 \sin 30^\circ, 8 \cos 30^\circ)$
(4) $(4, 4\sqrt{3})$

Part II

Answer all questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including formula substitution, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [12]

21. Show that the following can be ordered from smallest to largest for all $x > 1$. Describe the method you used and state the correct order.

$$1, \quad x, \quad \sqrt{x}, \quad \frac{1}{x}, \quad \text{and} \quad \frac{1}{\sqrt{x}}$$

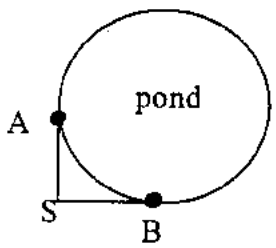
22. Jim can drive a golf ball over 220 yards 40% of the time. He regularly plays on a golf course where drives of that distance are needed on 12 holes. Determine the probability that exactly 7 of his drives will be over 220 yards.

23. The period of a pendulum (T), in seconds, is the length of time it takes for the pendulum to make one complete swing back and forth. The formula $T=2\pi\sqrt{\frac{L}{32}}$ gives the period T for a pendulum of length L in feet. If you want to build a grandfather clock with a pendulum that swings back and forth once every 3 seconds, how long, *to the nearest tenth of a foot*, would you make the pendulum?

24. A survey of the soda drinking habits of the population in a high school revealed the mean number of cans of soda consumed per person per week to be 20 with a standard deviation of 3.5. If a normal distribution is assumed, find an interval that the total number of cans per week approximately 95% of the population of this school will drink. Explain why you selected that interval.

25. Given two lines whose equations are $3x + y - 8 = 0$ and $-2x + by + 9 = 0$, determine the value of b such that the two lines will be perpendicular.

26. Two docks, A and B, are located on a circular pond as shown in the diagram below. A surveyor wants to determine the distance these two docks are from each other across the pond. The surveyor, located at point S, knows that he is 200 yards from both docks, and his measuring equipment indicates that there is a 90° angle between his sight lines to dock A and to dock B. How far, to the nearest tenth of a yard, is it across the pond from dock A to dock B?



Part III

Answer all questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including formula substitution, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [24]

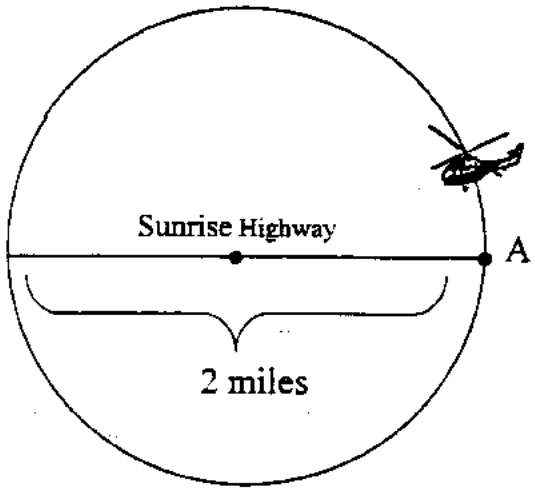
27. Sketch the graph of the functions $f(x) = 3^x$ and $g(x) = \log_3 x$. Considering the graphs, describe the relationship between $f(x)$ and $g(x)$. Specify the domain and the range of g.

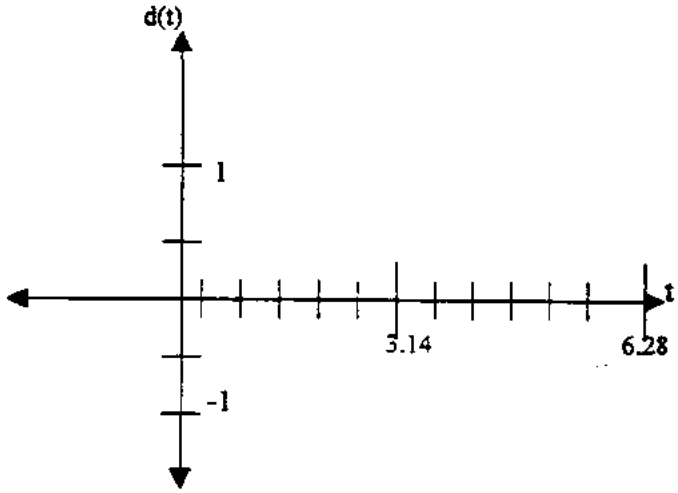
28. Solve the equation $x^2 = 6x - 12$ and express the roots in simplest $a + bi$ form.

29. The Vietnam Veteran's Memorial in Washington, DC consists of two walls of black, polished granite, each 246.75 feet long, which meet at an angle of 125.2°. If extended, the west wall would reach to the Lincoln Memorial, 900 feet away from the end of the wal,l and the east wall would reach to the Washington Monument 3,500 feet away from the end of the wall. Find the distance between the Lincoln Memorial and the Washington Monument to the nearest foot.

30. In the equation $y = 0.5(1.21^x)$, y represents the number of snowboarders in millions and x represents the number of years since 1988. Find the year in which the number of snowboarders will be 10 million for the first time. (Only an algebraic solution will be accepted.)

31. A helicopter, starting at point A on Sunrise Highway, circles a 2-mile section of the highway in a counterclockwise direction. If the helicopter is traveling at a constant speed and it takes approximately 6.28 minutes to make one complete revolution to return to point A, sketch a possible graph of distance (dependent variable) from the helicopter to the highway, versus time (independent variable). If the helicopter is north of the highway, distance (d) is positive; if the helicopter is south of the highway, distance (d) is negative. (Disregard the height of the helicopter.) State the equation of this graph.



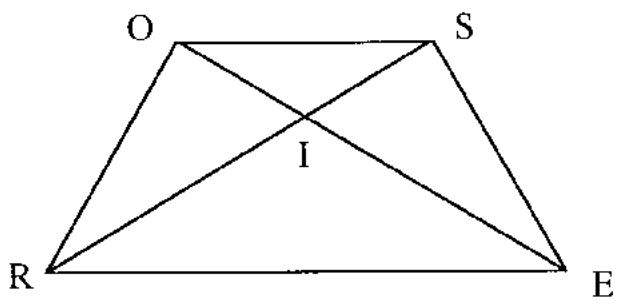


32. If an arc of 60° on circle A has the same length as an arc of 45° on circle B, what is the ratio of the area of circle B to the area of circle A?

Part IV

Answer all questions in this part. Each correct answer will receive 6 credits. Clearly indicate the necessary steps, including formula substitution, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [12]

33. Given trapezoid ROSE with diagonals $\overline{RS}$ and $\overline{EO}$ intersecting at point I, prove that the diagonals of the trapezoid do *not* bisect each other.



34. The volume of a particular gas was determined at various pressures. P is the pressure (in atmospheres) and is the independent variable on the horizontal axis, and V is the volume (in liters) and is the dependent variable on the vertical axis:

create a scatter plot and find the equation of the curve of best fit. (Round answer constants to nearest tenth.) and

then, using the regression equation found, estimate V if P = 2.5.

P	V
0.1	225
0.3	74.999
0.5	45
0.7	32.139
0.9	25
1.1	20.45
1.5	15
1.7	13.24
1.9	11.84
2.1	10.71
2.3	9.78

Scoring Guide

Following the answers to the multiple-choice items # 1-20 are the specific rubrics for the student constructed questions # 21-34. A complete and correct student response is provided for each of these open-ended questions. The response shows one example of how to solve the problem. In most cases there are other acceptable solutions.

In addition to a full credit response for all the questions # 21-34, one 2-pointer (# 24), one 4-pointer (# 30) and one 6-pointer (# 34) have been selected to show the full range of student responses.

Like the Mathematics A Regents Examination, the Mathematics B Regents Examination final scaled score will be determined by a conversion table. The raw score has a maximum of 88 points as follows:

Part I - 20 two point multiple-choice questions	40 points
Part II - 6 two point open-ended questions	12 points
Part III - 6 four point open-ended questions	24 points
Part IV - 2 six point open-ended questions	12 points

The conversion chart will be constructed through a standard setting procedure similar to the one used for all new Regents examinations.

Answers Key for Multiple Choice Items

1. 3	6. 3	11. 4	16. 2
2. 4	7. 2	12. 3	17. 4
3. 3	8. 1	13. 2	18. 3
4. 3	9. 3	14. 2	19. 2
5. 4	10. 1	15. 4	20. 2

PART II

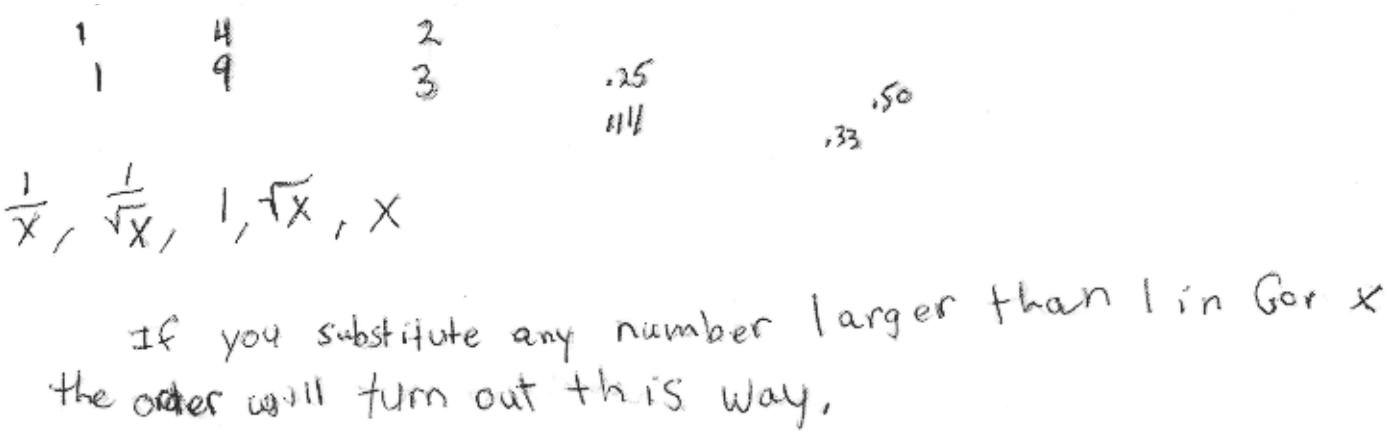
21. Arrange the following numbers in order from smallest to largest if 1 < x, and show or describe your method.

1 , x , $\sqrt{x}$, $\frac{1}{x}$, and $\frac{1}{\sqrt{x}}$

Rubric

[2 points]	$\frac{1}{x}$, $\frac{1}{\sqrt{x}}$, 1 , $\sqrt{x}$, x
	Explanation: $\sqrt{x}$ is less than x , therefore $x > \sqrt{x}$ for values $x > 1$; also expressed as a fraction $\frac{1}{\sqrt{x}} > \frac{1}{x}$ since for unit fractions the larger the denominator, the smaller the fraction)
OR	Equivalent explanation
OR	Uses a numerical value for x to establish order and then ranks the correctly in terms of x
[1 point]	Correct answer with no explanation
OR	At least three in the correct order with some supporting explanation
OR	Correctly orders an answer using a numerical value rather than "in terms of x" such as if x = 4 the order would be 1/4, 1/2, 1, 2, 4
[0 points]	Response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 2:

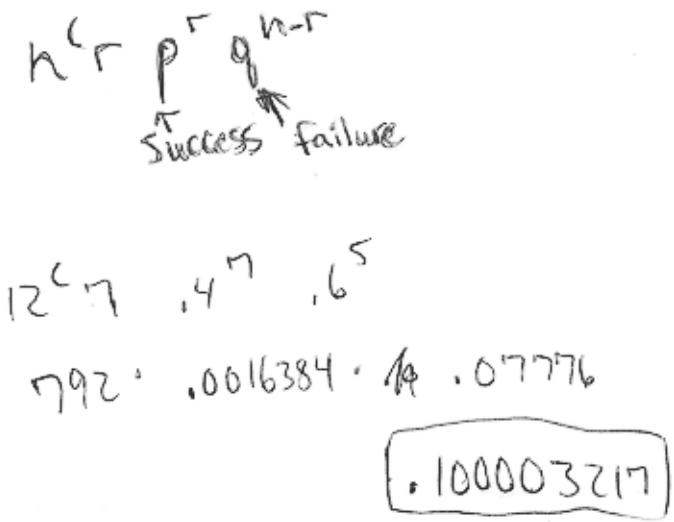


22. Jim can drive a golf ball over 220 yards 40% of the time. He regularly plays on a golf course where drives of that distance are needed on 12 holes. Determine the probability that exactly 7 of his drives on those 12 holes will be over 220 yards.

Rubric

[2 points]	0.1, 0.101, 0.099, or 10% or equivalent answer with appropriate work shown such as ${}_{12}C_7(0.4)^7(0.6)^5$
[1 point]	Finds an appropriate answer based on an incorrest value for one of the variables
OR	Makes correct substitutions, but has a rounding, percent conversion error, or arithmetic mistake.
OR	Correct answer with no work shown.
OR	Does not come to final answer, such as 792 $\left(\frac{128}{78125}\right)$ $\left(\frac{243}{3125}\right)$
[0 points]	Response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure.

Student work—Score 2:



23. The period of a pendulum (T), in seconds, is the length of time it takes for the pendulum to make one complete swing back and forth. The formula $T=2\pi\sqrt{\frac{L}{32}}$ gives the period T for a

pendulum of length L in feet. If you want to build a grandfather clock with a pendulum that swings back and forth once every 3 seconds, how long, to the nearest tenth of a foot, would you make the pendulum?

Rubric

[2 points]	Answer of 7.3, with appropriate substitution shown
[1 point]	Answer given, but not rounded correctly
OR	Correct answer only, no work shown
OR	Shows correct substitution, but answer is incorrect
OR	Log equation, no substitution of values
[0 points]	A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure
OR	Substitutes 3 for L

Student work—Score 2:

$$T = 2\pi\sqrt{\frac{L}{32}}$$

$$\frac{3}{2\pi} = \frac{\cancel{2\pi}\sqrt{\frac{L}{32}}}{\cancel{2\pi}}$$

$$\left(\frac{3}{2\pi}\right)^2 = \left(\sqrt{\frac{L}{32}}\right)^2$$

$$\cancel{\frac{L}{32} = \frac{9}{4\pi^2}}$$

$$4\pi^2 L = 288$$

$$\frac{39.478\,L}{39.478} = \frac{288}{39.478}$$

ans

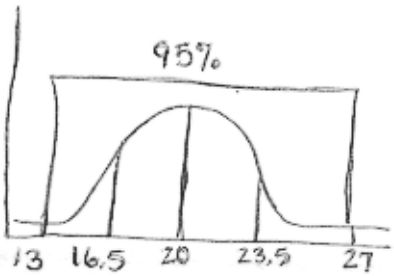
$$\boxed{L = 7.3\text{ft}}$$

24. A survey of the soda drinking habits of the population in a high school revealed the mean number of cans of soda consumed per person per week to be 20 with a standard deviation of 3.5. If a normal distribution is assumed, find an interval that contains the total number of cans per week approximately 95% of the population of this school will drink. Explain why you selected that interval.

Rubric

[2 points]	Interval from 13 - 27, and correctly drawn and labeled curve with the correct explanation
OR	A statement explaining how to interpret the curve and the correct answer, but no curve drawn
[1 point]	Makes a mathematical error
OR	Has the correct answer based on an incorrect curve
OR	Just has a correct answer with no curve drawn, and no explanation of the curve
[0 points]	Response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 2:

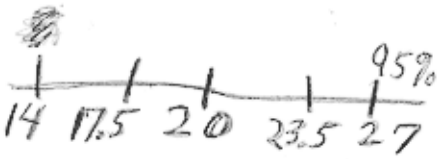


13-27

13-27 is the answer because 95% is two standard deviations away from the mean. 7 is subtracted and added to 20 ∴ the answer is 13-27.

Student work—Score 1:

20 cans



14-27 cans

The rule is that 2 deviations over are 95%.

25. Given two lines whose equations are $3x + y - 8 = 0$ and $-2x + by + 9 = 0$, determine the value of b such that the two lines will be perpendicular.

Rubric

[2 points]	b = 6 by determining the slopes of both lines, sets $\frac{2}{b}$ = negative reciprocal slope of -3 (ie. 1/3).
OR	b = 6 by determining the product of the slopes = -1
[1 point]	sets $\frac{2}{b} = -3$ and solves for b = $\frac{-2}{3}$
	OR Finds slope of perpendicular as $\frac{1}{3}$, but does not solve b
	OR b = 6 and no work shown
[0 points]	Does not identify slopes
OR	A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 2:

$3x + y - 8 = 0$

$3x + y = 8$

$y = -3x + 8$

$\boxed{m = -3}$

The slopes (m) are negative reciprocals and are perpendicular.

$-2x + by + 9 = 0$

$-2x + by = -9$

$\frac{by}{b} = \frac{2x - 9}{b}$

$y = \frac{2x - 9}{b}$

$y = \frac{2x - 9}{6}$

$\frac{2}{x} = \frac{1}{3}$

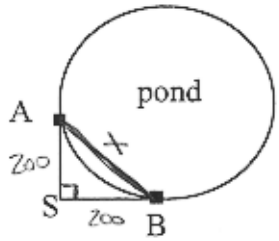
$b = 6$

26. Two docks are located on a circular pond as shown in the diagram below. A surveyor wants to determine the distance these two docks are from each other across the pond. The surveyor, located at point S, knows that he is 200 yards from both dock A and dock B, and his measuring equipment indicates that there is a 90° angle between his sight line to dock A and to dock B. How far, to the nearest tenth of a yard, is it across the pond from dock A to dock B?

Rubric

[2 points]	282.8 using an appropriate method such as law of cosines, Pythagorean Theorem, right triangle trig or special right triangle 45, 45, 90
[1 point]	Gives a correct answer of 282.8 with no work shown
OR	Gives an incorrectly rounded answer such as 283, or 282.84, or 282
OR	Uses the Pythagorean Theorem correctly, but makes an incorrect substitution for one of the sides, and then rounds correctly
OR	Uses an appropriate method, but makes a calculation mistake and then rounds answer correctly
[0 points]	A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 2:



$200^2 + 200^2 = x^2$

$80{,}000 = x^2$

$\boxed{x = 282.8 \text{ YARDS}}$

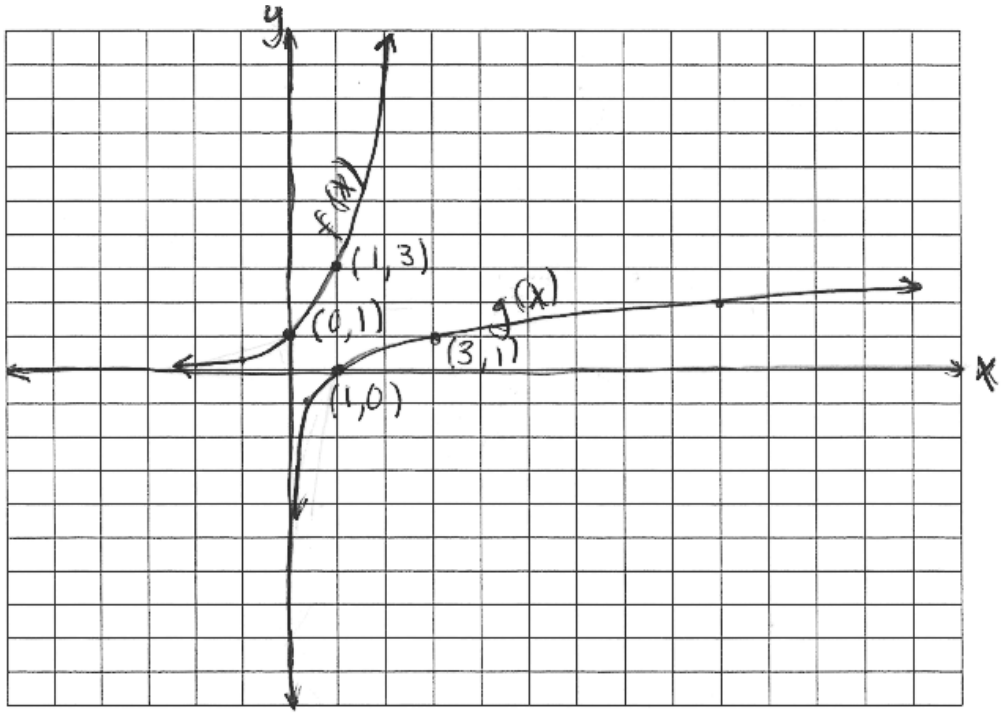
PART III

27. Sketch the graph of the functions $f(x) = 3^x$ and $g(x) = \log_3 x$. Considering the graphs, describe the relationship between f(x) and g(x). Specify the domain and the range of g.

Rubric

[4 points]	Correct graphs, relationship, domain, and range: f (x) and g (x) are reflections in the line y = x or f (x) and g (x) are inverses. and Domain of g: The set of all real numbers such that x > 0 and Range of g: The set of all real numbers
[3 points]	Correct graphs and relationship; incorrect domain and/or range
OR	Correct graphs, domain, and range; incorrect relationship
OR	One correct graph; correct relationship, domain, and range
[2 points]	Correct graphs; incorrect relationship, and domain and/or range
OR	Incorrect graphs; correct relationship and domain and range
OR	One correct graph and either relationship, or domain and range correct
[1 point]	No graphs, or incorrect graph with correct relationship
OR	No graphs, or incorrect graphs with correct domain and range
OR	One correct graph only
[0 points]	Response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 4:



f(x) and g(x) ~~of~~ are inverse functions

domain ~~of~~ of g(x) ~~[illegible]~~ : x>0

range of g(x) : y = ℝ

28. Solve the equation $x^2 = 6x - 12$ and express the roots in simplest a + bi form.

Rubric

[4 points]	Finds $3 + i\sqrt{3}$ and $3 - i\sqrt{3}$, or $3 + 1.73i$ and $3 - 1.73i$ by using the quadratic formula or some other valid method
[3 points]	Finds a correct answer, but does not simplify
OR	Uses a correct procedure, but makes an arithmetic mistake or simplifies improperly
OR	Finds incorrect roots based upon a mistake in the quadratic formula which keeps the dis criminant negative
[2 points]	Writes a correct equation: $x^2 - 6x + 12 = 0$, and a correct discriminant of $i\sqrt{12}$ or $2i\sqrt{3}$, but incorrect roots
OR	Uses a correct procedure, but makes more than one error
[1 point]	Writes the correct equationonly
	OR Obtains correct answer, but no work is shown
[0 points]	Response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 4:

$x^2 - 6x + 12 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{6 \pm \sqrt{36 - 4(1)(12)}}{2}$$

$$x = \frac{6 \pm \sqrt{36 - 48}}{2}$$

$$x = \frac{6 \pm \sqrt{-12}}{2}$$

$$x = \frac{6 \pm i\sqrt{(4)(3)}}{2}$$

$$x = \frac{\cancel{6}^{3} \pm \cancel{2}^{1} i\sqrt{3}}{\cancel{2}_{1}}$$

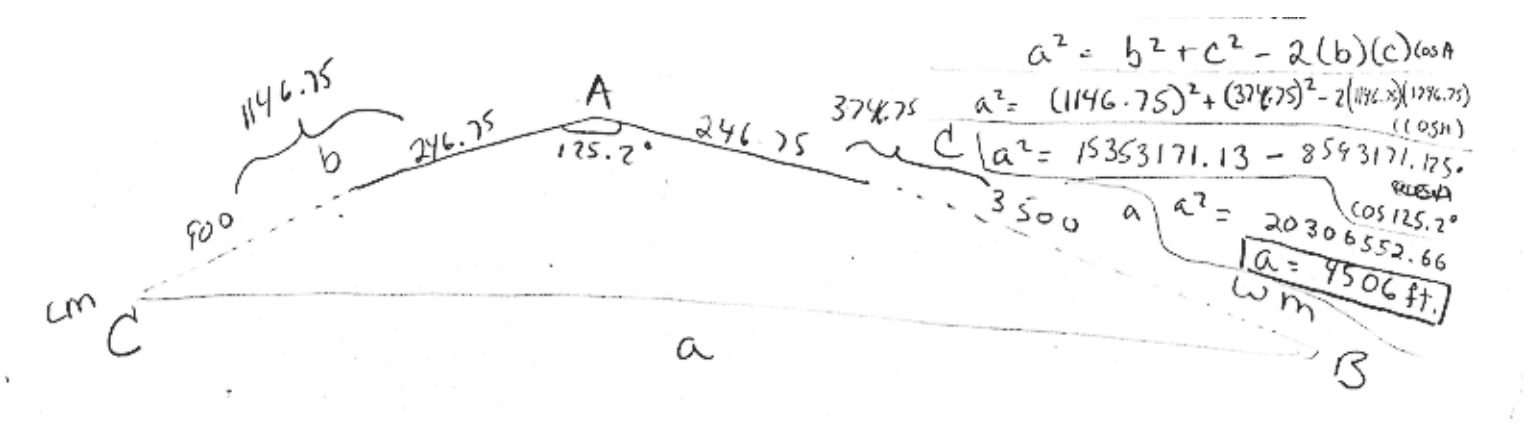
$$\boxed{x = 3 + i\sqrt{3} \quad \Big| \quad x = 3 - i\sqrt{3}}$$

29. The Vietnam Veteran's Memorial in Washington, DC consists of two walls of black, polished granite, each 246.75 feet long, which meet at an angle of 125.2^{o}. If extended, the west wall would reach to the Lincoln Memorial, 900 feet away from the end of the wall, and the east wall would reach to the Washington Monument 3,500 feet away from the end of the wall. Find the distance between the Lincoln Memorial and the Washington Monument to the nearest foot.

Rubric

[4 points]	4506 and shows an appropriate application of the Law of Cosines such as $a^2 = 1146.75^2 + 3746.75^2 - 2\,(1146.75)\,(3746.75)\cos 125.2^{o}$
[3 points]	Makes an appropriate application of the Law of Cosines, but does not add the wall length to the distances. (answer 4086)
OR	Uses the appropriate method, but makes a minor mathematical or rounding error
OR	4506 showing a correct diagram but showing no Law of Cosines
[2 points]	Correctly uses the Law of Cosines, with or without the wall added, but does not find the square root.
OR	Uses Law of Cosines without the wall added and makes a minor mathematical mistake
OR	Finds the distance between the ends of the two walls (answer 438) using the Law of Sines or Cosines
[1 point]	Obtains the correct answer of 4506, but does not show any work
OR	Sets up diagram with correct sides (1146.75 and 3746.75) and angle, but does not solve problem
[0 points]	Response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 4:



30. In the equation $y = .5(1.21^x)$, y represents the number of snowboarders in millions and x represents the number of years since 1988. Find the first year in which the number of snowboarders will be 10 million. (Only an algebraic solution will be accepted.)

Rubric

[4 points]	2003 or 2004 (since the calculator yields 15.7 either year is acceptable) and correctly solves the log problem algebraically with work shown
[3 points]	Algebraically solves, with work shown, for 15.7, but does not find the correct year
OR	Makes a computational error in solving the log problem, but uses the answer to find a year
[2 points]	Sketches a graph and gets 15.7, and finds the year
OR	Uses trail and error method (with at least 3 trials) and finds the correct year
OR	Tries to use logs and makes multiple mechanical errors, but finds a year
OR	Sets up correct log equation
[1 point]	Finds 15.7, or gives the year with no work shown
OR	Sets equation equal to 10 or 10,000,000 but does not solve
[0 points]	Response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 4:

$$y = .5(1.21^x)$$

$$\frac{10}{.5} = \frac{.5(1.21^x)}{.5}$$

$$20 = 1.21^x$$

$$\frac{\log 20}{\log 1.21} = \frac{x \log 1.21}{\log 1.21}$$

$$\frac{\log 20}{\log 1.21} = x$$

$$15.71569941 = x$$

$$16 = x$$

$$\begin{array}{r} 1988 \\ +\ 16 \\ \hline 2004 \end{array}$$

2004

Student work—Score 3:

$$10\,000\,000 = 0.5(1.21^x)$$
$$20\,000\,000 = 1.21^x$$
$$\log 20\,000\,000 = \log 1.21^x$$
$$\log 20\,000\,000 = x \log 1.21$$
$$\frac{\log 20\,000\,000}{\log 1.21} = x$$

88 yrs. = x

$$\begin{array}{r} 1988 \\ +\ 88 \\ \hline \end{array}$$

in year $\boxed{2076}$ there will be 10 million

Student work—Score 2:

$$10 = .5(1.21^x)$$
$$20 = 1.21^x$$
$$\log 20 = x \log 1.21$$

Student work—Score 1:

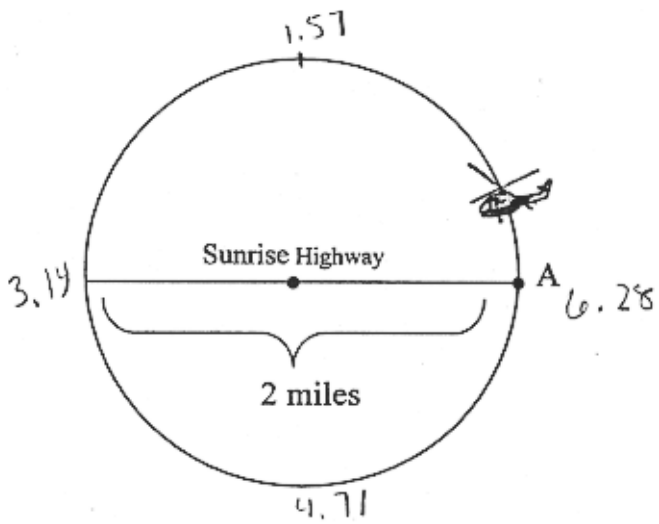
$$10 = .5(1.21^x)$$
$$20 = (1.21^x)$$

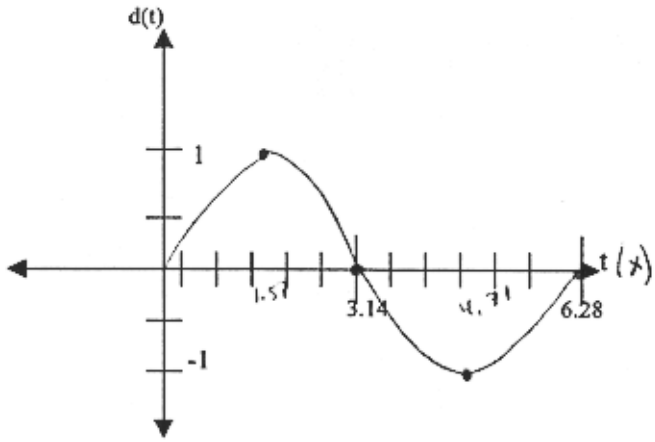
31. A helicopter, starting at point A on Sunrise Highway, circles a 2-mile section of the highway in a counterclockwise direction. If the helicopter is traveling at a constant speed and it takes approximately 6.28 minutes to make one complete revolution to return to point A, sketch a possible graph of distance (dependent variable) from the helicopter to the highway, versus time (independent variable). If the helicopter is north of the highway, distance (d) is positive; if the helicopter is south of the highway, distance (d) is negative. (Disregard the height of the helicopter.) State the equation of this graph.

Rubric

[4 points]	Correct graph of d(t) = sin t over the specified interval and a correct equation written
[3 points]	Correct graph with an incorrect equation, such as y = sinx, or graph contains minor flaws
[2 points]	Incorrect trig graph with an appropriate equation such as y = - sinx
OR	Correct trig graph with incorrect equation or no equation, such as d(t) = cost.
[1 point]	Identifies sine function correctly, but no work and no graph are shown
OR	Recognizes the graph as a form of the sine function, such as d(t) = -sin t and graph contains minor flaws
[0 points]	A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 4:





6.28 ÷ 4 = 1.57

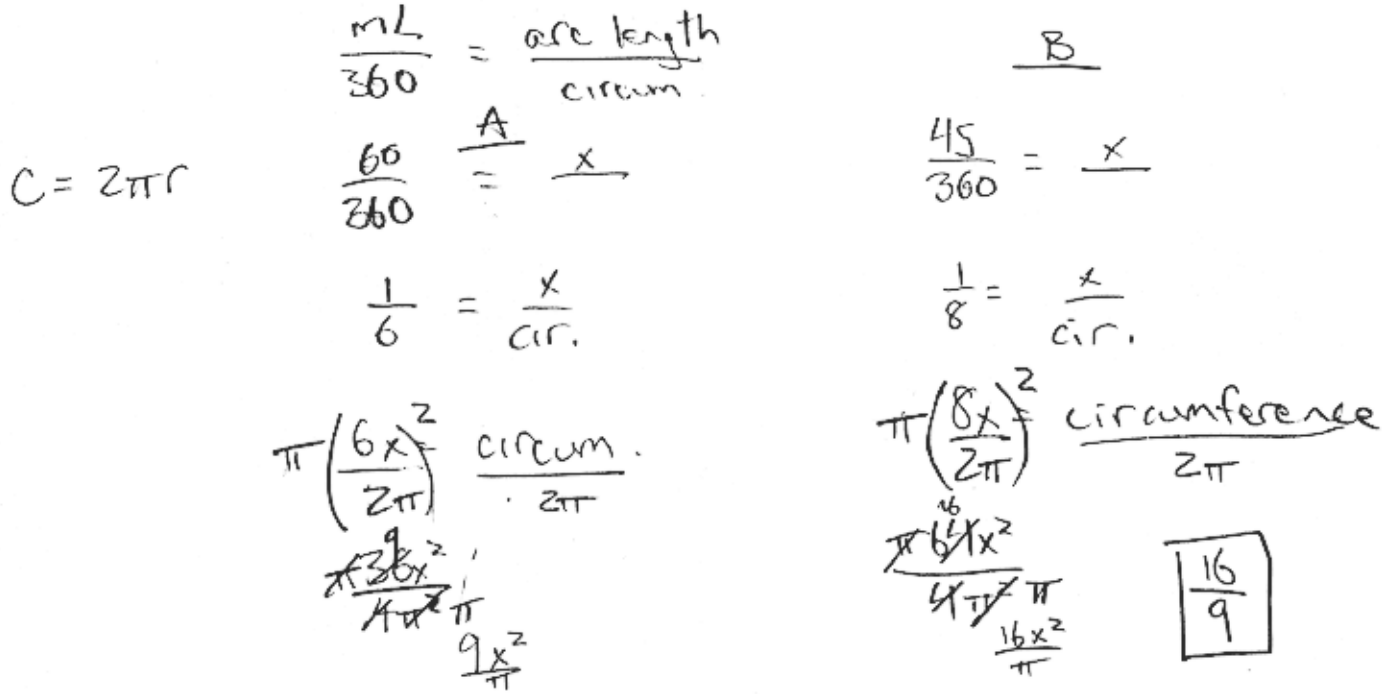
d(t) = sin(t)

32. If an arc of 60° on circle A has the same length as an arc of 45° on circle B, what is the ratio of the area of circle B to the area of circle A?

Rubric

[4 points]	16/9 or 16:9 is found by determining the ratio of their radii and the correct areas ratio.
[3 points]	Incorrectly identifies radian measure, but produces a ratio based on areas.
OR	Incorrect statement of correct area ratio such as 9:16
[2 points]	Gets correct ratio of radii, but uses $C = 2\pi r$, instead of $A = \pi r^2$ giving answer of 4:3
[1 point]	Finds correct ratio of radii, 4:3 only.
OR	16/9 with no work.
[0 points]	A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure.

Student work—Score 4:



PART IV

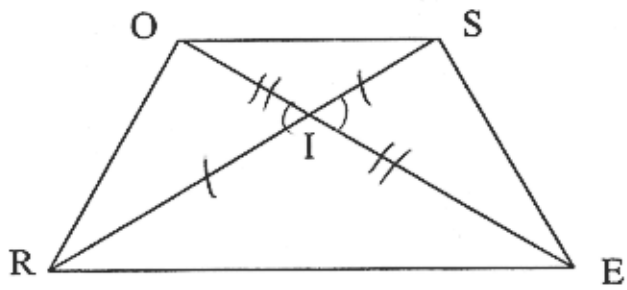
33. Given trapezoid ROSE with diagonals RS and EO intersecting at point I, prove that the diagonals of the trapezoid do not bisect each other.

Rubric

Proof: Statements	Reasons
1. Trapezoid ROSE with diagonals $\overline{RS}$ & $\overline{EO}$ intersecting at Point I	1. Given
2. $\overline{OS}$ ll $\overline{RE}$	2. A trapezoid is quadrilateral with 1 & only 1 pair of ll sides
3. Assume diagonals bisect each other . . RI = IS, OI = EI	3. definition of a bisector
4. ∠RIO ≅ ∠EIS	4. If 2 lines intersect, the vertical ∠s are =
5. triangle RIO ≅ triangle EIS	5. SAS = SAS
6. ∠ORI ≅ ∠ESI	6. cpctc
7. $\overline{OR}$ ll $\overline{SE}$	7. If 2 lines are cut by a transversal, & the alternate interior ∠s are ≅ , the lines are ll
8. Contradiction by definition of a trapezoid, which has only one pair of parallel sides	
9. Therefore the diagonals do not bisect each other	

[6 points]	Complete and correct proof (statement and reason or paragraph form)
[5 points]	1 statement and/or reason incorrect/incomplete, but leads to the conclusion
[4 points]	No or incorrect conclusion drawn to correct proof of parallel lines OR and SE
OR	2 statements and/or reasons incorrect/incomplete, but leads to proper conclusion
[3 points]	Partial proof, missing more than two steps, with correct conclusion
[2 points]	Assumes bisection and only proves triangles congruent
[1 point]	Gives proper assumption and conclusion only
[0 points]	A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 6:



1. Given $\overline{OS} \parallel \overline{RE}$	1. Def of trapezoid
2. Assume $\overline{RI} \cong \overline{IS}$, $\overline{EI} \cong \overline{IO}$	2. Def. of bisector
3. $m\angle OIR = m\angle SIE$	3. Vertical ∠s are =.
4. $\triangle IOR \cong \triangle IES$	4. SAS
5. $\angle ORS \cong \angle ESR$	5. CPCTC
6. $\overline{OR} \parallel \overline{SE}$	6. If 2 lines are cut by transversal with congruent alternate interior ∠s, the lines are ∥
7. Contradiction	7. Def of trapezoid – only one pair of ∥ sides
8. ∴ $RI \neq IS$, $EI \neq IO$ The diagonals do not bisect each other	

34. The volume of a particular gas was determined at various pressures. P is the pressure (in atmospheres) and is the independent variable on the horizontal axes, and 'V' is the volume (in liters) and is the dependent variable on the vertical axes:

Create a scatter plot and find the curve of best fit. (Round answer constants to nearest tenth.) and
Then, using the regression equation found in Part A, estimate V if P = 2.5.

P	V
0.1	225
0.3	74.999
0.5	45
0.7	32.139
0.9	25
1.1	20.45
1.5	15
1.7	13.24
1.9	11.84
2.1	10.71
2.3	9.78

Rubric

6 points]	Correct scatterplot including labeled axes, equation of best fit ($V = 22.5\ P^{-1}$), and at P = 2.5, the value of V is 9
[5 points]	All correct but: no or improper labels on axes
OR	Incorrectly plotted points
OR	Arithmetic error finding the equation or V
[4 points]	Incorrect type of function for equation
OR	No labels on axes and some incorrectly plotted points
OR	No functional value at 2.5 and single graphing error
[3 points]	Completely incorrect graph, but correct equation and functional value at 2.5
OR	Correctly drawn graph, but no or incorrect equation, and no or incorrect functional value at 2.5
[2 points]	Correct scatterplot, but no labels on axes
OR	Correct equation only
[1 point]	Correct value at 2.5, but no work shown
OR	Correct scatter plot but minor errors on intervals of axes
[0 points]	A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure

Student work—Score 6:

quadratic ($R^2 = .7$)
$y = 78.3x^2 - 246.1x + 185.3$
logarithmic ($r = -.9$)
$y = 36.3 + -59.4 \ln x$

linear $r = -.7$
$y = -57.4x + 112.3$
* power ($r = -.9999\ldots$
$y = 22.5x^{-1}$

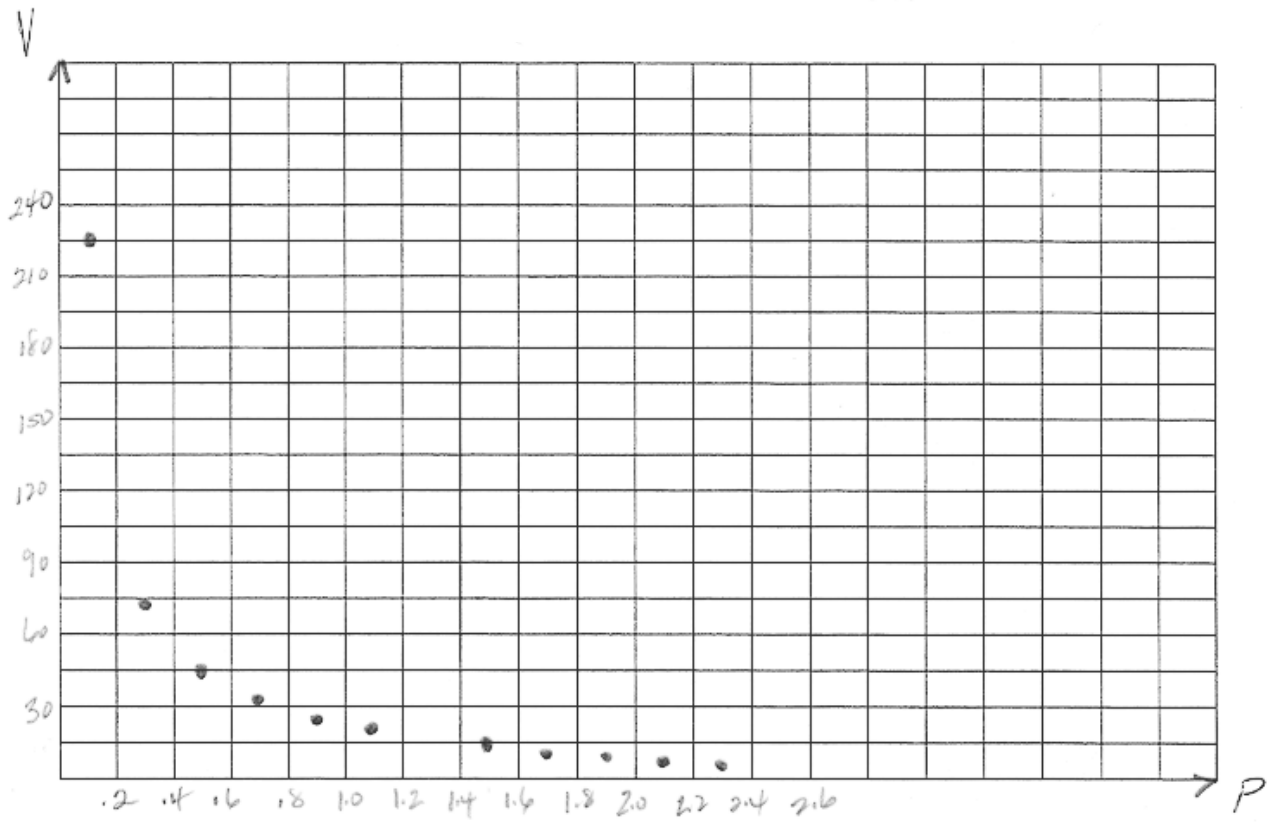
$P \to L1$
$V \to L2$

$\boxed{V = 22.5P^{-1}}$

$V = 22.5(2.5)^{-1}$
$\boxed{V = 9}$

[-.12, 2.52] by [-26.8074, 261.5874]

STATPLOT 1

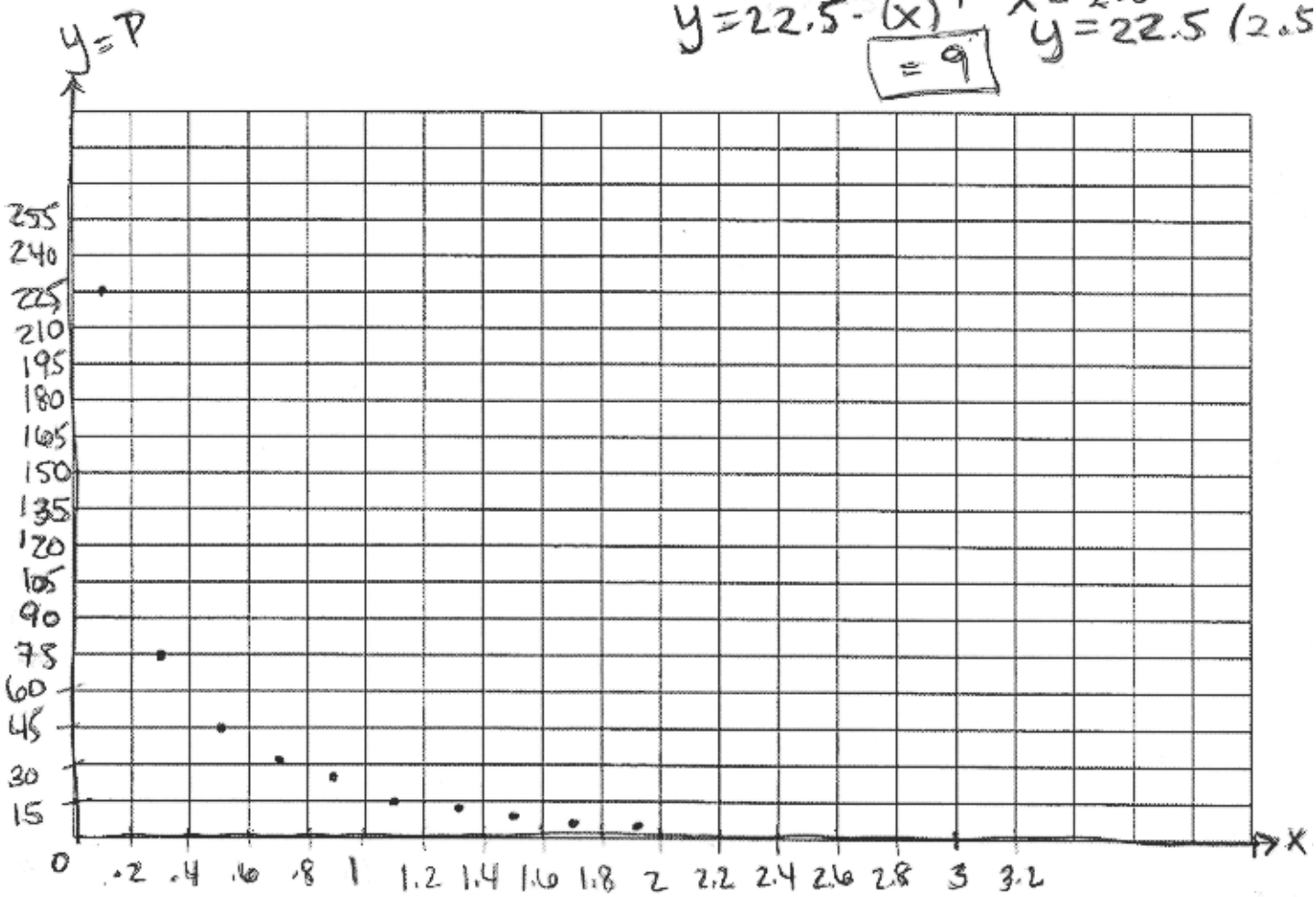


Student work—Score 5:

used Ti 83
Power Reg.

$y = 22.5 \cdot (x)^{-1}$

$y = 22.5 \cdot (x)^{-1}$ $x = 2.5$
$\boxed{= 9}$ $y = 22.5 / 2.5$



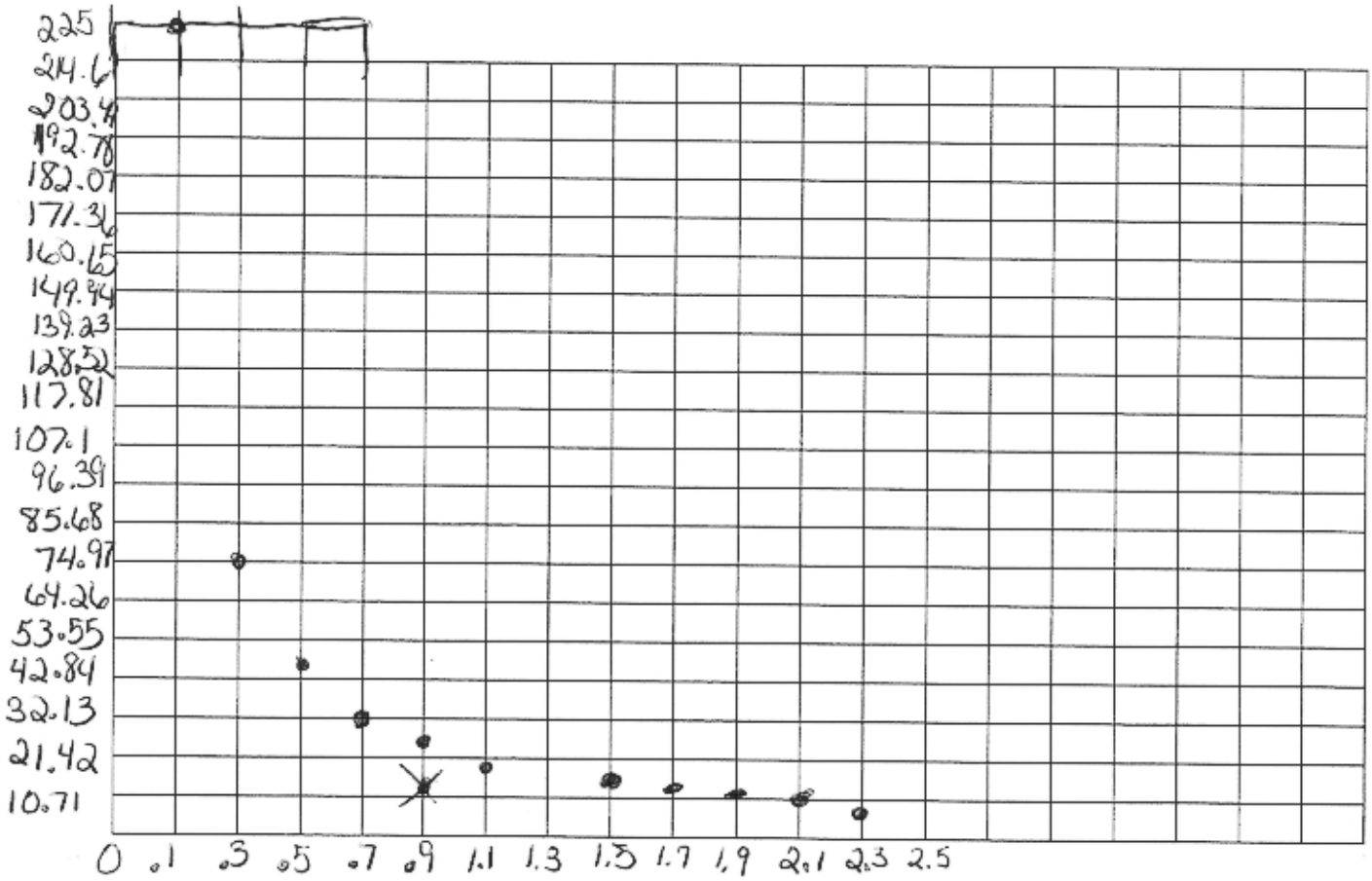
Student work—Score 4:

cubic regression

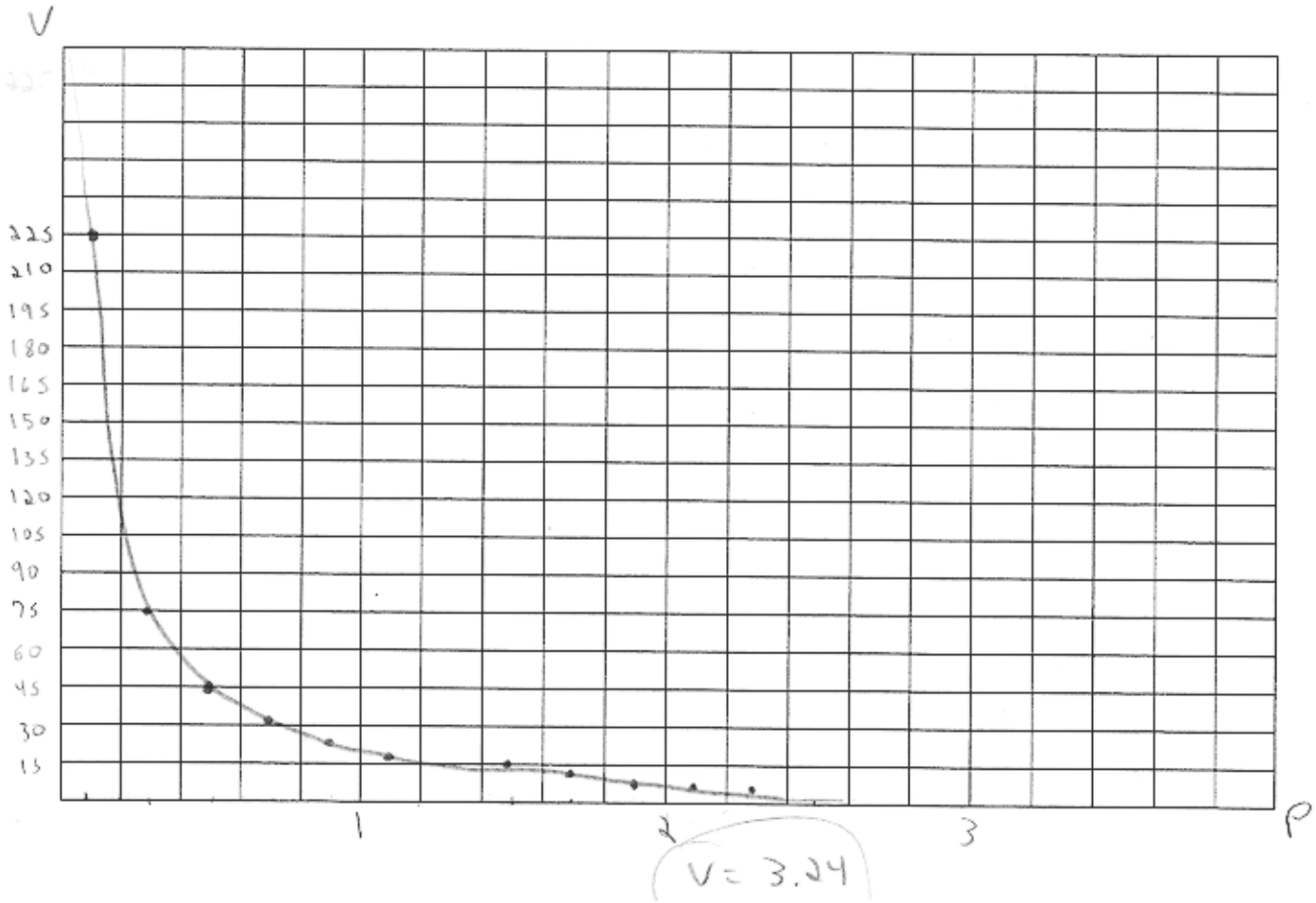
$Y = -88.3x^3 + 394.2X^2 - 547.6X + 246$

$x = 2.5$

$Y = -38.4375$



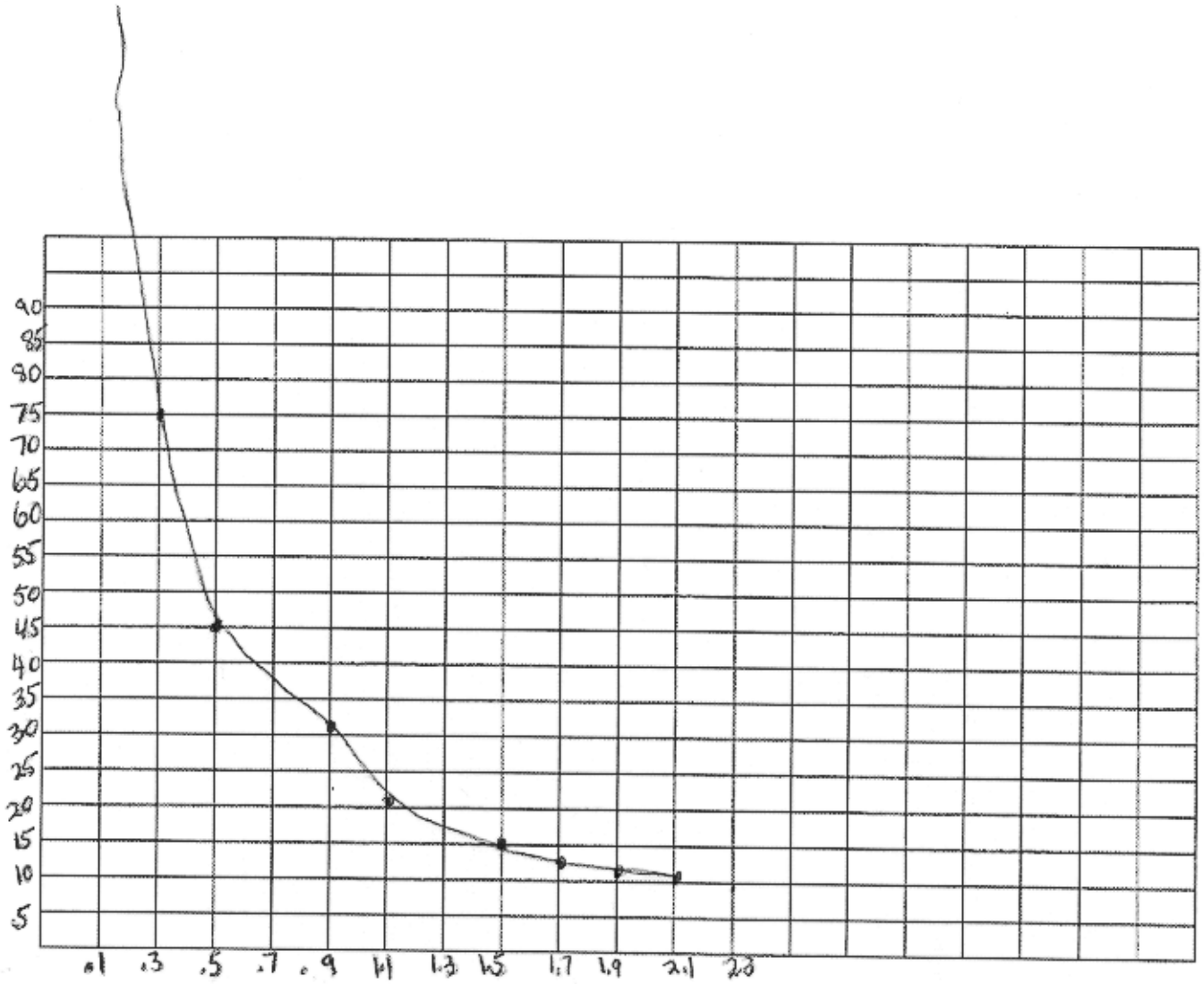
Student work—Score 3:



Student work—Score 2:

$V = 22.498^{-}P^{-1}$

Student work—Score 1:



APPENDICES

APPENDIX A

Mathematics B Regents Assessment Specifications

Key Ideas	Range	Item Type	Number of Items
Mathematical Reasoning	5-10%	Multiple-Choice	20 – 2 points each
Number and Numeration	5-10%	Short Constructed Responses	6 – 2 points each
Operations	5-10%	Longer Constructed Responses	6 – 4 points each
Modeling/Multiple Representations	15-25%	Extended Constructed Responses	2 – 6 points each
Measurement	15-20%		
Uncertainty	10-15%		
Patterns/Functions	15-25%		

The percentage of the assessment that will either be an application or be given in a contextual setting is 50-60%

APPENDIX B

Map to Learning Standards

Key Ideas	Multiple-Choice Item #	Two Point Item #	Four Point Item #	Six Point Item #
Mathematical Reasoning				33
Number and Numeration	6,9,11	21		
Operations	3,7,8		28	
Modeling/Multiple Representations	4,13,15,16,17,19		30,31	
Measurement	12,14,20	24	29,32	
Uncertainty	10,18	22		34
Patterns/Functions	1,2,5	23,25,26	27	

New York State Education Department, Room 681 EBA, Albany, NY 12234

Mathematics B Regents Assessment
Test Sampler Draft, Fall 1999
Comment Sheet

YES	YES with exceptions	No

1. **Content**—Are the questions generally appropriate in content?
   Comments:

2. **Difficulty**—Are the questions generally appropriate in difficulty?
   Comments:

3. **Directions**—Are the directions in the Test Sampler Draft clear and easy for students to follow?
   Comments:

4. **Format**—Is the format of the Test Sampler Draft satisfactory in terms of type size, space, arrangement of questions, etc.?
   Comments:

5. **Time**—Would most of the students be able to complete the Test Sampler Draft within the time allotted (3 hours)?
   Comments:

5. **Additional Comments:**

Please fax this sheet to (518) 486-1386 or mail it to the New York State Education Department at the above address.