The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ELEVENTH YEAR
MATHEMATICS

Wednesday, August 15, 1979 — 8:30 to 11:30 a.m., only

The last page of the booklet is the answer sheet. Fold the last page along the perforations and, slowly and carefully, tear off the answer sheet. Then fill in the heading of your answer sheet.

The "Reference Tables for Mathematics" which you may need to answer some questions in this examination are stapled in the center of this booklet.

When you have completed the examination, you must sign the statement printed at the end of the answer paper, 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 paper cannot be accepted if you fail to sign this declaration.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN
Part I

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed.

Directions (1-20): Write in the space provided on the separate answer sheet the numeral preceding the expression that best completes each statement or answers each question.

1. If \( n \) represents an even integer, then an odd integer may be represented by the expression
   \[ \begin{align*}
   & (1) \ 5n \\
   & (2) \ n^2 + 1 \\
   & (3) \ n^3 \\
   & (4) \ n + 2
   \end{align*} \]

2. For which value of \( x \) is the expression \( \frac{x - 3}{x^2} - \frac{x}{2} \) undefined?
   \[ \begin{align*}
   & (1) \ 1 \\
   & (2) \ 2 \\
   & (3) \ 3 \\
   & (4) \ 0
   \end{align*} \]

3. Which inequality is represented by the accompanying graph?
   \[ \begin{align*}
   & (1) \ -2 < x < 1 \\
   & (2) \ -2 < x \leq 1 \\
   & (3) \ -2 < x < 1 \\
   & (4) \ -2 \leq x < 1
   \end{align*} \]

4. Which statement is true?
   \[ \begin{align*}
   & (1) \ \frac{1}{2}^2 = 6 \frac{2}{3} \\
   & (2) \ (5 - 2)^3 = 5^2 - 2^2 \\
   & (3) \ 2^9 = 123^9 \\
   & (4) \ (-5)^3 > -5
   \end{align*} \]

5. The complex fraction \( \frac{x - 3}{x - 2} \) is equal to
   \[ \begin{align*}
   & (1) \ 1 \\
   & (2) \ -1 \\
   & (3) \ x - 2 \\
   & (4) \ 2 - x
   \end{align*} \]

6. The graph of the equation \( \frac{x^2}{4} + \frac{y^2}{16} = 1 \) passes through the point whose coordinates are
   \[ \begin{align*}
   & (1) \ (0,0) \\
   & (2) \ (0,2) \\
   & (3) \ (0,4) \\
   & (4) \ (4,0)
   \end{align*} \]

7. The expression \( \frac{y^4}{y^5 - y^3} \) is equivalent to
   \[ \begin{align*}
   & (1) \ \frac{1}{y - 1} \\
   & (2) \ y - 1 \\
   & (3) \ \frac{1}{y} \\
   & (4) \ \frac{1}{y}
   \end{align*} \]

8. The equation \( x + \sqrt{x - 2} = 2 \) has as its roots
   \[ \begin{align*}
   & (1) \ both \ 2 \ and \ 3 \\
   & (2) \ 2, \ only \\
   & (3) \ 3, \ only \\
   & (4) \ neither \ 2 \ nor \ 3
   \end{align*} \]

9. Which is an example of a trigonometric identity?
   \[ \begin{align*}
   & (1) \ \sin x \cos x = 1 \\
   & (2) \ \cot x \tan x = 1 \\
   & (3) \ \cos x \cot x = 1 \\
   & (4) \ \tan x \sin x = 1
   \end{align*} \]

10. Which value of \( \theta \) in the interval \( 0^\circ < \theta < 180^\circ \) satisfies the equation \( 2 \sin \theta \cos \theta + \cos \theta = 0 \)?
    \[ \begin{align*}
    & (1) \ 30^\circ \\
    & (2) \ 60^\circ \\
    & (3) \ 90^\circ \\
    & (4) \ 150^\circ
    \end{align*} \]

11. As \( x \) varies from \( -\pi \) to \( \pi \), the value of \( \cos x \)
    \[ \begin{align*}
    & (1) \ increases, \ only \\
    & (2) \ decreases, \ only \\
    & (3) \ increases, \ then \ decreases \\
    & (4) \ decreases, \ then \ increases
    \end{align*} \]

12. The expression \( \frac{14}{3 - \sqrt{2}} \) is equal to
    \[ \begin{align*}
    & (1) \ 6 + 2\sqrt{2} \\
    & (2) \ 6 - 2\sqrt{2} \\
    & (3) \ -4\sqrt{2} \\
    & (4) \ -\frac{14\sqrt{2}}{5}
    \end{align*} \]

13. The graphs of \( 3x - 2y = 9 \) and \( x + y = 8 \) intersect at the point whose abscissa is
    \[ \begin{align*}
    & (1) \ -3 \\
    & (2) \ -5 \\
    & (3) \ 3 \\
    & (4) \ 5
    \end{align*} \]

14. A straight line which passes through the points \( (2,1) \) and \( (2,7) \) has a slope that is
    \[ \begin{align*}
    & (1) \ zero \\
    & (2) \ undefined \\
    & (3) \ positive \\
    & (4) \ negative
    \end{align*} \]

15. The numerical value of \( \cos (-210^\circ) \) is
    \[ \begin{align*}
    & (1) \ \frac{\sqrt{3}}{2} \\
    & (2) \ \frac{\sqrt{3}}{2} \\
    & (3) \ \frac{1}{2} \\
    & (4) \ \frac{1}{2}
    \end{align*} \]

16. If \( 19 = 22 - 21 \cos C \), what is the measure of angle \( C \) to the nearest degree?
    \[ \begin{align*}
    & (1) \ 8 \\
    & (2) \ 19 \\
    & (3) \ 82 \\
    & (4) \ 98
    \end{align*} \]
17 The value of \( \cos (\text{Arc sec } 1) \) is

(1) 1
(2) 2
(3) 0
(4) \( \pi \)

18 The expression \( \frac{\sin (x + y)}{\cos x \cos y} \) is equivalent to

(1) \( 1 + \cot x \)
(2) \( \tan x + \tan y \)
(3) \( \tan x + \tan y \)
(4) \( \frac{1}{\cos y} + \frac{1}{\cos x} \)

19 The roots of the equation \( 4x^2 - 3x + 5 = 0 \) are

(1) real, equal, and rational
(2) real, unequal, and rational
(3) real, unequal, and irrational
(4) imaginary

20 The accompanying diagram is the graph of which equation?

\[ y = |x| \]

21 If \( f(x) = |x + 2| \), find \( f(-5) \).

22 What is the solution set of the equation \( n + \frac{1}{2} \pi = \frac{3}{4} \)?

23 If \( 3^{x-1} = 27 \), find the value of \( x \).

24 If \( x \) varies inversely as \( y \) and \( x = 2 \) when \( y = 4 \), what is the value of \( x \) when \( y = 2 \)?

25 If \( \log n = 0.4946 \), find \( n \) to the nearest thousandth.

26 If \( x \) is a positive acute angle and \( \cos x = \frac{4}{5} \), what is the value of \( \tan x \)?

27 In \( \triangle ABC \), \( \sin A = \frac{\sqrt{3}}{3} \), \( \sin B = \frac{2}{3} \), and \( a = \sqrt{5} \).

What is the length of side \( b \)?

28 Express \( 8 \tan^2 x + 2 \tan x - 15 \) as a product of two binomials.

29 In \( \triangle ABC \), \( m\angle C = 90 \), \( a = 6 \), and \( c = 10 \). What is the area of the triangle?

30 Express \( 105^\circ \) in radian measure.
Answers to the following questions are to be placed on paper provided by the school.

Part II

Answer four questions from this part. Show all work unless otherwise directed.

31 Solve the following system of equations algebraically and check your solution(s) in both equations:

\[
\begin{align*}
(x - 2)^2 + (y + 3)^2 &= 25 \\
x + y &= 6
\end{align*}
\]  [8,2]

32 a Sketch and label the graph of \( y = \cos 2x \) in the interval \(-\pi \leq x \leq \pi\).  [4]

b On the same set of axes used in answer to part a, sketch and label the graph of \( y = \frac{1}{2} \sin x \).  [4]

c For how many values of \( x \) in the interval \(-\pi \leq x \leq \pi\) does \( \cos 2x = \frac{1}{2} \sin x \)?  [2]

33 a Using logarithms, find \( A \) to the nearest tenth:

\[
A = \frac{(9.74)^2 \tan 56^\circ + 20'}{\sqrt{72.9}}
\]  [8]

b If \( \log_a x = -1 \), then \( x \) is equal to

(1) 1  
(2) -2  
(3) \(-\frac{1}{2}\)  
(4) \(-\frac{1}{2}\)  [2]

34 a Draw the graph of the function

\( f(x) = x^2 - 2x - 2 \) for \(-2 \leq x \leq 4\).  [5]

b Using the graph in part a, estimate to the nearest tenth the roots of \( x^2 - 2x - 2 = 0 \).  [2]

c Write an equation of the axis of symmetry.  [1]

d Find the minimum value of \( f(x) \) in part a.  [2]

35 In \( \triangle ABC \), \( AB = 51 \), \( BC = 40 \), and \( CA = 20 \). Find the measure of angle \( C \) to the nearest degree.  [10]

36 Write the equation or a system of equations that would be used to solve each of the following problems. In each case state what the variable or variables represent. [Solution of the equations is not required.]

a An older model meat grinder can prepare an order of hamburger in 12 hours. For one order, the older model was used for 5 hours, and then a newer model was also used, and the two machines finished the order in 3 more hours. How long would it take the newer model to prepare the entire order?  [5]

b A theater has two admission prices, regular and senior citizen. On the first night, 180 regular admissions and 80 senior citizens paid a total of $960. On the second night, 100 regular admissions and 60 senior citizens paid $580. What is the price of each admission?  [5]

37 Find to the nearest degree all values of \( x \) in the interval \( 0^\circ \leq x < 360^\circ \) that will satisfy the equation \( 4 - \cos x = 6 \sin^2 x \).  [10]

Math. 11-Aug. '79  [4]
This table gives the mantissas of numbers with the decimal point omitted in each case. Characteristics are determined from the numbers by inspection.
### Values of Trigonometric Functions

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<th>Cot</th>
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### B Values of Trigonometric Functions

### C Logarithms of Trigonometric Functions

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* These tables give the logarithms increased by 10. Hence in each case 10 should be subtracted.
### Logarithms of Trigonometric Functions

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<td>9.9418</td>
<td>9.7438</td>
<td>10.2564</td>
</tr>
</tbody>
</table>

*These tables give the logarithms increased by 10. Hence in each case 10 should be subtracted.*

---

### Logarithms of Trigonometric Functions

<table>
<thead>
<tr>
<th>Angle</th>
<th>L Sin</th>
<th>L Cos</th>
<th>L Tan</th>
<th>L Cot</th>
</tr>
</thead>
<tbody>
<tr>
<td>36° 00'</td>
<td>9.7682</td>
<td>9.9080</td>
<td>9.8861</td>
<td>10.1387</td>
</tr>
<tr>
<td>39° 00'</td>
<td>9.7730</td>
<td>9.9070</td>
<td>9.8839</td>
<td>10.1357</td>
</tr>
<tr>
<td>42° 00'</td>
<td>9.7778</td>
<td>9.9057</td>
<td>9.8816</td>
<td>10.1328</td>
</tr>
<tr>
<td>45° 00'</td>
<td>9.7826</td>
<td>9.9042</td>
<td>9.8793</td>
<td>10.1298</td>
</tr>
<tr>
<td>48° 00'</td>
<td>9.7874</td>
<td>9.9029</td>
<td>9.8770</td>
<td>10.1265</td>
</tr>
<tr>
<td>51° 00'</td>
<td>9.7922</td>
<td>9.9015</td>
<td>9.8747</td>
<td>10.1232</td>
</tr>
<tr>
<td>54° 00'</td>
<td>9.7970</td>
<td>9.9001</td>
<td>9.8724</td>
<td>10.1199</td>
</tr>
<tr>
<td>57° 00'</td>
<td>9.8018</td>
<td>9.8987</td>
<td>9.8701</td>
<td>10.1165</td>
</tr>
<tr>
<td>60° 00'</td>
<td>9.8066</td>
<td>9.8973</td>
<td>9.8677</td>
<td>10.1132</td>
</tr>
</tbody>
</table>

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FOR TEACHERS ONLY

SCORING KEY

ELEVENTH YEAR MATHEMATICS

Wednesday, August 15, 1979 — 8:30 to 11:30 a.m., only

Use only red ink or red pencil in rating Regents papers. Do not attempt to correct the pupil's work by making insertions or changes of any kind. Use checkmarks to indicate pupil errors.

Unless otherwise specified, mathematically correct variations in the answers will be allowed. In problems involving logarithms, answers should be left correct to four significant digits unless directions say otherwise. Units need not be given when the wording of the questions allows such omissions.

Part I

Allow 2 credits for each correct answer; allow no partial credit. For questions 1–20, allow credit if the pupil has written the correct answer instead of the numeral 1, 2, 3, or 4.

(1) 2  (11) 3  (21) 3
(2) 4  (12) 1  (22) \(-\frac{1}{2}\) or \(\frac{1}{2}
(3) 4  (13) 4  (23) 4
(4) 3  (14) 2  (24) 4
(5) 2  (15) 1  (25) 3.123
(6) 3  (16) 3  (26) \(\frac{3}{4}\)
(7) 1  (17) 1  (27) 2
(8) 2  (18) 3  (28) \((2 \tan x + 3)(4 \tan x - 5)\)
(9) 2  (19) 4  (29) 24
(10) 3 (20) 4  (30) \(\frac{7\pi}{12}\)

[OVER]
Part II

Please refer to the Department's pamphlet *Suggestions on the Rating of Regents Examination Papers in Mathematics*. Care should be exercised in making deductions as to whether the error is purely a mechanical one or due to a violation of some principle. A mechanical error generally should receive a deduction of 10 percent, while an error due to a violation of some cardinal principle should receive a deduction ranging from 30 percent to 50 percent, depending on the relative importance of the principle in the solution of the problem.

\[
\begin{align*}
(31) & \quad x = 6, \ y = 0 \\
& \quad x = 5, \ y = 1 \quad [8] \\
\text{Check} & \quad [2] \\
(32) & \quad c \ 4 \quad [2] \\
(33) & \quad a \ 34.1 \quad [8] \\
& \quad b \ 4 \quad [2] \\
(34) & \quad b \ 2.6, \ 2.7, \ or \ 2.8; \\
& \quad -0.6, -0.7, \ or \ -0.8 \quad [2] \\
& \quad c \ x = 1 \quad [1] \\
& \quad d \ -3 \quad [2] \\
(35) & \quad 112 \quad [10] \\
(36) & \quad a \ x = \text{number of hours it takes the older} \\
& \quad \text{model to prepare the order} \\
& \quad \frac{5}{12} + \frac{3}{x} + \frac{3}{12} = 1 \quad [5] \\
& \quad b \ r = \text{price of each regular admission} \\
& \quad s = \text{price of each senior citizen admission} \\
& \quad 180r + 80s = 960 \quad [5] \\
& \quad 100r + 60s = 580 \\
(37) & \quad 48, \ 120, \ 240, \ 312 \quad [10]
\end{align*}
\]