

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

# COURSE II

Tuesday, January 26, 1993 — 9:15 a.m. to 12:15 p.m., only

**Notice . . .**

Calculators must be available to all students taking this examination.

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.

On page 9 you will find the “Tables of Natural Trigonometric Functions” which you may need to answer some questions in this examination. Fold this page along the perforations, and tear it off also slowly and carefully.

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

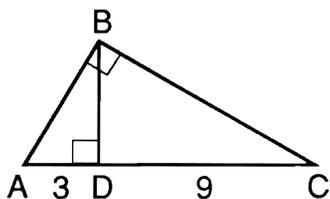
Answer 30 questions from this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Write your answers in the spaces provided on the separate answer sheet. Where applicable, answers may be left in radical form. [60]

- 1 A translation maps  $A(4,1)$  onto  $A'(6,6)$ . Find the coordinates of the image of  $B(-1,0)$  under the same translation.
- 2 The accompanying table defines the operation  $\mathcal{D}$  for set  $\{e,f,g,h\}$ .

$\mathcal{D}$	$e$	$f$	$g$	$h$
$e$	$e$	$f$	$g$	$h$
$f$	$f$	$h$	$e$	$g$
$g$	$g$	$e$	$h$	$f$
$h$	$h$	$g$	$f$	$e$

Using the table, solve for  $x$ :  $g \mathcal{D} x = h$

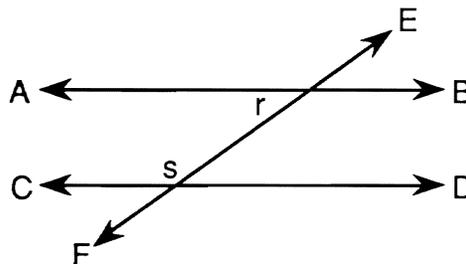
- 3 In right triangle  $ABC$ ,  $m\angle A = 2x + 2$ ,  $m\angle B = 7x + 7$ , and  $m\angle C = 90$ . Find the value of  $x$ .
- 4 In the accompanying diagram of right triangle  $ABC$ , altitude  $\overline{BD}$  divides hypotenuse  $\overline{AC}$  into segments with lengths of 3 and 9. Find the length of leg  $\overline{AB}$ .



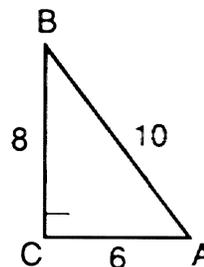
5 Solve for  $x$ :  $\frac{x+1}{8} = \frac{11}{16}$

- 6 In the set of rational numbers, what is the identity element for multiplication?
- 7 The line whose equation is  $y = -3$  is reflected in the  $x$ -axis. Write an equation of the image of that line.

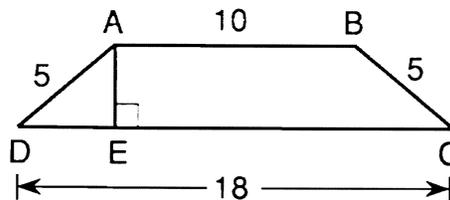
- 8 In the accompanying diagram,  $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$ ,  $\overleftrightarrow{EF}$  intersects  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$ , and the ratio of  $m\angle r$  to  $m\angle s$  is 1:4. Find  $m\angle r$ .



- 9 Vertex angle  $A$  of isosceles triangle  $ABC$  measures  $70^\circ$ . What is the measure, in degrees, of an exterior angle at  $B$ ?
- 10 In the accompanying diagram of right triangle  $ABC$ ,  $AB = 10$ ,  $BC = 5$ ,  $CA = 6$ , and  $\angle C$  is a right angle. Which angle of the triangle has a cosine equal to 0.5000?

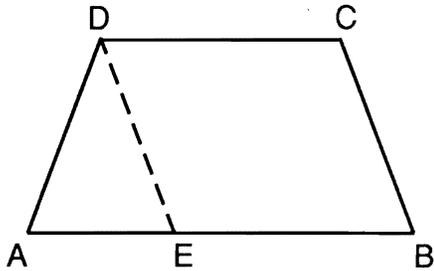


- 11 In the accompanying diagram,  $ABCD$  is an isosceles trapezoid.  $AD = BC = 5$ ,  $AB = 10$ , and  $DC = 18$ . Find the length of altitude  $\overline{AE}$ .



- 12 How many different four-letter arrangements can be formed from the letters in the word "PAPA"?

- 13 If  ${}_nC_2 = 15$ , find the value of  $n$ .
- 14 In a plane, what is the total number of points 5 units from the point  $(4, -2)$  and 2 units from the  $x$ -axis?
- 15 In the accompanying diagram,  $ABCD$  is an isosceles trapezoid with  $\overline{DE} \parallel \overline{CB}$ . Find the measure of  $\angle ADE$  if  $m\angle C = 110$ .



- 16 Given the graphs of these four equations:

$$\begin{aligned} x &= 4 \\ y &= 2 \\ x &= y \\ x + y &= 1 \end{aligned}$$

If one of these graphs is picked at random, what is the probability the graph will *not* intersect the  $y$ -axis?

- 17 Write an equation of the locus of points 4 units from the origin.

*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 Given the true statements  $\sim(p \wedge \sim q)$  and  $\sim q$ , which must be true?
- (1)  $\sim p \wedge q$                       (3)  $p$   
 (2)  $p \vee \sim q$                       (4)  $\sim p$
- 19 If the lengths of two sides of a triangle are 4 and 5, the length of the third side can *not* be
- (1) 1                                      (3) 3  
 (2) 2                                      (4) 4

- 20 If the hypotenuse of a right triangle measures 8 and one leg measures 5, then the other leg measures

- (1)  $\sqrt{3}$                                       (3)  $\sqrt{39}$   
 (2)  $\sqrt{13}$                                     (4)  $\sqrt{89}$

- 21 In  $\triangle ABC$ ,  $m\angle A = 58$  and  $m\angle B = 64$ . Which statement about the sides of the triangle is true?

- (1)  $AB > BC$                               (3)  $AB > AC$   
 (2)  $AB = BC$                               (4)  $BC > AC$

- 22 Which statement is logically equivalent to  $\sim p \rightarrow q$ ?

- (1)  $p \rightarrow \sim q$                               (3)  $\sim q \rightarrow p$   
 (2)  $q \rightarrow \sim p$                               (4)  $q \rightarrow p$

- 23 What is the midpoint of the line segment connecting the points  $(-2, 4)$  and  $(5, -2)$ ?

- (1)  $(\frac{3}{2}, 1)$                                       (3)  $(\frac{7}{2}, 1)$   
 (2)  $(3, \frac{3}{2})$                                       (4)  $(\frac{3}{2}, 2)$

- 24 Which statement is *always* true about a parallelogram?

- (1) Diagonals bisect the angles.  
 (2) Diagonals are perpendicular.  
 (3) Adjacent sides are congruent.  
 (4) Diagonals bisect each other.

- 25 Which triangles must be similar?

- (1) two obtuse triangles  
 (2) two scalene triangles  
 (3) two right triangles  
 (4) two isosceles triangles with congruent vertex angles

- 26 The graph of the equation  $y = x^2$  is a

- (1) circle                                      (3) point  
 (2) parabola                                    (4) straight line

- 27 Which is an equation of the line that passes through the point  $(0, 4)$  and is perpendicular to the line whose equation is  $y = -\frac{1}{2}x + 3$ ?

- (1)  $y = -\frac{1}{2}x + 4$                               (3)  $y = 2x + 4$   
 (2)  $y = -2x + 4$                               (4)  $y = -2x - 4$

28 Which statement is the converse of the statement, "If Jamie got a ticket, then Jamie was speeding"?

- (1) If Jamie was speeding, then Jamie got a ticket.
- (2) If Jamie did not get a ticket, then Jamie was not speeding.
- (3) If Jamie got a ticket, then Jamie was not speeding.
- (4) If Jamie was not speeding, then Jamie did not get a ticket.

29 Which must be true for  $x$  in the equation

$$\frac{1}{x} + \frac{1}{x+3} = 2?$$

- (1)  $x = 0, x = -3$
- (2)  $x \neq 0, x = -3$
- (3)  $x = 0, x \neq -3$
- (4)  $x \neq 0, x \neq -3$

30 If the coordinates of a parallelogram are  $Q(3,-2)$ ,  $R(7,-2)$ ,  $S(9,3)$ , and  $T(5,3)$ , the area of the parallelogram is

- (1) 10
- (2) 20
- (3) 30
- (4) 40

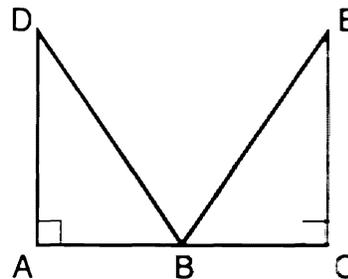
31 Which equation has  $-5$  and  $3$  as its roots?

- (1)  $x^2 + 2x + 15 = 0$
- (2)  $x^2 + 2x - 15 = 0$
- (3)  $x^2 - 2x + 15 = 0$
- (4)  $x^2 - 2x - 15 = 0$

32 What is an equation of the axis of symmetry of the graph of the parabola  $y = 2x^2 + 3x + 5$ ?

- (1)  $y = -\frac{3}{2}$
- (2)  $y = -\frac{3}{4}$
- (3)  $x = -\frac{3}{2}$
- (4)  $x = -\frac{3}{4}$

33 In the accompanying diagram,  $B$  is the midpoint of  $\overline{AC}$ ,  $\overline{DA} \perp \overline{AC}$ ,  $\overline{EC} \perp \overline{AC}$ , and  $\overline{DB} \cong \overline{EB}$ .



Which method of proof may be used to prove  $\triangle DAB \cong \triangle ECB$ ?

- (1) SAS  $\cong$  SAS
- (2) ASA  $\cong$  ASA
- (3) HL  $\cong$  HL
- (4) AAS  $\cong$  AAS

34 What is the slope of the line determined by the points  $(5,-3)$  and  $(-9,-6)$ ?

- (1)  $\frac{3}{14}$
- (2)  $-\frac{3}{14}$
- (3)  $\frac{14}{3}$
- (4)  $-\frac{14}{3}$

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

35 *On the answer sheet*, construct the bisector of  $\angle ABC$ .

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

Part II

Answer three questions from this part. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Calculations that may be obtained by mental arithmetic or the calculator do not need to be shown. [30]

- 36 *a* Solve the following system of equations algebraically:

$$\begin{aligned} y &= x^2 - 6x + 6 \\ y - x &= -4 \end{aligned} \quad [6]$$

- b* For all values of  $x$  for which these expressions are defined, find the product in simplest form.

$$\frac{x^2 - 9}{x} \cdot \frac{x^2 + 2x}{x^2 + 5x + 6} \quad [4]$$

- 37 *a* On graph paper, draw the graph of the equation  $y = x^2 - 6x + 5$ , including all values of  $x$  in the interval  $0 \leq x \leq 6$ . [5]  
*b* On the same set of axes, sketch the image of the graph drawn in part *a* after a reflection in the  $y$ -axis. [3]  
*c* Write an equation of the axis of symmetry of the graph drawn in part *b*. [2]

- 38 Given: points  $A(8,0)$  and  $B(0,4)$ .  
*a* Write an equation of  $\overleftrightarrow{AB}$ . [3]  
*b* Describe fully the locus of points equidistant from  $A$  and  $B$ . [2]  
*c* Write an equation of the locus described in part *b*. [3]  
*d* Is the point  $(1,-4)$  equidistant from  $A$  and  $B$ ? Justify your answer. [2]

- 39 On your answer paper, write the letters  $a$  through  $e$ . Next to each letter, write a valid conclusion that can be deduced from each set of true statements. If no valid conclusion can be deduced, write "NO CONCLUSION."

*a*  $A \vee \sim B$  [2]  
 $\sim A$

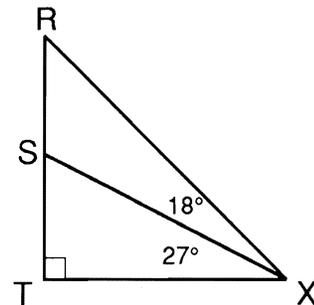
*b*  $\sim P \rightarrow Q$  [2]  
 $P$

*c*  $\sim X \vee \sim Y$  [2]  
 $\sim X$

*d*  $\sim A \rightarrow B$  [2]  
 $C \rightarrow \sim B$

*e*  $\sim A \rightarrow \sim B$  [2]  
 $B$

- 40 In the accompanying diagram,  $\overline{RT} \perp \overline{TX}$ ,  $m\angle TXS = 27$ ,  $m\angle SXR = 18$ , and  $SX = 21.2$  meters.



- a* To the nearest tenth of a meter, find:  
 (1)  $TX$  [3]  
 (2)  $RT$  [2]  
 (3)  $RX$  [3]  
*b* Using the answers from part *a*, find the area of  $\triangle RTX$  to the nearest square meter. [2]

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

Part III

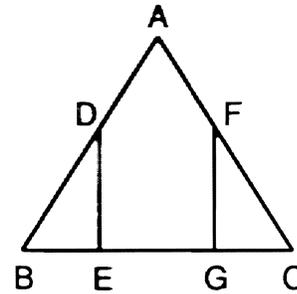
Answer one question from this part. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Calculations that may be obtained by mental arithmetic or the calculator do not need to be shown. [10]

41 Points  $A(-a,0)$ ,  $B(a,0)$ ,  $C(a,b)$ , and  $D(-a,b)$  form a quadrilateral.

*a* Prove that quadrilateral  $ABCD$  is a rectangle. [7]

*b* If  $b = 7$  and  $a = 10$ , prove that  $ABCD$  is not a square. [3]

42 Given:  $\overline{AD} \cong \overline{AF}$ ,  $\overline{BE} \cong \overline{CG}$ ,  $\overline{AB} \cong \overline{AC}$ ,  $\overline{DE} \perp \overline{BC}$ ,  $\overline{FG} \perp \overline{BC}$ , and  $\overline{BG} \cong \overline{CE}$ .



Prove:  $\overline{BD} \cong \overline{CF}$  [3]

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# FOR TEACHERS ONLY

## SCORING KEY

### THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

## COURSE II

Tuesday, January 26, 1993 — 9:15 a.m. to 12:15 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) (1,5)	(11) 3	(21) 2	(31) 2
(2) $g$	(12) 6	(22) 3	(32) 4
(3) 9	(13) 6	(23) 1	(33) 3
(4) 6	(14) 4	(24) 4	(34) 1
(5) $4\frac{1}{2}$	(15) $40^\circ$	(25) 4	(35) construction
(6) 1	(16) $\frac{1}{4}$	(26) 2	
(7) $y = 3$	(17) $x^2 + y^2 = 16$	(27) 3	
(8) 36	(18) 4	(28) 1	
(9) 125	(19) 1	(29) 4	
(10) $B$	(20) 3	(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.

**Note:** In October 1991, a supplement to the *Guide for Rating Regents Examinations in Mathematics* was sent to all schools. This supplement includes references to problem solving and calculator use. Teachers should become familiar with these modifications before rating student papers.

(36) *a* (5,1) and (2,-2) [6]

*b*  $x - 3$  [4]

(37) *c*  $x = -3$  [2]

(38) *a*  $y = -\frac{1}{2}x + 4$  [3]

*c*  $y = 2x - 6$  [3]

(39) *a*  $\sim B$  [2]

*b* NO CONCLUSION [2]

*c* NO CONCLUSION [2]

*d*  $C \rightarrow A$

*or* [2]

$\sim A \rightarrow \sim C$

*e*  $A$  [2]

(40) *a* (1) 18.9 [3]

(2) 18.9 [2]

(3) 26.7 [3]

*b* 179 [2]