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AUG 31 1983

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

**COURSE II**

Wednesday, January 26, 1983 — 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**

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 Find the value of  $(B \# S) \# S$  within the system defined below.

| # | B | E | S | T |
|---|---|---|---|---|
| B | T | S | E | B |
| E | S | T | B | E |
| S | E | B | T | S |
| T | B | E | S | T |

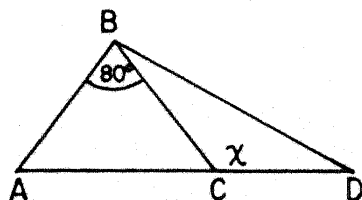
- 2 What is the identity element in the system defined by the table below?

| # | L | U | C | K |
|---|---|---|---|---|
| L | K | C | U | L |
| U | C | K | L | U |
| C | U | L | K | C |
| K | L | U | C | K |

- 3 Solve the equation  $3 * y = 1$  for  $y$  in the system defined below.

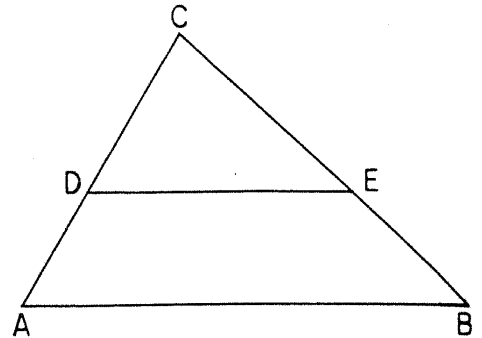
| * | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | 4 | 1 | 2 | 3 |
| 2 | 1 | 2 | 3 | 4 |
| 3 | 2 | 3 | 4 | 1 |
| 4 | 3 | 4 | 1 | 2 |

- 4 In the accompanying diagram of  $\triangle ABD$ ,  $\overline{BC}$  is drawn so that  $\overline{AB} \cong \overline{BC}$ . If  $m\angle ABC = 80$  and  $m\angle BCD = x$ , find  $x$ .



- 5 In parallelogram  $ABCD$ ,  $m\angle A = 3x - 40$  and  $m\angle C = 7x - 100$ . Find the numerical value of  $x$ .

- 6 In the accompanying diagram of  $\triangle ABC$ ,  $\overleftrightarrow{DE}$  is parallel to  $\overleftrightarrow{AB}$ . If  $CA = 10$ ,  $CD = 6$ , and  $CE = 7.5$ , find the length of  $\overline{CB}$ .

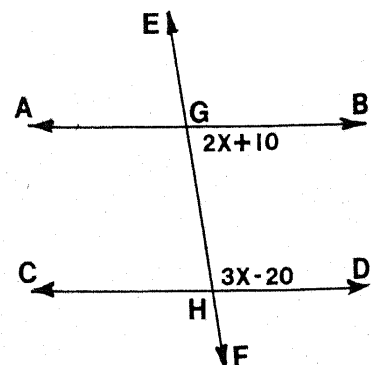


- 7 A jar contains 4 red marbles and 5 blue marbles. Carol chooses two marbles at random without replacement. What is the probability that they are both red?

- 8 What is the positive root of the equation  $x^2 + 2x - 15 = 0$ ?

- 9 The measures of the angles of a triangle are in the ratio 3:5:7. Find the measure of the *smallest* angle.

- 10 In the accompanying figure, two parallel lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$  are cut by transversal  $\overleftrightarrow{EF}$  intersecting  $\overleftrightarrow{AB}$  in  $G$  and  $\overleftrightarrow{CD}$  in  $H$ . If  $m\angle BGH = (2x + 10)$  and  $m\angle GHD = (3x - 20)$ , find the value of  $x$ .



11 The coordinates of two of the vertices of parallelogram  $ABCD$  are  $B(2,5)$  and  $D(6,1)$ . What are the coordinates of the point of intersection of the diagonals of parallelogram  $ABCD$ ?

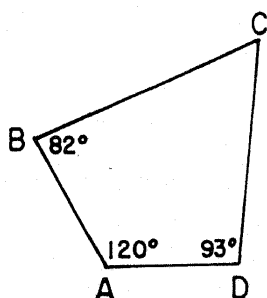
12 How many different five-letter permutations can be formed from the letters in the word "PUPPY"?

13 A club has 15 members. How many different two-person committees can be formed?

14 Find the radius of a circle whose center is  $(2,5)$  and which passes through the point  $(5,9)$ .

15 Write an equation of the line that passes through the point  $(0,7)$  and is parallel to the line whose equation is  $y = 2x + 3$ .

16 In the accompanying diagram of quadrilateral  $ABCD$ ,  $m\angle A = 120$ ,  $m\angle B = 82$ , and  $m\angle D = 93$ . Find  $m\angle C$ .



17 The coordinates of the vertices of parallelogram  $ABCD$  are  $A(2,1)$ ,  $B(4,3)$ ,  $C(10,3)$ , and  $D(x,1)$ . What is the value of  $x$ ?

18 Find the area of parallelogram  $ABCD$  whose vertices have the coordinates  $A(0,0)$ ,  $B(3,0)$ ,  $C(4,4)$ , and  $D(1,4)$ .

19 Find the slope of the line joining the points  $(3,-2)$  and  $(4,1)$ .

20 The lengths of the diagonals of a rhombus are 24 and 10. What is the length of a side of the rhombus?

21 What positive number is the mean proportional between 4 and 9?

22 Write an equation of the locus of points in the coordinate plane that are 5 units from the origin.

23 In rectangle  $ABCD$ ,  $BC = 12$  and  $CD = 16$ . Find  $BD$ .

*Directions (24-34):* 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.

24 Which statement logically follows from the true statements, "If the weather is warm, then the birds sing," and "If the birds sing, then the dog barks"?

- (1) If the weather is not warm, the birds will not sing.
- (2) If the weather is warm, then the dog barks.
- (3) If the dog barks, the birds sing.
- (4) If the weather is not warm, the birds sing.

25 What are the coordinates of the  $y$ -intercept of the graph of  $y = x^2 - 4$ ?

- (1)  $(0, -2)$
- (2)  $(0, 2)$
- (3)  $(0, -4)$
- (4)  $(0, 4)$

26 Given the true statement,  $[(s \vee t) \wedge \sim s]$ , which statement must also be true?

- (1)  $t$
- (2)  $\sim t$
- (3)  $s$
- (4)  $s \wedge \sim t$

27 Which figure does *not* always have congruent diagonals?

- (1) rectangle
- (2) isosceles trapezoid
- (3) square
- (4) rhombus

28 Which set of numbers can *not* be the lengths of the sides of a triangle?

- (1) {2,3,4}                      (3) {6,9,10}  
(2) {3,5,8}                      (4) {7,8,9}

29 Which is the negation of the statement  $\sim A \wedge B$ ?

- (1)  $A \wedge \sim B$                       (3)  $\sim A \vee B$   
(2)  $A \vee \sim B$                       (4)  $\sim A \vee \sim B$

30 If  $\sim r \rightarrow s$  and  $\sim s$  are given, which statement must be true?

- (1)  $r$                                       (3)  $r \rightarrow s$   
(2)  $\sim r$                                       (4)  $s \wedge \sim s$

31 Which is the negation of  $\exists x, x + 2 = 10$ ?

- (1)  $\exists x, x + 2 \neq 10$                       (3)  $\exists x, x + 2 > 10$   
(2)  $\forall x, x + 2 = 10$                       (4)  $\forall x, x + 2 \neq 10$

32 The set  $\{0,1,2,3 \dots\}$  under multiplication does *not* form a group because

- (1) at least one element of the set does not have an inverse under multiplication  
(2) the set is not closed under multiplication  
(3) the set does not have an identity element under multiplication  
(4) multiplication is not associative

33 The roots of the equation  $2x^2 - 6x + 3 = 0$  are

- (1)  $\frac{-6 \pm \sqrt{12}}{4}$                       (3)  $\frac{6 \pm \sqrt{12}}{4}$   
(2)  $\frac{-6 \pm \sqrt{60}}{4}$                       (4)  $\frac{6 \pm \sqrt{60}}{4}$

34 What is the total number of points that are 2 units from the  $y$ -axis and also 3 units from the origin?

- (1) 0                                      (3) 3  
(2) 2                                      (4) 4

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

35 *On the answer sheet,* construct a line perpendicular to line  $n$  and containing point  $P$ .

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 *a* Draw the graph of the equation  $y = 8 - 2x^2$  including all values of  $x$  such that  $-3 \leq x \leq 3$ . [6]  
*b* Write an equation of the axis of symmetry of this parabola. [2]  
*c* What are the roots of  $8 - 2x^2 = 0$ ? [1,1]

- 37 Given the elements  $d, e, f,$  and  $g$  and the operations  $\oplus$  and  $\otimes$  as defined by the accompanying tables.

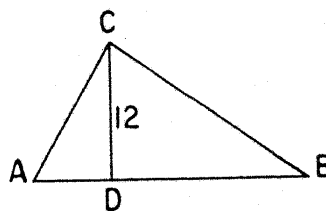
|          |     |     |     |     |
|----------|-----|-----|-----|-----|
| $\oplus$ | $d$ | $e$ | $f$ | $g$ |
| $d$      | $g$ | $d$ | $e$ | $f$ |
| $e$      | $d$ | $e$ | $f$ | $g$ |
| $f$      | $e$ | $f$ | $g$ | $d$ |
| $g$      | $f$ | $g$ | $d$ | $e$ |

|           |     |     |     |     |
|-----------|-----|-----|-----|-----|
| $\otimes$ | $d$ | $e$ | $f$ | $g$ |
| $d$       | $f$ | $g$ | $d$ | $e$ |
| $e$       | $g$ | $d$ | $e$ | $f$ |
| $f$       | $d$ | $e$ | $f$ | $g$ |
| $g$       | $e$ | $f$ | $g$ | $d$ |

- a* What is the identity element for  $\otimes$ ? [2]  
*b* What is the inverse of element  $g$  under the operation  $\otimes$ ? [2]  
*c* Find the value of  $(d \oplus e) \otimes (f \oplus g)$ . [3]  
*d* Solve for  $y$ :  $(f \oplus g) \otimes y = e$  [3]

- 38 A vase contains 4 yellow roses, 3 pink roses, and 5 red roses.  
*a* How many combinations of 3 roses are possible? [2]  
*b* How many combinations of 3 roses will be of one color only? [3]  
*c* How many combinations of 3 roses will contain exactly one rose of each color? [3]  
*d* What is the probability that a combination of 3 roses will have either all roses of the same color or one rose of each color? [2]

- 39 In the accompanying diagram of right triangle  $ABC$ ,  $\overline{CD}$  is the altitude to hypotenuse  $\overline{AB}$ . If  $CD = 12$ ,  $AD = x$ , and  $BD$  is 7 more than  $AD$ , find  $x$ . [Only an algebraic solution will be accepted.] [4,6]



- 40 Solve the following system of equations and check.

$$\begin{aligned} y &= 2x^2 + 3x - 1 \\ y &= 2x \end{aligned} \quad [8,2]$$

➡ GO RIGHT ON TO THE NEXT PAGE.

31

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

Part III

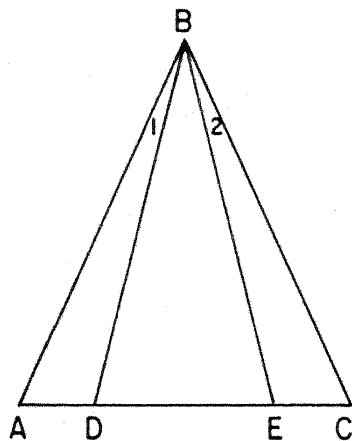
Answer one question from this part. Show all work unless otherwise directed.

41 The vertices of  $\triangle ABC$  are  $A(-1,2)$ ,  $B(3,8)$ , and  $C(5,-2)$ .

a Prove that  $\triangle ABC$  is a right triangle. [4]

b Prove that point  $M$ , the midpoint of the hypotenuse, is equidistant from all three vertices of the triangle. [6]

42 Given:  $\triangle ABC$ ,  $\overline{BD} \cong \overline{BE}$ ,  $\overline{ADEC}$ , and  $\angle 1 \cong \angle 2$ .



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

43 Given the following statements:

Either the Yankees are in the World Series or the Royals are in the World Series.

If the Brewers do not finish in second place, the Tigers will not be in last place.

The Yankees are not in the World Series.

If the Royals are in the World Series, the Tigers are in last place.

Let  $B$  represent: "The Brewers finish in second place."

Let  $R$  represent: "The Royals are in the World Series."

Let  $T$  represent: "The Tigers are in last place."

Let  $Y$  represent: "The Yankees are in the World Series."

a Using  $B$ ,  $R$ ,  $T$ ,  $Y$ , and proper connectives, express *each* statement in symbolic form. [2]

b Prove that the Brewers finished in second place. [8]

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

**SEQUENTIAL MATH — COURSE II**

Wednesday, January 26, 1983 — 1:15 to 4:15 p.m., only

Part I Score: .....

Rater's Initials:

.....

**ANSWER SHEET**

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

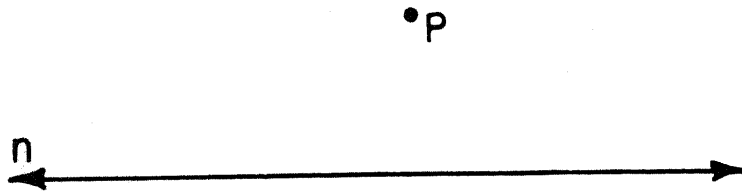
School.....Grade.....

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<br>on the other side<br>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.

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Signature



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SCORING KEY

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## THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

### COURSE II

Wednesday, January 26, 1983 — 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 24–34, allow credit if the pupil has written the correct answer instead of the numeral 1, 2, 3, or 4.

- |                     |  |                       |                   |
|---------------------|--|-----------------------|-------------------|
| (1) B               | (11) (4,3) or $\begin{matrix} x = 4 \\ y = 3 \end{matrix}$ | (21) 6                | (31) 4            |
| (2) K               | (12) 20  | (22) $x^2 + y^2 = 25$ | (32) 1            |
| (3) 4               | (13) 105   | (23) 20               | (33) 3            |
| (4) 130             | (14) 5   | (24) 2                | (34) 4            |
| (5) 15              | (15) $y = 2x + 7$  | (25) 3                | (35) construction |
| (6) 12.5            | (16) 65  | (26) 1                |                   |
| (7) $\frac{12}{72}$ | (17) 8   | (27) 4                |                   |
| (8) 3               | (18) 12  | (28) 2                |                   |
| (9) 36              | (19) 3   | (29) 2                |                   |
| (10) 38             | (20) 13  | (30) 1                |                   |

[OVER]

35

SEQUENTIAL MATH—COURSE II — *concluded*

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)  $b \ x = 0 \quad [2]$   
 $c \ 2, -2 \quad [1.1]$

(37)  $a \ f \quad [2]$   
 $b \ e \quad [2]$   
 $c \ f \quad [3]$   
 $d \ g \quad [3]$

(38)  $a \ 220 \quad [2]$   
 $b \ 15 \quad [3]$   
 $c \ 60 \quad [3]$   
 $d \ \frac{75}{220} \quad [2]$

(39)  $9 \quad [4.6]$

(40)  $(-1, -2) \quad [8]$   
 $(\frac{1}{2}, 1)$

*or*

$x = -1 \quad y = -2$

and

$x = \frac{1}{2} \quad y = 1$

**Part III**

(43)  $a \ Y \vee R$   
 $\quad \sim B \rightarrow \sim T$   
 $\quad \sim Y$   
 $\quad R \rightarrow T \quad [2]$

**NOTE:** Beginning in June 1983, Part III will consist of only *two* questions from which the student must select one.