The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

COURSE II

Friday, January 29, 1982 — 1:15 to 4:15 p.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

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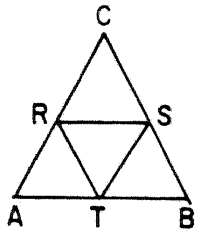
Part I

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.

1 Given the set $\{p,q,r,s\}$ and the operation $\square$ as shown in the accompanying table. Find the value of $p \square (q \square s)$.

$\square$	p	q	r	s
p	p	r	s	q
q	r	p	s	q
r	q	r	s	p
s	s	q	q	q

2 In the accompanying figure, equilateral triangle ABC has a perimeter of 18. Points R, S, and T are midpoints of the sides of triangle ABC. What is the length of $\overline{RS}$?



3 In rhombus $ABCD$, $AB = 4x - 2$ and $BC = 3x + 3$. Find x.

4 How many different 5-letter arrangements can be made using the letters in the word "PAPER"?

5 In an isosceles right triangle, the measure of an acute angle is represented by $2x + 5$. Find the value of x.

6 If the measure of one angle of a parallelogram is 90, what is the probability that the parallelogram is a rectangle?

7 Using the accompanying table, find y if $a * y = c * d$.

$*$	a	b	c	d
a	b	c	d	a
b	c	d	a	b
c	d	a	b	c
d	a	b	c	d

8 The length of a side of a square is $\sqrt{2}$. What is the length of a diagonal of the square?

9 Write an equation of the locus of points equidistant from the points (2,3) and (−6,3).

10 What is the distance, in radical form, between the points $A(5,6)$ and $B(2,1)$?

11 Write an equation of the circle whose center is (−4,2) and whose radius is 7.

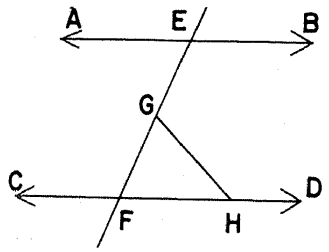
12 The altitude drawn to the hypotenuse of a right triangle divides the hypotenuse into segments of lengths 4 and 9. Find the length of the altitude.

13 Find the slope of a line whose graph is perpendicular to the line whose equation is $y = -3x + 5$.

14 What is the slope of a line that passes through the points (−1,2) and (1,4)?

15 How many combinations of 30 objects taken 28 at a time are possible?

16 In the accompanying diagram, $\overleftrightarrow{AB}$ is parallel to $\overleftrightarrow{CD}$. If $m\angle AEF = 65$ and $m\angle GHF = 45$, what is the measure of $\angle EGH$?



17 In parallelogram $PQRS$, the ratio of the measure of $\angle Q$ to the measure of $\angle R$ is 1:4. Find $m\angle Q$.

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 If each side of an equilateral triangle has length 6, what is the length of an altitude of the triangle?

(1) $2\sqrt{3}$
(2) 2
(3) 3
(4) $3\sqrt{3}$

19 If the diagonals of a parallelogram are perpendicular but *not* congruent, then the parallelogram is a
(1) rhombus (3) rectangle
(2) square (4) trapezoid

20 Which set of numbers may represent the lengths of the sides of a triangle?
(1) {2,5,9} (3) {6,4,2}
(2) {6,6,7} (4) {7,8,1}

21 The equation of the axis of symmetry of the parabola $y = -2x^2 + 12x - 19$ is
(1) $x = 6$ (3) $x = 3$
(2) $x = -6$ (4) $x = -3$

22 The point (2,1) is the midpoint of a line segment whose endpoints are (3,2) and $(1,a)$. What is the numerical value of a?
(1) 1 (3) 3
(2) 2 (4) 0

23 The roots of $x^2 - 5x - 3 = 0$ are
(1) $\frac{-5 \pm \sqrt{37}}{2}$ (3) $\frac{5 \pm \sqrt{37}}{2}$
(2) $\frac{-5 \pm \sqrt{13}}{2}$ (4) $\frac{5 \pm \sqrt{13}}{2}$

24 In $\triangle ABC$, $m\angle B = 120$, $m\angle A = 55$, and D is the point on $\overline{AC}$ such that $\overline{BD}$ bisects $\angle ABC$. Which is the longest side of $\triangle ABD$?
(1) $\overline{AB}$ (3) $\overline{BD}$
(2) $\overline{AD}$ (4) $\overline{DC}$

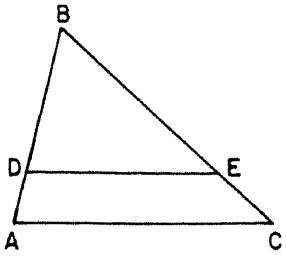
25 If $a \rightarrow b$ and $b \rightarrow c$ are both true statements, then which statement must also be true?
(1) $a \rightarrow \sim c$ (3) $c \rightarrow a$
(2) $\sim a \rightarrow c$ (4) $\sim c \rightarrow \sim a$

26 The locus of points in a plane that are a given distance d from a point P is
(1) one circle
(2) two circles
(3) one circle and one point
(4) two parallel lines

27 If x is an integer, which statement is true?
(1) $\exists_x\ 3x = 5$ (3) $\forall_x\ 8x = 9x$
(2) $\exists_x\ x + 3 = 2$ (4) $\forall_x\ 3x = 2x + 6$

28 Which statement is the negation of $r \wedge \sim k$?
(1) $\sim r \wedge k$ (3) $\sim r \vee k$
(2) $\sim r \wedge \sim k$ (4) $\sim r \vee \sim k$

29 In the accompanying diagram, $\overline{AC} \parallel \overline{DE}$, $AB = 8$, $BC = 12$, and $BD = 6$. What is the length of $\overline{EB}$?



(1) 10 (3) 3
(2) 2 (4) 9

30 Which is *not* a tautology?
(1) $(p \rightarrow q) \leftrightarrow (q \rightarrow p)$
(2) $[(p \rightarrow q) \wedge p] \rightarrow q$
(3) $[(a \rightarrow b) \wedge (b \rightarrow c)] \rightarrow (a \rightarrow c)$
(4) $\sim(p \vee q) \leftrightarrow (\sim p \wedge \sim q)$

31 The set of integers and the operation multiplication do *not* form a group because
(1) no identity element exists
(2) the associative property is not satisfied
(3) the set is not closed under the given operation
(4) inverses do not exist for some elements

32 Given the set $\{a,b,c,d\}$ and the operation Δ as shown in the accompanying table, except for the second row which has been left out. If the operation is commutative, which could be the second row?

Δ	a	b	c	d
a	b	c	d	a
b				
c	d	a	b	c
d	a	b	c	d

(1) $a\ b\ c\ d$ (3) $c\ d\ a\ b$
(2) $b\ c\ d\ a$ (4) $d\ a\ b\ c$

33 If $B \rightarrow \sim C$ and C are both true statements, then which conclusion must be true?
(1) B (3) $\sim C$
(2) $\sim B$ (4) $B \rightarrow C$

34 An equation whose roots are 1 and 2 is
(1) $x^2 + 3x + 2 = 0$
(2) $x^2 + 2x + 3 = 0$
(3) $x^2 - 2x + 3 = 0$
(4) $x^2 - 3x + 2 = 0$

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

35 *On the answer sheet*, construct an equilateral triangle such that one side has length AB.

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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.

36 Coach Euclid is going to select 6 players at random from a group of 10 students trying out for a team.

a How many different 6-player combinations are possible? [2]

b If Jill is one of the ten students trying out for the team, how many of the 6-player combinations will include Jill? [2]

c What is the probability that Jill will be selected as one of the 6 players? [2]

d After selecting the team, Coach Euclid asked the 6 members to stand in a straight line. How many different lineups are possible? [2]

e If Jill is on the team, what is the probability that she will be standing first in the lineup? [2]

37 *a* Draw the graph of the equation $y = x^2 - 2x - 1$ for all values of x such that $-2 \leq x \leq 4$. [6]

b Write the coordinates of the turning point of the graph. [2]

c Between which two consecutive positive integers does a root of $x^2 - 2x - 1 = 0$ lie? [2]

38 The vertices of parallelogram $ABCD$ are $A(1,3)$, $B(6,3)$, $C(4,-1)$, $D(-1,-1)$, and diagonals $\overline{AC}$ and $\overline{BD}$ intersect at point E.

a Find the slope of the line passing through points B and C. [2]

b Find the slope of the altitude drawn from vertex A to side $\overline{BC}$. [2]

c Find the coordinates of point E. [2]

d Write an equation of the line which passes through point E and is parallel to side $\overline{DC}$. [2]

e Find the length of diagonal $\overline{AC}$. [2]

39 Solve the following system of equations and check.

$$y = x^2 - x + 2$$
$$y = x + 5$$ [8,2]

40 In right triangle ABC, $\overline{CD}$ is the altitude drawn to hypotenuse $\overline{AB}$. The length of $\overline{DB}$ is 5 units longer than the length of $\overline{AD}$. If $CD = 3$, find the length of $\overline{AD}$ in radical form. [*Only an algebraic solution will be accepted.*] [4,6]

41 Given the elements $\{M,A,T,H\}$ and the operation #, as shown in the accompanying table. Write the letters *a* through *e* on your answer paper. After each letter, give the answer to the corresponding question below.

#	M	A	T	H
M	A	T	H	M
A	T	H	M	A
T	H	M	A	T
H	M	A	T	H

a What is the identity element for the operation #? [2]

b What is the inverse of M? [2]

c Which statement illustrates commutativity?

(1) $H \# T = T$

(2) $H \# H = H$

(3) $M \# T = T \# M$

(4) $(M \# A) \# T = M \# (A \# T)$ [2]

d Find the value of $M \# [A \# (T \# H)]$. [2]

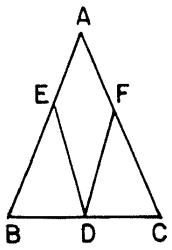
e Find x if $H \# x = A$. [2]

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.

42 Given: $\triangle ABC$, D is the midpoint of $\overline{BC}$, $\overline{AEB}$, $\overline{AFC}$, $\overline{ED} \cong \overline{FD}$, $\angle EDC \cong \angle FDB$.



Prove: $\triangle ABC$ is isosceles. [10]

43 Given: $\triangle ABC$, $A(-1,2)$, $B(7,0)$, $C(1,-6)$ and a point $D(4,-3)$ on $\overline{BC}$.

Prove: *a* $\overline{AD}$ is the perpendicular bisector of $\overline{BC}$. [6]

b $\triangle ABC$ is isosceles. [4]

44 Given the following statements:

If Leslie has high grades, then she will run for sophomore class president.

If Leslie runs for sophomore class president, then she will be elected.

Leslie has high grades or she is in big trouble.

Leslie is not in big trouble.

Let L represent: "Leslie has high grades."

Let R represent: "She will run for sophomore class president."

Let E represent: "She will be elected."

Let B represent: "She is in big trouble."

a Using L,R,E,B, and proper connectives, express each sentence in symbolic form. [2]

b Prove that Leslie will be elected. [8]

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The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

SEQUENTIAL MATH — COURSE II

Friday, January 29, 1982 — 1:15 to 4:15 p.m., only

Part I Score: .....

Rater's Initials:

.....

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.....	

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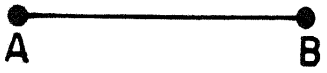

Your answers for Part II and Part III should be placed on paper provided by the school.

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

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Tear Here

Tear Here

FOR TEACHERS ONLY

SCORING KEY

THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

COURSE II

Friday, January 29, 1982 — 1:15 to 4:15 p.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) r

(2) 3

(3) 5

(4) 60

(5) 20

(6) 1

(7) b

(8) 2

(9) $x = -2$

(10) $\sqrt{34}$

(11) $(x + 4)^2 + (y - 2)^2 = 49$

(12) 6

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

(14) 1

(15) 435

(16) 110

(17) 36

(18) 4

(19) 1

(20) 2

(21) 3

(22) 4

(23) 3

(24) 1

(25) 4

(26) 1

(27) 2

(28) 3

(29) 4

(30) 1

(31) 4

(32) 3

(33) 2

(34) 4

(35) construction

[OVER]

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.

Part II

(36) *a* 210 [2]
b 126 [2]
c $\frac{126}{210}$ [2]
d 720 [2]
e $\frac{1}{6}$ [2]

(37) *b* (1,−2) [2]
c 2 and 3 [2]

(38) *a* 2 [2]
b $-\frac{1}{2}$ [2]
c $(\frac{5}{2},1)$ [2]
d $y = 1$ [2]
e 5 [2]

(39) (−1,4)
(3,8) [8]

(40) $\frac{-5 + \sqrt{61}}{2}$ [4,6]

(41) *a* *H* [2]
b *T* [2]
c 3 [2]
d *A* [2]
e *A* [2]

Part III

(44) *a* $L \rightarrow R$
$R \rightarrow E$
$L \vee B$
$\sim B$ [2]