The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

TENTH YEAR MATHEMATICS

Friday, June 16, 1978 — 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.

On page 5 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 all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Unless otherwise specified, answers may be left in terms of $\pi$ or in radical form. Write your answers in the spaces provided on the separate answer sheet.

1. The ratio of the circumferences of two circles is 1:4. If the length of the radius of the smaller circle is 3, find the length of the radius of the larger circle.

2. Triangle $ABC$ is inscribed in circle $O$, $\overline{AB}$ is the diameter of the circle, and $m \angle A = 40$. Which is the shortest side of the triangle?

3. The lengths of the sides of a triangle are 4, 6, and 8. If the midpoints of the three sides are joined to form a second triangle, find the perimeter of the second triangle.

4. Find the area of a right triangle whose legs have lengths 5 and 10.

5. In $\triangle ABC$, $\overline{AB} \cong \overline{BC}$ and $m \angle A = 30$. Find $m \angle B$.

6. In the accompanying diagram of rectangle $ABCD$, $AB = 10$ and $BC = 4$. Find, in radical form, the length of diagonal $\overline{AC}$.

7. A regular hexagon is inscribed in a circle whose radius has length 4. Find the length of a side of the hexagon.

8. Circle $O$ has center $(0,2)$ and diameter $\overline{AB}$. If the coordinates of $A$ are $(-3,2)$, find the coordinates of $B$.

9. Find the radius of a circle whose area is $36\pi$.

10. The area of parallelogram $ABCD$ is equal to the area of a square whose side is 6. If $AB = 12$, find the length of an altitude drawn to side $\overline{AB}$.

11. If the lengths of the bases of a trapezoid are 9 and 23, find the length of the median.

12. In the accompanying diagram, diameter $\overline{CD}$ of circle $O$ is drawn perpendicular to chord $\overline{AB}$ at $E$. If $AB = 8$ and $CE = 8$, find $ED$.

13. Find the circumference of a circle if an arc whose measure is 120 degrees has a length of $8\pi$.

14. The lengths of the bases of a trapezoid are 11 centimeters and 15 centimeters. If the area of the trapezoid is 78 square centimeters, find the number of centimeters in the length of the altitude.

15. In the accompanying figure, $ABC$ is a right triangle with $m \angle C = 90$, $BC = 7$, and $AC = 10$. Find, to the nearest degree, the measure of $\angle B$.

Directions (16–29): Write in the space provided on the separate answer sheet the numeral preceding the expression that best completes each statement or answers each question.

16. If $\triangle ABC \cong \triangle DEF$ and $\triangle DEF \sim \triangle RST$, then which must be true?
   (1) $\triangle ABC \cong \triangle RST$
   (2) $\triangle ABC \sim \triangle RST$
   (3) area of $\triangle ABC = $ area of $\triangle RST$
   (4) perimeter of $\triangle ABC = $ perimeter of $\triangle RST$

17. In parallelogram $ABCD$, if $m \angle A = x$, then $m \angle B$ equals
   (1) $90 - x$
   (2) $180 - x$
   (3) $180 - 2x$
   (4) $2x$
18 If two polygons are similar, which statement must be true?
(1) The polygons are congruent.
(2) The polygons are equiangular.
(3) The lengths of the corresponding sides of the polygons are in proportion.
(4) The polygons are equilateral.

19 Point $P$ is 2 inches from $CD$. What is the total number of points that are 1 inch from $CD$ and also 1 inch from $P$?
(1) 1
(2) 2
(3) 3
(4) 4

20 To prove by indirect proof that an angle $x$ of a certain triangle is an obtuse angle, it could be shown that
(1) the measure of angle $x$ is greater than the measure of some other angle $y$ which is known to be acute
(2) the two sides of the triangle which form angle $x$ are not perpendicular
(3) the measure of angle $x$ is equal to the measure of some other angle $z$ which is known to be acute
(4) angle $x$ is neither an acute angle nor a right angle

21 An equation of the locus of points whose ordinates are 3 less than twice their abscissas is
(1) $y = 2x - 3$
(2) $y = 2x + 3$
(3) $x = 2y - 3$
(4) $x = 2y + 3$

22 The measure of each exterior angle of a regular ten-sided polygon is
(1) $36^\circ$
(2) $144^\circ$
(3) $180^\circ$
(4) $360^\circ$

23 If in triangle $ABC$, $m\angle A = 60$ and the measure of an exterior angle at $B$ is $140^\circ$, then
(1) $BC$ is the shortest side of the triangle
(2) $AB$ is the longest side of the triangle
(3) the triangle is obtuse
(4) the triangle is isosceles

24 Which set may be the lengths of the sides of an obtuse triangle?
(1) $\{3,3,3\}$
(2) $\{3,4,8\}$
(3) $\{3,4,5\}$
(4) $\{3,4,6\}$

25 The distance between the points $(-2,3)$ and $(6,-2)$ is
(1) $\sqrt{17}$
(2) $\sqrt{65}$
(3) $\sqrt{80}$
(4) 10

26 In the accompanying diagram, $O$ is the center of the circle circumscribed about scalene $\triangle ABC$ and $R$ is the center of the circle inscribed in scalene $\triangle ABC$. Which statement is false?

(1) Point $R$ is equidistant from $AC$ and $BC$.
(2) Point $O$ is equidistant from points $B$ and $C$.
(3) Point $R$ lies on the bisectors of angles $A$ and $C$.
(4) Point $O$ lies on the bisectors of angles $A$ and $C$.

27 An altitude drawn to the hypotenuse of a right triangle divides the hypotenuse into segments whose lengths are 4 and 16. The length of the altitude to the hypotenuse is
(1) 8
(2) 10
(3) 20
(4) 64

28 Which statement is not always true?
(1) A square is a rhombus.
(2) A square is a rectangle.
(3) A parallelogram is a polygon.
(4) A trapezoid is a parallelogram.

29 What is true of the line segment joining $(-5,2)$ and $(-5,-7)$?
(1) Its slope is $-2$.
(2) Its slope is $\frac{7}{2}$.
(3) Its slope is undefined.
(4) Its slope is zero.

Directions (30): Leave all construction lines on the answer sheet.

30 On the answer sheet, construct a triangle similar to the given triangle $RST$, using the line segment $AB$ as the base corresponding to $RS$. 

GO RIGHT ON TO THE NEXT PAGE.
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 Prove either a or b, but not both:

a The sum of the measures of the angles of a triangle is 180 degrees. [10]

OR

b The measure of an angle formed by two chords intersecting inside the circle is equal to one-half the sum of the measures of the intercepted arcs. [10]

32 Given: rectangle ABCD, DFECE, AGE, BGF, DF = EC

Prove: $a \angle 1 \equiv \angle 2$ [6]

$b \angle 3 \equiv \angle 4$ [2]

c $AG \equiv GB$ [2]

33 Given: rectangle DEFG, triangle ABC with a right angle at B, AEB, BDC, AFGC

Prove: $ED \times DG = DC \times EB$ [10]

34 Given: circle O, tangent DE, secant DAC, diameter AOB, OE, BE = BC, $m \angle x : m \angle y = 2 : 1$

Find:

$a m \angle y$ [2]

$b m \angle B$ [3]

c $m \angle EOA$ [2]

d $m \angle D$ [3]

35 Given: $\triangle ABC$ with $BDC, AED$, and $EC$ drawn

Prove: $m \angle AEC > m \angle ABC$ [10]

36 The vertices of quadrilateral ABCD are A(0, -3), B(1, 0), C(4, 0), and D(3, -3).

a Show by means of coordinate geometry that ABCD is a parallelogram and state a reason for your conclusion. [6]

b Find the area of the parallelogram. [4]

*37 The coordinates of points A, B, and C are A(0, 2), B(2, 6), and C(4, 1).

a Write an equation of $\overrightarrow{AB}$. [4]

b Write an equation of the line through C perpendicular to $\overrightarrow{AB}$. [6]

* This question is based on an optional topic in the syllabus.
### Tables of Natural Trigonometric Functions
(For use with 9th and 10th Year Mathematics Regents Examinations)

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TENTH YEAR MATHEMATICS

Friday, June 16, 1978 — 1:15 to 4:15 p.m., only

ANSWER SHEET

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

School.........................................................................................................................................................

Name and author of textbook used..............................................................................................................

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 ......................................................
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8. ...................................................... 18 ...................................................... 28 ......................................................
9. ...................................................... 19 ...................................................... 29 ......................................................
10. ................................................. 20 ...................................................... 30 Answer question 30 on the other side of this sheet.
Your answers for Part II 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

12-June '78
FOR TEACHERS ONLY

SCORING KEY

TENTH YEAR MATHEMATICS

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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 2 credits for each correct answer; allow no partial credit. For questions 16–29, allow credit if the pupil has written the correct answer instead of the numeral 1, 2, 3, or 4.

(1) 12 (11) 16 (21) 1
(2) $BC$ or $a$ (12) 2 (22) 1
(3) 9 (13) $24\pi$ (23) 2
(4) 25 (14) 6 (24) 4
(5) 120 (15) 35 (25) 3
(6) $\sqrt{16}$ or $2\sqrt{29}$ (16) 2 (26) 4
(7) 4 (17) 2 (27) 1
(8) $(3, 2)$ or $x = 3$ (18) 3 (28) 4
(9) 6 (19) 1 (29) 3
(10) 3 (20) 4

[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.

\[(34) \ a \ 30 \ [2]\]
\[b \ 120 \ [3]\]
\[c \ 60 \ [2]\]
\[d \ 90 \ [3]\]

\[(36) \ b \ 9 \ [4]\]

\[(37) \ a \ y - 2 = 2(x - 0)\]

\[or\]
\[y = 2x + 2 \ [4]\]

\[b \ y - 1 = -\frac{1}{2}(x - 4)\]

\[or\]
\[x + 2y = 6 \ [6]\]
The University of the State of New York

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Part 1

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Unless otherwise specified, answers may be left in terms of $\pi$ or in radical form. Write your answers in the spaces provided on the separate answer sheet.

1 In the accompanying diagram, $ABCDE$ is a regular pentagon and diagonals $CE$ and $CA$ are drawn. If $CE = 6$, what is the length of $CA$?

2 In $\triangle ABC$, $D$ is the midpoint of $AB$, $E$ is the midpoint of $BC$, and $DE$ is drawn. If $m\angle A = 75^\circ$, find $m\angle BDE$.

3 In triangle $RST$, $m\angle T = 60$ and $m\angle S > m\angle R$. Which is the longest side of the triangle?

4 In triangle $ABC$, $\overline{AB} = \overline{AC}$ and $m\angle A = 70$. Find the number of degrees in the measure of an exterior angle at $C$.

5 The lengths of the diagonals of a rhombus are 10 and 15. Find the area of the rhombus.

6 In the accompanying diagram, $\overline{CD}$ is parallel to $\overline{AB}$, $CA = 4$, $DB = 5$, and $EC = 8$. Find $ED$.

7 In the accompanying figure, $\overline{BD}$ bisects $\angle ABC$. If $m\angle A = 44$ and $m\angle C = 34$, find $m\angle DBC$.

8 The length of a side of an equilateral triangle is 8. What is the length, in radical form, of an altitude of the triangle?

9 The length of a side of a square is 4. What is the length, in radical form, of a diagonal of the square?

10 In the accompanying diagram, $\triangle ABC$ is a right triangle with $m\angle ACB = 90^\circ$, $\overline{AD}$, and $\overline{CD} \perp \overline{AB}$. If $AB = 8$ and $AD = 2$, find the length of $AC$.

11 Find the distance from point $A(3, -1)$ to point $B(9, 7)$.

12 The area of a sector of a circle is 8 square inches and the measure of the central angle of the sector is $90^\circ$. Find the number of square inches in the area of the circle.

13 Quadrilateral $ABCD$ is inscribed in a circle. If $m\overline{AB} = 70$, $m\overline{BC} = 100$, and $m\overline{CD} = 130$, find $m\angle ABC$.

14 The length of a side of a triangle is 12 and the length of the altitude drawn to that side is 11. Find the area of the triangle.

15 In the accompanying diagram, diameter $\overline{CE}$ of circle $O$ is perpendicular to chord $\overline{AB}$ at $D$. If $AB = 8$ and $OD = 3$, find $OA$.

16 A line which passes through the points (5,3) and (x,6) has a slope of 1. What is the value of $x$?

17 In tri $AB = \text{[Diagram]}

Direction:
separate answer sheet that b
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(2) 110^\circ$

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Math. 10–June 78
17 In triangle $ABC$, $m \angle C = 90$, $m \angle A = 30$, and $AB = 4$. Find $BC$.

**Directions** (18–29): Write in the space provided on the separate answer sheet the numeral preceding the expression that best completes each statement or answers each question.

18 Which of the following must be true about the diagonals of a rectangle?

A. The diagonals are perpendicular.
B. The diagonals have the same length.
C. The diagonals bisect each other.

(1) A, only
(2) A and C, only
(3) B and C, only
(4) A, B, and C

19 In the accompanying diagram, parallel lines $AB$ and $CD$ are intersected by transversal $EF$ at $G$ and $H$, respectively. If $m \angle BGE = 70^\circ$, then what is $m \angle CHG$?

A. $35^\circ$
B. $70^\circ$
C. $90^\circ$
D. $110^\circ$

(1) 35
(2) 70
(3) 90
(4) 110

20 If the lengths of two sides of a triangle are 7 and 10, the length of the third side may be

(1) 7
(2) 2
(3) 3
(4) 17

21 The exact number of points equidistant from the $x$- and $y$-axes and also two inches from the origin is

(1) 1
(2) 2
(3) 3
(4) 4

22 Two tangents are drawn to a circle from an exterior point. If the measure of the angle formed by the two tangents is $40^\circ$, then the measure of the minor intercepted arc is

(1) $20^\circ$
(2) $110^\circ$
(3) $140^\circ$
(4) $220^\circ$

23 Which is not a good example of indirect reasoning?

(1) To prove a triangle is scalene, prove it is not isosceles and not equilateral.
(2) To prove an angle is acute, prove it is not obtuse.
(3) To prove two lines in a plane intersect, prove they are not parallel.
(4) To prove $AB$ is greater than $BC$, prove $AB$ is not less than $BC$ and $AB$ is not equal to $BC$.

24 In the accompanying figure, $\overline{AB} \cong \overline{AD}$ and $\overline{BC} \cong \overline{CD}$. Which statement must be true?

(1) $\overline{BD} \perp \overline{AC}$
(2) $\overline{BD} \cong \overline{AC}$
(3) $ABCD$ is a parallelogram.
(4) $\angle BAD \cong \angle BCD$

25 If two circles have exactly three common tangents, then the circles

(1) are internally tangent
(2) are externally tangent
(3) intersect in two distinct points
(4) are nonintersecting

26 An isosceles trapezoid has two base angles whose measures are each 45 degrees. If the bases are 8 and 12, respectively, then the length of an altitude of the trapezoid must be

(1) 6
(2) 2
(3) 10
(4) 4

27 What is a converse of the statement, "If the altitude is drawn to the base of an isosceles triangle, then it bisects the base"?

(1) If a triangle is isosceles, then the altitude does not bisect the base.
(2) If a triangle is not isosceles, then the altitude does not bisect the base.
(3) If the altitude bisects the base of a triangle, then the triangle is isosceles.
(4) The altitude bisects the base of an isosceles triangle.

28 In the accompanying diagram, $\overline{BD}$ is an altitude of $\triangle ABC$, $m \angle A = 36$, $AB = 6$, and $AC = 8$. What is the length of $\overline{BD}$ to the nearest tenth?

A. 3.5
B. 4.7
C. 6.5
D. 4.9

[OVER]
29 If the area of a square is 64, then the length of its apothem is

1. 32
2. 16
3. 8
4. 4

Directions (30): Leave all construction lines on the answer sheet.

30 On the answer sheet, locate by construction a point on $\overline{DC}$ that is equidistant from points A and B.

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 Prove either $a$ or $b$, but not both:

a The square of the length of the hypotenuse of a right triangle is equal to the sum of the squares of the lengths of the legs. [10]

OR

b If three angles of one triangle are congruent to the three angles of another triangle, the triangles are similar. [10]

32 Given: $\triangle ABC$ with $\overline{AB} \cong \overline{AC}$, $\overline{BDC} \cong \overline{AED}$, and $m \angle 1 = m \angle 2$.

Prove: $\triangle BDE \cong \triangle CDE$ [10]

33 In the accompanying diagram, $ABCD$ is a parallelogram, and diagonals $\overline{AC}$ and $\overline{BD}$ intersect at $E$. The midpoints of $\overline{AE}$, $\overline{BE}$, $\overline{CE}$, and $\overline{DE}$ are $S$, $P$, $Q$, and $R$, respectively.

Prove: $PQRS$ is a parallelogram. [10]

34 Given: $\overline{AD}$ and $\overline{BC}$ intersect at point $E$, $\overline{AB} \parallel \overline{CD}$.

Prove: $\overline{AB} \times \overline{DE} = \overline{DC} \times \overline{AE}$ [10]

35 In the accompanying diagram, $\overline{EOF}$ is a diameter of circle $O$. $\overline{CD}$ is tangent to the circle at $C$, $\overline{CD} \perp \overline{EF}$, and $m \angle G = 40^\circ$. Chords $\overline{CG}$ and $\overline{EF}$ intersect at $M$, and $\overline{FG}$ is drawn.

a Find $m \angle FGM$. [2]

b Find $m \angle CF$. [2]

c Find $m \angle DCG$. [3]

d Find $m \angle EMG$. [3]

36 The vertices of parallelogram $ABCD$ are $A(4,6)$, $B(3,7)$, $C(6,-8)$, and $D(r,t)$.

a Find the coordinates of the midpoint of $\overline{AC}$. [2]

b Find the coordinates of the midpoint of $\overline{BD}$ in terms of $r$ and $t$. [4]

c Find the numerical value of $r$. [2]

d Find the numerical value of $t$. [2]

37 The vertices of triangle $ABC$ are $A(-4,4)$, $B(6,4)$, and $C(5,1)$.

a Using graph paper, draw $\triangle ABC$. [1]

b Using methods of coordinate geometry, show that triangle $ABC$ is a right triangle. State a reason for your conclusion. [5]

b Using methods of coordinate geometry, show that the median to the hypotenuse equals one-half the hypotenuse. [4]

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The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION
TENTH YEAR MATHEMATICS
Friday, June 23, 1978 — 1:15 to 4:15 p.m., only

ANSWER SHEET

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

School .........................................................................................................................................................

Name and author of textbook used .........................................................................................................................

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. .............................................................................

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8. ............................................................................. 18. ............................................................................. 28. .............................................................................

9. ............................................................................. 19. ............................................................................. 29. .............................................................................

10. .......................................................................... 20. .......................................................................... 30. Answer question 30 on the other side of this sheet.

Math. 10—June '78 B

[7]

[OVER]
Your answers for Part II 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

Math. 10–June '78B

22
FOR TEACHERS ONLY
SCORING KEY
TENTH YEAR MATHEMATICS

Friday, June 23, 1978 — 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 2 credits for each correct answer; allow no partial credit. For questions 18–29, allow credit if the pupil has written the correct answer instead of the numeral 1, 2, 3, or 4.

(1) 6  (11) 10  (21) 4
(2) 75  (12) 32  (22) 3
(3) TR or s  (13) 95  (23) 2
(4) 125  (14) 66  (24) 1
(5) 75  (15) 5  (25) 2
(6) 10  (16) 8  (26) 2
(7) 51  (17) 2  (27) 3
(8) $4\sqrt{3}$ or $\sqrt{48}$  (18) 3  (28) 1
(9) $4\sqrt{2}$ or $\sqrt{32}$  (19) 4  (29) 4
(10) 4  (20) 1

[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.

(35) a 70 [2]
b 90 [2]
c 65 [3]
d 115 [3]

(36) a (5, -1) or x = 5, y = -1 [3]
b \left( \frac{3 + r}{2}, \frac{-7 + t}{2} \right)

or

\[ x = \frac{3 + r}{2}, \quad y = \frac{-7 + t}{2} \] [4]

c 7 [2]
d 5 [2]