The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

COURSE II

Tuesday, August 19, 1986 — 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.

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**

Answer 30 questions from 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. Where applicable, answers may be left in radical form.   [60]

1 Using the accompanying table, solve the equation $c * y = a$ for y.

*	e	a	b	c
e	e	a	b	c
a	a	b	c	e
b	b	c	e	a
c	c	e	a	b

2 If $A * B$ is a binary operation defined as $A^2 + B^2$, evaluate $5 * 2$.

3 In the accompanying figure, $\overleftrightarrow{EGF}$ intersects $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$, and $\overline{AG}$ is drawn. If $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$, $m\angle FED = x$, $m\angle GAF = 2x$, and $m\angle FGA = 3x$, find x.
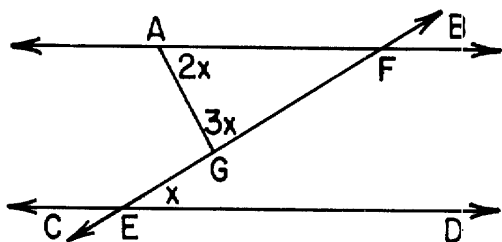

4 Using the accompanying table, find the inverse of y.

*	x	y	z
x	z	x	y
y	x	y	z
z	y	z	x

5 The sides of a triangle have lengths 6, 8, and 11. What is the length of the *longest* side of a similar triangle whose perimeter is 75?

6 The length of the hypotenuse of a right triangle is 17 centimeters and the length of one leg is 15 centimeters. What is the number of centimeters in the length of the other leg?

7 The accompanying diagram shows four congruent rectangles, each measuring 3 by 2. If the coordinates of A are (3,0) and the coordinates of B are (0,2), find the coordinates of C.
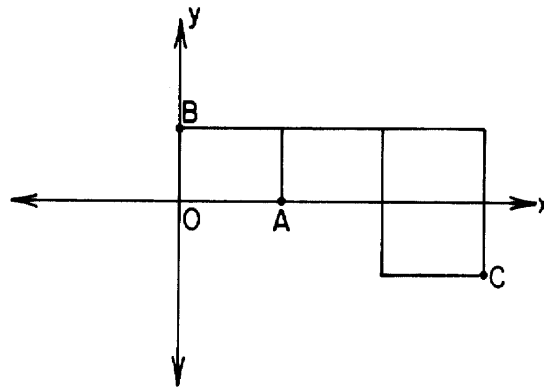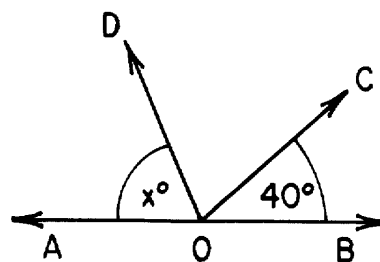

8 In parallelogram $ABCD$, the measures of angles A and B are in the ratio 1:8. Find $m\angle A$.

9 In $\triangle ABC$, $AB = 8$, $BC = 10$, and $CA = 16$. If D is the midpoint of $\overline{AB}$ and E is the midpoint of $\overline{BC}$, find the length of $\overline{DE}$.

10 What is the slope of the line that passes through the points (4,5) and (7,3)?

11 In the accompanying diagram, $\overleftrightarrow{AOB}$ is a straight line, $m\angle BOC = 40$, and $m\angle DOA = x$. If $m\angle DOC$ is 8 more than x, find x.

12 How many different 5-letter arrangements are there of the letters in the name "ANITA"?

13 The coordinates of the endpoints of a diameter of a circle are (3,7) and (−5,3). Find the coordinates of the center of the circle.

14 Point P has coordinates $(-12,5)$. What is its distance from the origin?

15 How many subcommittees, each consisting of 2 Republicans and 1 Democrat, can be formed from a committee of 3 Republicans and 3 Democrats?

16 In triangle PQR, $\overline{PR}$ is extended through R to S. If $m\angle SRQ = 28x$, $m\angle Q = 125$, and $m\angle P = 3x$, find x.

17 In right triangle ABC, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$. If $m\angle A = 40$, find $m\angle BCD$.

Directions (18–34): For *each* question chosen, write on the separate answer sheet the *numeral* preceding the word or expression that best completes the statement or answers the question.

18 Which statement is the negation of $\sim p \lor q$?
(1) $p \lor \sim q$ (3) $\sim p \lor \sim q$
(2) $p \land \sim q$ (4) $\sim p \land \sim q$

19 Which is a solution of the system
$(y = x^2 + 3) \land (y = x + 3)$?
(1) $(0,3)$ (3) $(1,5)$
(2) $(2,7)$ (4) $(6,3)$

20 Two straight lines $\overleftrightarrow{RO}$ and $\overleftrightarrow{NA}$ intersect at G. What is the number of points that are 3 centimeters from G and also equidistant from both $\overleftrightarrow{RO}$ and $\overleftrightarrow{NA}$?
(1) 1 (3) 3
(2) 2 (4) 4

21 Which is a property of a field but *not* of a group?
(1) associative property
(2) distributive property
(3) closure
(4) identity element

22 Which statement is logically equivalent to $\sim a \to b$?
(1) $a \to \sim b$ (3) $\sim b \to a$
(2) $\sim a \to \sim b$ (4) $b \to \sim a$

23 The negation of $\forall_x \ x = 5$ is
(1) $\forall_x \ x = 5$ (3) $\exists_x \ x = 5$
(2) $\forall_x \ x \neq 5$ (4) $\exists_x \ x \neq 5$

24 A set contains 5 trapezoids, 3 squares, and 1 rhombus that is not a square. If a figure is chosen at random from the set, what is the probability that it will be equilateral?
(1) 1 (3) $\frac{3}{9}$
(2) $\frac{4}{9}$ (4) 0

25 Which conclusion logically follows from the true statements, "If the negotiations fail, the baseball strike will not end," and "If the World Series is played, the baseball strike has ended"?
(1) If negotiations fail, the World Series will not be played.
(2) If negotiations fail, the World Series will be played.
(3) If the baseball strike ends, the World Series will be played.
(4) If negotiations do not fail, the baseball strike will not end.

26 In the accompanying diagram of the graph of the parabola $y = ax^2 + bx + c$, which must be one root of the equation $ax^2 + bx + c = 0$?
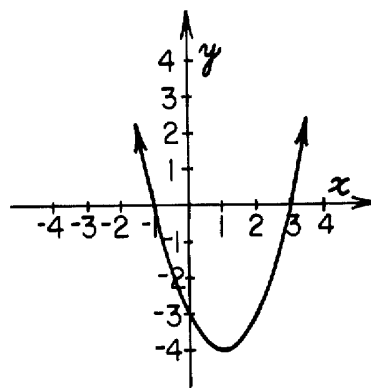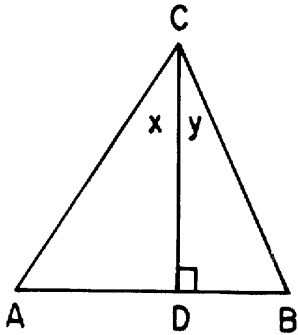

(1) 1 (3) 3
(2) –3 (4) –4

27 In rectangle $ABCD$, $AB = 6$ and the length of diagonal $\overline{AC}$ is 10. The area of $ABCD$ is
(1) 60 (3) 32
(2) 48 (4) 28

28 The value of $_5P_2$ divided by 2! is
(1) 10   (3) 30
(2) 20   (4) 5

29 In the accompanying diagram of scalene triangle ABC, altitude $\overline{CD}$ divides $\angle C$ into angles x and y. Which equation describes the relationship of angles x, y, A, and B?

(1) $m\angle x + m\angle y = m\angle A + m\angle B$
(2) $m\angle x - m\angle y = m\angle A - m\angle B$
(3) $m\angle x + m\angle B = m\angle y + m\angle A$
(4) $m\angle x + m\angle A = m\angle y + m\angle B$

30 What are the roots of the equation $2x^2 + 4x - 5 = 0$?

(1) $\dfrac{4 \pm \sqrt{56}}{4}$ (3) $1 \pm \sqrt{14}$

(2) $\dfrac{-4 \pm \sqrt{56}}{4}$ (4) $\dfrac{-4 \pm \sqrt{14}}{4}$

31 All of the following figures must have congruent diagonals *except*
(1) a rectangle
(2) a square
(3) an isosceles trapezoid
(4) a parallelogram

32 Which is an equation of the circle whose center is (5,−1) and whose radius is 3?
(1) $(x + 5)^2 + (y - 1)^2 = 9$
(2) $(x + 5)^2 + (y - 1)^2 = 3$
(3) $(x - 5)^2 + (y + 1)^2 = 9$
(4) $(x - 5)^2 + (y + 1)^2 = 3$

33 What is the slope of a line perpendicular to the graph of the equation $5x - 3y = 2$?

(1) $-\dfrac{3}{5}$ (3) $\dfrac{5}{3}$

(2) $-\dfrac{1}{5}$ (4) 5

34 The solution set of the equation $2x^2 - 9x - 5 = 0$ is

(1) $\{-\frac{1}{2},5\}$ (3) $\{-\frac{1}{2}\}$

(2) $\{\frac{1}{2},-5\}$ (4) $\{-5\}$

Directions (35): Leave all construction lines on the answer sheet.

35 *On the answer sheet*, construct triangle *DEF* similar to triangle *ABC*, using given line segment *DE*.

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

Part II

Answer three questions from this part. Show all work unless otherwise directed. [30]

36 Given: set $A = \{1,2,3,4\}$ and operations # and @ as defined by the accompanying tables.

#	1	2	3	4
1	1	2	3	4
2	2	3	4	1
3	3	4	1	2
4	4	1	2	3

@	1	2	3	4
1	1	1	1	1
2	1	2	3	4
3	1	3	4	2
4	1	4	2	3

a Evaluate: (3 # 4) @ (3 @ 2)   [2]

b Find the inverse of 4 under the operation #. [2]

c Find x: (2 # x) @ 3 = 2   [3]

d State one reason $(A, @)$ is *not* a group.   [3]

37 A teacher has a stockpile of 15 questions. The stockpile contains 7 true-false questions, 5 multiple-choice questions, and 3 essay questions. Five questions are selected at random from the stockpile for a particular quiz.

a How many different 5-question selections can be made?   [2]

b How many 5-question selections will contain 2 true-false, 2 multiple-choice, and 1 essay question?   [3]

c What is the probability that the 5-question selection will contain 2 true-false, 2 multiple-choice, and 1 essay question?   [2]

d What is the probability that the 5-question selection will contain all multiple-choice questions?   [3]

38 a Draw the graph of the equation $y = x^2 - 2x - 8$ including all values of x such that $-3 \le x \le 5$.   [6]

b Write an equation of the locus of points 4 units from the turning point of the graph drawn in part *a*.   [4]

39 The vertices of $\triangle ABC$ are $A(0,7)$, $B(0,-3)$, and $C(4,5)$. Median $\overline{CM}$ and altitude $\overline{CD}$ are drawn to side $\overline{AB}$.

a Find the area of $\triangle CMB$.   [4]

b Find the coordinates of N, the midpoint of $\overline{BC}$.   [2]

c Find the area of quadrilateral $CDMN$.   [4]

40 In right triangle ABC, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$. The length of $\overline{DB}$ is 11 units less than 3 times the length of $\overline{AD}$.

a If $CD = 2$, find AD. [*Only an algebraic solution will be accepted.*]   [8]

b Using the answer obtained in part *a*, find AC. [*Answer may be left in radical form.*]   [2]

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

Part III

Answer one question from this part. Show all work unless otherwise directed.   [10]

41 The vertices of quadrilateral $ABCD$ are $A(1,2)$, $B(10,5)$, $C(9,8)$, and $D(0,5)$. Prove that quadrilateral $ABCD$ is a rectangle.   [10]

42 Given: $\triangle ABC$, $\overline{CDA}$, $\overline{CEB}$, $\overline{DFB}$, $\overline{EFA}$, with $\overline{AD} \cong \overline{BE}$ and $\overline{AE} \cong \overline{BD}$.
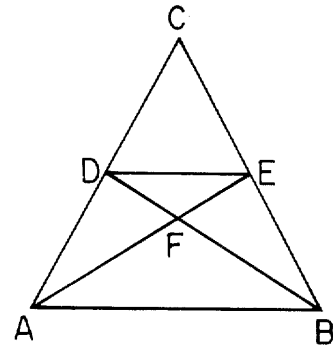
Prove: *a* $\angle BDE \cong \angle AED$ [5]

   b $\angle FAB \cong \angle FBA$ [5]

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REGENTS HIGH SCHOOL EXAMINATION

SEQUENTIAL MATH — COURSE II

Tuesday, August 19, 1986 — 8:30 to 11:30 a.m., only

ANSWER SHEET

Pupil . . . . Teacher . . . .

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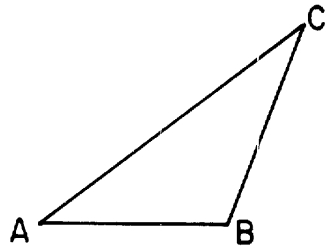
Your answers to Part I should be recorded on this answer sheet.

Part I
Answer 30 questions from this part.

1	11	21	31 . . . .
2	12	22	32 . . . .
3	13	23	33 . . . .
4	14	24	34 . . . .
5	15	25	35 Answer question 35 on the other side of this sheet.
6	16	26	
7	17	27	
8	18	28	
9	19	29	
10	20	30	

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

The declaration below should be signed when you have completed the examination.

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination, and that I have neither given nor received assistance in answering any of the questions during the examination.

_____
                                                                           Signature

FOR TEACHERS ONLY

SCORING KEY

THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

COURSE II

Tuesday, August 19, 1986 — 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. Units need not be given when the wording of the questions allows such omissions.

Part I

Allow a total of 60 credits, 2 credits for each of 30 of the following. [If more than 30 are answered, only the first 30 answered should be considered.] Allow no partial credit. For questions 18–34, allow credit if the pupil has written the correct answer instead of the numeral 1, 2, 3, or 4.

(1) b	(11) 66	(21) 2	(31) 4
(2) 29	(12) 60	(22) 3	(32) 3
(3) 30	(13) (–1,5)	(23) 4	(33) 1
(4) y	(14) 13	(24) 2	(34) 1
(5) 33	(15) 9	(25) 1	(35) construction
(6) 8	(16) 5	(26) 3	
(7) (9,–2)	(17) 40	(27) 2	
(8) 20	(18) 2	(28) 1	
(9) 8	(19) 1	(29) 4	
(10) $-\frac{2}{3}$	(20) 4	(30) 2	

Part II

Please refer to the Department's pamphlet *Guide for Rating Regents Examinations 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.

(36) a 3   [2]
    b 2   [2]
    c 3   [3]

(37) a 3003   [2]
    b 630   [3]
    c $\dfrac{630}{3003}$ [2]
    d $\dfrac{1}{3003}$ [3]

(38) b $(x - 1)^2 + (y + 9)^2 = 16$ [4]

(39) a 10   [4]
    b (2,1)   [2]
    c 11   [4]

(40) a 4   [8]
    b $\sqrt{20}$ *or* $2\sqrt{5}$ [2]