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 be 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:

New York State Education Department
Office of Curriculum and Instruction
Room 671 EBA
Albany, NY 12234

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.
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

\[ \sin \frac{1}{2}A = \pm \sqrt{\frac{1 - \cos A}{2}} \]
\[ \cos \frac{1}{2}A = \pm \sqrt{\frac{1 + \cos A}{2}} \]

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?

   ![Relationship of Transformed Particle Size to Water Velocity Graph](Image)

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

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

   ![Graph with x and y axes](Image)

   (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 \( \frac{x}{(x)} \) which of the following is the graph of $-f(x)$?

(1) \( y \) \( x \) (2) \( y \) \( x \) (3) \( y \) \( x \) (4) \( y \) \( x \)

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: \( 64^{x^2} = 256^2 \)

\[
\begin{align*}
(1) \quad & \frac{6}{11} \\
(2) \quad & \frac{-6}{5} \\
(3) \quad & \frac{-1}{5} \\
(4) \quad & 0
\end{align*}
\]

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

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

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

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

\[
\begin{align*}
(1) \quad y &= 60x^2 \\
(2) \quad y &= \frac{80}{x} \\
(3) \quad y &= 63 \log x \\
(4) \quad y &= -25x
\end{align*}
\]

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

\[
\begin{align*}
(1) \quad z \\
(2) \quad 2z \\
(3) \quad \frac{1}{2}z \\
(4) \quad z^2
\end{align*}
\]

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?

\[
\begin{align*}
(1) \quad 243 \\
(2) \quad 242 \\
(3) \quad 241 \\
(4) \quad 240
\end{align*}
\]
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) \((8 \cos 30°, 8 \sin 30°)\)
(3) \((8 \sin 30°, 8 \cos 30°)\)
(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 \( T = 2\pi \sqrt{\frac{1}{32 \cdot L}} \) 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 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.
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 RS and 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 $P = 2.5$.

<table>
<thead>
<tr>
<th>$P$</th>
<th>$V$</th>
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<tr>
<td>0.1</td>
<td>225</td>
</tr>
<tr>
<td>0.3</td>
<td>74.999</td>
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<tr>
<td>0.5</td>
<td>45</td>
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<tr>
<td>0.7</td>
<td>32.139</td>
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<tr>
<td>0.9</td>
<td>25</td>
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<td>1.1</td>
<td>20.45</td>
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<td>1.5</td>
<td>15</td>
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<tr>
<td>1.7</td>
<td>13.24</td>
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<tr>
<td>1.9</td>
<td>11.84</td>
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<tr>
<td>2.1</td>
<td>10.71</td>
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<td>2.3</td>
<td>9.78</td>
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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

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PART II

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

$1, \quad x, \quad \sqrt[3]{x}, \quad \frac{1}{x}, \quad \frac{1}{\sqrt{x}}$

Rubric

[2 points] $1, \quad 1, \quad \frac{1}{\sqrt{x}}, \quad \sqrt{x}, \quad \frac{1}{x}$

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:

\[
\begin{array}{cccccc}
1 & \frac{1}{4} & \frac{1}{9} & \frac{1}{3} & \frac{1}{11} & \frac{1}{33} \\
\frac{1}{x} & \sqrt[3]{x} & \sqrt{x} & x
\end{array}
\]

If you substitute any number larger than 1 in for $x$ the order will turn out this way.
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 \( \binom{12}{7}(0.4)^7(0.6)^5 \)

[1 point] Finds an appropriate answer based on an incorrect 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 \( \binom{128}{78125} \) \( \binom{243}{3125} \)

[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:

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

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

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

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

$$4\pi^2 L = 2.88$$

$$\frac{3.9.478}{39.478} L = 2.88$$

$$L = 7.34$$
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 is the answer because 95% is two standard deviations away from the mean. 7 is subtracted and added to 20. So, the answer is 13-27.
Student work—Score 1:

14 17.5 20 23.5 27

14-27 cans

The rule is that 2 deviations over are 95%.

20 cans
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 $-3$ (i.e. $1/3$).
- 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 for $b$
- 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:**

\[
\begin{align*}
3x + y - 8 &= 0 \\
3x + y &= 8 \\
y &= -3x + 8 \\
(m &= -3) \\
\end{align*}
\]

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

\[
\begin{align*}
-2x + by + 9 &= 0 \\
-2x + by &= -9 \\
by &= 2x - 9 \\
y &= \frac{2x - 9}{b} \\
\end{align*}
\]

\[
\begin{align*}
\frac{2}{x} &= \frac{1}{3} \\
3 \cdot \frac{2}{x} &= 1 \\
6 &= b
\end{align*}
\]
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 $90^\circ$ 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:**

\[200^2 + 200^2 = x^2\]

\[40000 = x^2\]

\[x = 282.8\text{ yards}\]
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**

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>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. Domain of ( g ): The set of all real numbers such that ( x &gt; 0 ) and Range of ( g ): The set of all real numbers</td>
</tr>
<tr>
<td>3</td>
<td>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</td>
</tr>
<tr>
<td>2</td>
<td>Correct graphs; incorrect relationship and domain and range OR Incorrect graphs; correct relationship and domain and range OR One correct graph; incorrect relationship, or domain and range correct</td>
</tr>
<tr>
<td>1</td>
<td>No graphs, or incorrect graph with correct relationship OR No graphs, or incorrect graphs with correct domain and range OR One correct graph only</td>
</tr>
<tr>
<td>0</td>
<td>Response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure</td>
</tr>
</tbody>
</table>

Student work—Score 4:

\[ f(x) \text{ and } g(x) \text{ are inverse functions} \]
\[ \text{domain of } g(x): x > 0 \]
\[ \text{range of } g(x): y = \mathbb{R} \]
28. Solve the equation $x^2 = 6x - 12$ and express the roots in simplest $a + bi$ form.

<table>
<thead>
<tr>
<th>Rubric</th>
</tr>
</thead>
<tbody>
<tr>
<td>[4 points]</td>
</tr>
<tr>
<td>[3 points]</td>
</tr>
<tr>
<td>OR</td>
</tr>
<tr>
<td>OR</td>
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<tr>
<td>[2 points]</td>
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<tr>
<td>OR</td>
</tr>
<tr>
<td>[1 point]</td>
</tr>
<tr>
<td>OR</td>
</tr>
<tr>
<td>[0 points]</td>
</tr>
</tbody>
</table>

Student work—Score 4:

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

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

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

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

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

$$x = 3 \pm i \sqrt{3}$$

$$x = 3 + i \sqrt{3} \quad x = 3 - i \sqrt{3}$$
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°. 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.

\[
a^2 = 1146.75^2 + 3746.75^2 - 2 \cdot 1146.75 \cdot 3746.75 \cdot \cos 125.2°
\]

**Rubric**

**[4 points]** 4506 and shows an appropriate application of the Law of Cosines such as

\[
a^2 = 1146.75^2 + 3746.75^2 - 2 \cdot 1146.75 \cdot 3746.75 \cdot \cos 125.2°
\]

**[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:**

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

\[
a^2 = 1146.75^2 + 3746.75^2 - 2 \cdot 1146.75 \cdot 3746.75 \cdot \cos 125.2°
\]

\[
1146.75^2 = 131711.75 - 2 \cdot 1146.75 \cdot 3746.75 \cdot \cos 125.2°
\]

\[
\cos 125.2° = 0.5266
\]

\[
c = 4506.5
\]
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 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:

\[
y = 0.5(1.21^x) \\
10 = 0.5(1.21^x) \\
\frac{10}{0.5} = 1.21^x \\
\log 20 = x \log 1.21 \\
\log 1.21 \\
\frac{\log 20}{\log 1.21} = x \\
15.71569941 = x \\
16 = x \\
1988 + \frac{16}{2004} = 2004
\]
Student work—Score 3:

\[
\begin{align*}
10,000,000 &= 0.5 \times (1.21^x) \\
20,000,000 &= 1.21^x \\
\log 20,000,000 &= \log 1.21^x \\
\log 20,000,000 &= x \log 1.21 \\
\frac{\log 20,000,000}{\log 1.21} &= x \\
88 \text{ yrs.} &= x \\
1988 + 88 &= \underline{2076} \\
\text{In year 2076 there will be 10 million}
\end{align*}
\]

Student work—Score 2:

\[
\begin{align*}
10 &= 0.5 \times (1.21^x) \\
20 &= 1.21^x \\
\log 20 &= x \log 1.21
\end{align*}
\]

Student work—Score 1:

\[
\begin{align*}
10 &= 0.5 \times (1.21^x) \\
20 &= (1.21^x)
\end{align*}
\]
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 \( y = \sin x \), or graph contains minor flaws

[2 points] Incorrect trig graph with an appropriate equation such as \( y = -\sin x \)

OR Correct trig graph with incorrect equation or no equation, such as \( d(t) = \cos t \).

[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
32. If an arc of $60^\circ$ on circle A has the same length as an arc of $45^\circ$ 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:**

\[
\frac{\frac{\text{arc length}}{\text{circum.}}}{\frac{60}{360}} = \frac{A}{x} = \frac{1}{6} = \frac{x}{\text{circ.}}
\]

\[
\pi \left(\frac{6x}{2\pi}\right)^2 \frac{\text{circum.}}{2\pi} \quad \pi \left(\frac{16}{2\pi}\right)^2 \frac{\text{circumference}}{2\pi} \quad \frac{16}{9}
\]
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 RS & EO intersecting at Point I 1. Given
2. OS // 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. OR // 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
1. Given $\overline{OS} \parallel \overline{RE}$
2. Assume $\overline{RI} = \overline{IS}$
   $\overline{EI} = \overline{IO}$
3. $m\angle\text{LOIR} = m\angle\text{LSIE}$
4. $\triangle IOR \cong \triangle IESR$
5. $\angle ORS \equiv \angle ESR$
6. $\overline{OR} \parallel \overline{IS}$
7. Contradiction
8. $\overline{RI} \neq \overline{IS}$
   $\overline{EI} \neq \overline{IO}$
   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.

<table>
<thead>
<tr>
<th>P</th>
<th>V</th>
</tr>
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<tbody>
<tr>
<td>0.1</td>
<td>225</td>
</tr>
<tr>
<td>0.3</td>
<td>74.999</td>
</tr>
<tr>
<td>0.5</td>
<td>45</td>
</tr>
<tr>
<td>0.7</td>
<td>32.139</td>
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<tr>
<td>0.9</td>
<td>25</td>
</tr>
<tr>
<td>1.1</td>
<td>20.45</td>
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<td>1.5</td>
<td>15</td>
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<tr>
<td>1.7</td>
<td>13.24</td>
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<tr>
<td>1.9</td>
<td>11.84</td>
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<tr>
<td>2.1</td>
<td>10.71</td>
</tr>
<tr>
<td>2.3</td>
<td>9.78</td>
</tr>
</tbody>
</table>

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 ($R^2 = 0.7$)

\[ y = 78.3x^2 - 246.1x + 185.3 \]

Linear

\[ y = -59.4x + 112.3 \]

Exponential

\[ y = 22.5^x \]

\[ \rho \rightarrow 2.1 \]

\[ V = 9 \]

\[ V = 22.5 \rho^{-1} \]

\[ [-1.12, 2.52] \text{ by } [-26.8071, 261.8874] \]
Student work—Score 5:

\[ y = 22.5 \times (x)^{-1} \]

\[ y = 22.5 - (x)^{-1} \quad x = 2.5 \quad y = 22.5 \times (2.5)^{-1} = 9 \]

Graph with labeled axes and points plotted.
cubic regression

\[ y = -88.3x^3 + 394.2x^2 - 547.4x + 24.6 \]

\[ x = 2.5 \]

\[ y = -38.4375 \]
Student work—Score 3:

\[ V = 3.24 \]
\[ V = 22.498/\rho^{-1} \]
Student work—Score 1:
APPENDIX A

Mathematics B Regents Assessment Specifications

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

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

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