The University of the State of New York

11

REGENTS HIGH SCHOOL EXAMINATION

ELEVENTH YEAR MATHEMATICS

Monday, January 26, 1970 — 1:15 to 4:15 p.m., only

The last page of the booklet is the answer sheet, which is perforated. Fold the last page along the perforation and then, slowly and carefully, tear off the answer sheet. Now fill in the heading of your answer sheet. When you have finished the heading, you may begin the examination immediately.

Part I

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

1 Factor: $y^2 - .09x^2$

2 If the number 3,100,000 is written in the form 3.1×10^n, find the value of n.

3 Solve for x in terms of a:

$$x + y = 2a$$
$$x - y = a$$

4 Multiply the complex numbers $(3 - 5i)$ and $(2 + 3i)$ and express the product in the form $a + bi$.

5 If $\log \sin x = 9.5807 - 10$, find the acute angle x to the *nearest minute*.

6 Find the solution set of $\sqrt{x^2 + 5} - 1 = x$.

7 Find in degrees the value of A greater than 270° and less than 360° which satisfies the equation $\tan A - \cot A = 0$.

8 What is the numerator of a fraction whose denominator is $3a^2 - 6$ if the fraction is equal to $\frac{2}{3}$?

9 If an arc 20 feet long subtends an angle of 2 radians at the center of the circle, what is the number of feet in the radius of the circle?

10 If $10^{0.3247} = 2.112$, what is the value of $10^{2.3247}$?

11 Express $\tan (-140°)$ as a function of a positive acute angle.

12 Write an equation of the straight line which passes through the points $(0,-1)$ and $(1,2)$.

13 If y varies inversely as x and $y = 6$ when $x = 7$, what is the value of y when $x = 3$?

14 If $\sin x = -\frac{1}{3}$, find the value of $\cos 2x$.

15 The sides of a triangle are 5, 8, and 9. Find the cosine of the largest angle.

16 Find the solution set of $|x - 5| = 11$.

17 Express $x^2 + ax + bx + ab$ as the product of two binomial factors.

[OVER]

22

Directions (18-30): Write in the space provided on the separate answer sheet the *number* preceding the expression that best completes *each* statement or answers *each* question.

18 If $x = -2$, which is *not* an expression for zero?

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

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

19 The roots of the quadratic equation $x^2 - 8x + 17 = 0$ are

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

20 In triangle ABC, angle $B = 40°$, $b = 8$, and $c = 6$. Angle C

(1) must be acute
(2) must be obtuse
(3) must be a right angle
(4) may be either acute or obtuse

21 The multiplicative inverse of $3 + i$ is

(1) $3 - i$ (3) $\frac{3 + i}{10}$

(2) $\frac{3 - i}{8}$ (4) $\frac{3 - i}{10}$

22 The sum of the roots of the equation $x^2 - 7x + 2 = 0$ exceeds the product of the roots by

(1) -9 (3) 5
(2) -5 (4) 9

23 For all values of the variables for which the expression is defined, which statement of equality is an identity?

(1) $\sqrt{c^2 - a^2} = c - a$
(2) $\sec^2 \theta - \tan^2 \theta = 1$
(3) $\sin 2x = 2 \sin x$
(4) $\sin \theta \sec \theta = 1$

24 The expression $\sqrt{\frac{4}{3}} - \sqrt{\frac{3}{4}}$ is equivalent to

(1) 1 (3) $\frac{\sqrt{3}}{6}$

(2) 0 (4) $2\sqrt{3}$

25 If angle A terminates in quadrant II and angle B terminates in quadrant III, which can *not* be true?

(1) $\sin A = \sin B$ (3) $\cos A = \cos B$
(2) $\sin A = \tan B$ (4) $\cos A = \sin B$

26 The value of $\cos \pi - \cos \frac{3\pi}{4}$ is

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

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

27 What is the period of the graph of $y = 2 \sin 3x$?

(1) $\frac{\pi}{3}$ (3) π

(2) $\frac{2\pi}{3}$ (4) 6π

28 The positive value of cos (arc sin a) is

(1) $\frac{1}{1 - a^2}$ (3) $1 - a^2$

(2) $\frac{1}{\sqrt{1 - a^2}}$ (4) $\sqrt{1 - a^2}$

29 In $\triangle ABC$, $a = 5$, $b = 10$, and $B = 150°$. The value of sin A is

(1) 1 (3) $\frac{1}{4}$

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

30 The solution set of the inequality $x^2 - x - 6 < 0$ is

(1) $x < -2$ or $x > 3$
(2) $x < -3$ or $x > 2$
(3) $-2 < x < 3$
(4) $-3 < x < 2$

Answers to the following questions are to be written on paper provided by the school.

Part II

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

31 *a* Find to the *nearest tenth* the roots of the equation $2x^2 - 7 = 3x$. [8]

b If $x = \tan \theta$ in the equation $2x^2 - 7 = 3x$ and θ lies in the interval $180° < \theta < 270°$, find θ to the *nearest degree*. [2]

32 *a* Starting with the formula for $\tan (x + y)$ *derive* the formula for $\tan 2x$ in terms of $\tan x$. [3]

b For all x for which the expression is defined, show that the following is an identity: [7]

$$\frac{1}{\tan x - \cot x} = \frac{\sin x \cos x}{2 \sin^2 x - 1}$$

33 Solve the following system of equations, and check in both equations: [8,2]

$$x^2 - 3y^2 = 13$$
$$x - 2y = 2$$

34 *a* On the same set of axes sketch the graphs of $y = \sin 2x$ and $y = 2 \cos x$ for all values of x which are in the interval $0 \leq x \leq \pi$. [4,4]

b For what value(s) of x in the interval $0 \leq x \leq \pi$ is $\sin 2x = 2 \cos x$? [2]

35 Using *logarithms*, find to the *nearest hundredth* the value of

$$\frac{\sqrt[3]{71.5 \sin 14° 10'}}{3.81}.$$ [10]

36 Write an equation or a system of equations which can 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 A motorist starts from city A at 60 miles per hour and travels toward city B on a certain route. After traveling some time on this route, he encounters road construction along the remaining portion which requires him to reduce his speed to 40 miles per hour for the remainder of the trip. If the portion of the road on which he traveled 60 miles per hour is 60 miles longer than that on which he traveled 40 miles per hour and the total time of the trip is 6 hours, how many miles did the motorist travel at the slower speed? [5]

b How many quarts of water must be evaporated from 20 quarts of a 25% salt solution to make it a 30% salt solution? [5]

37 Answer *either a* or *b*, but *not* both:

a Two forces act on a point at an angle of 102°. The first is a force of 130 pounds. If the resultant makes an angle of 38° 20′ with the first force, what is the magnitude of the resultant to the *nearest pound*? [4,6]

OR

b A local airline does not offer a direct connection from city A to city B. Rather, the flight travels 70 miles from city A to city C and then 100 miles from city C to city B. If the angle ACB between the two legs of the flight is 100°, find to the *nearest mile* the distance between A and B. [3,7]

Part I Score:.....

Rater's Initials:

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Monday, January 26, 1970 — 1:15 to 4:15 p.m., only

ANSWER SHEET

Pupil.....Teacher.....

School.....

Your answers to Part I should be recorded on this answer sheet.

Part I

Answer all questions in this part.

1.....	11.....	21.....
2.....	12.....	22.....
3.....	13.....	23.....
4.....	14.....	24.....
5.....	15.....	25.....
6.....	16.....	26.....
7.....	17.....	27.....
8.....	18.....	28.....
9.....	19.....	29.....
10.....	20.....	30.....

Your answers for Part II should be placed on paper provided by the school.

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FOR TEACHERS ONLY

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SCORING KEY
ELEVENTH YEAR MATHEMATICS

Monday, January 26, 1970—1:15 to 4:15 p.m., only

Use only *red* ink or 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 18–30, allow credit if the pupil has written the correct answer instead of the number 1, 2, 3, or 4.

(1) $(y + .3x)(y - .3x)$

(2) 6

(3) $\frac{3a}{2}$

(4) $21 - i$

(5) 22° 23′

(6) {2} *or* $x = 2$

(7) 315

(8) $2(a^2 - 2)$ *or* $2a^2 - 4$

(9) 10

(10) 211.2

(11) tan 40° *or* cot 50°

(12) $y = 3x - 1$

(13) 14

(14) $\frac{7}{9}$

(15) $\frac{1}{10}$

(16) {16,—6} *or* $x = 16, -6$

(17) $(x + a)(x + b)$

(18) 2

(19) 4

(20) 1

(21) 4

(22) 3

(23) 2

(24) 3

(25) 1

(26) 1

(27) 2

(28) 4

(29) 3

(30) 3

[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.

(31) *a* 2.8, —1.3 [8]
b 250 [2]

(33) *a* $x = 4, y = 1$
$x = -16, y = -9$ [8]

(34) *b* $\frac{\pi}{2}$ *or* 90° [2]

(35) 0.68 [10]

(36) *a* x = number of miles motorist traveled at slower speed
$\frac{x + 60}{60} + \frac{x}{40} = 6$ [5]

b x = number of quarts of water to be evaporated
$.25(20) = .30(20 - x)$ [5]

(37) *a* Analysis [4]
142 [6]

b Analysis [3]
132 [7]

DO YOU KNOW . . .

. . . that 400 classroom teachers were involved in preparing Regents examinations last year?

- Teachers wrote the questions.
- Other teachers assembled the examinations.
- Still other teachers reviewed the finished product.

And a committee of principals approved all of the examinations before they went to the printer.