The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

TENTH YEAR
MATHEMATICS

Tuesday, June 16, 1987—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 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 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 π or in radical form. Write your answers in the spaces provided on the separate answer sheet. [60]

1 If the measures of the angles of a triangle are in the ratio 1:4:7, find the number of degrees in the measure of the *smallest* angle.

2 Segment AB is the shorter base of trapezoid ABCD. Legs $\overline{CB}$ and $\overline{DA}$ are extended through B and A, respectively, to meet at E. If BE = 6, CB = 4, and AE = 9, find DA.

3 In the accompanying diagram, quadrilateral ABCD is inscribed in a circle. Diagonals $\overline{AC}$ and $\overline{BD}$ intersect at E. If $m\overset{\frown}{AD}$ = 140 and $m\overset{\frown}{BC}$ = 40, find $m\angle DEC$.
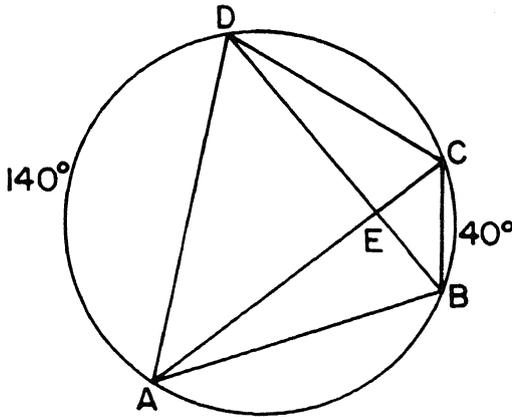
4 The coordinates of A are (1,2) and the coordinates of B are (5,14). What are the coordinates of the midpoint of $\overline{AB}$?

5 What is the total number of line segments that are determined by four distinct points, no three of which are collinear?

6 If the area of a circle is 16π, find the length of the diameter of the circle.

7 What is the slope of the line that passes through the points (3,2) and (−4,−3)?

8 If the length of an apothem of a regular polygon is 6, what is the radius of the inscribed circle?

9 Three of the vertices of rectangle ABCD are A(1,5), B(1,2), and C(5,2). Find the length of diagonal $\overline{BD}$.

10 If $\angle A$ and $\angle B$ are supplementary, $m\angle A = x$, and $m\angle B = 2x - 12$, find x.

11 Find the length of a side of a rhombus whose diagonals have lengths 6 and 8.

12 In the accompanying diagram, $\overline{AB}$ is tangent to circle O at B and secant $\overline{ACD}$ is drawn. If AC = 4 and AD = 9, find AB.
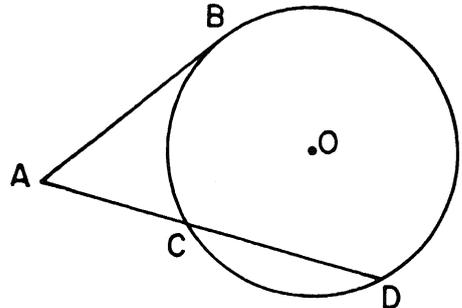
13 In $\triangle ABC$, $m\angle A = 50$ and $m\angle B = 30$. What is the *longest* side of $\triangle ABC$?

Directions (14–29): Write in the space provided on the separate answer sheet the *numeral* preceding the expression that best completes *each* statement or answers *each* question.

14 In an obtuse triangle, the bisectors of the angles intersect at a point which is
(1) outside the triangle
(2) inside the triangle
(3) one of the vertices
(4) the midpoint of a side

15 In the accompanying diagram, parallel lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are intersected by transversal $\overleftrightarrow{AC}$. Which is a true statement?
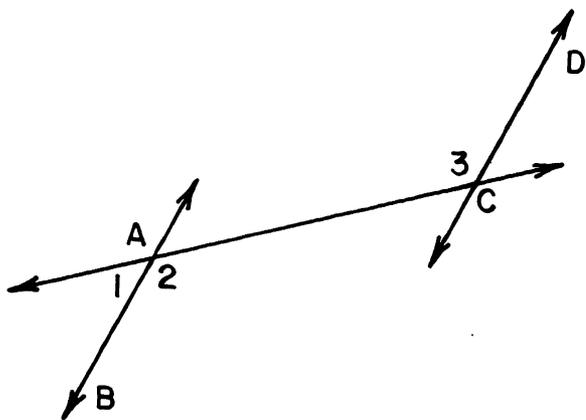
(1) $m\angle 1 = m\angle 3$
(2) $m\angle 1 + m\angle 2 = m\angle 3$
(3) $m\angle 1 + m\angle 3 = m\angle 2$
(4) $m\angle 1 + m\angle 3 = 180$

16 The measure of an exterior angle at the vertex of an isosceles triangle is 100°. What is the measure of one of the base angles of the triangle?
(1) 30°   (3) 50°
(2) 40°   (4) 60°

17 In a circle with a radius of 10 centimeters, a 16-centimeter chord is drawn. What is the distance, in centimeters, from the chord to the center of the circle?
(1) 6   (3) 10
(2) 8   (4) 16

18 The sum of the measures of four interior angles of a 5-sided convex polygon is 450°. What is the measure of the fifth angle?
(1) 30°   (3) 90°
(2) 60°   (4) 120°

19 What is the area of an equilateral triangle which has a side of length 5?
(1) $5\sqrt{3}$ (3) $25\sqrt{3}$
(2) $\frac{5\sqrt{3}}{4}$ (4) $\frac{25\sqrt{3}}{4}$

20 The total number of points equidistant from points A and B and also 5 centimeters from $\overleftrightarrow{AB}$ is
(1) 1   (3) 3
(2) 2   (4) 4

21 What is the area of a rectangle whose diagonal is 17 and whose width is 8?
(1) 60   (3) 120
(2) 68   (4) 136

22 What is the maximum number of common tangents that can be drawn to two internally tangent circles?
(1) 1   (3) 3
(2) 2   (4) 4

23 The area of a trapezoid is 57, the length of one base is 17, and its altitude is 3. What is the length of the other base?
(1) 21   (3) $26\frac{2}{3}$
(2) 2   (4) 37

24 In two similar triangles, the ratio of two corresponding medians is 4:9. The ratio of the perimeters of the triangles is
(1) 16:81   (3) 4:9
(2) 2:3   (4) $\sqrt{2}:\sqrt{3}$

25 What is an equation of the locus of points whose ordinates are 3 less than their abscissas?
(1) $x = -3y$ (3) $x = y - 3$
(2) $y = -3x$ (4) $y = x - 3$

26 In a circle, a central angle measuring 60° intercepts an arc whose length is 4π. The diameter of the circle is
(1) 6   (3) 24
(2) 12   (4) 36

27 In right triangle ABC, if $AB = 13$, $BC = 5$, and $AC = 12$, then $\cos A$ is equal to
(1) $\frac{5}{13}$ (3) $\frac{12}{13}$
(2) $\frac{5}{12}$ (4) $\frac{13}{12}$

28 What is the converse of the statement, "If the book is expensive, then I will not buy it"?
   (1) If the book is expensive, then I will buy it.
   (2) If the book is not expensive, then I will buy it.
   (3) If I will buy it, then the book is not expensive.
   (4) If I will not buy it, then the book is expensive.

29 In right triangle ABC, $\angle C$ is a right angle and $\overline{CD}$ is the altitude to hypotenuse $\overline{AB}$. If $AC = 6$ and $AD = 4$, then AB is equal to
   (1) 5   (3) 11
   (2) 9   (4) $\sqrt{24}$

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

30 *On the answer sheet*, locate by construction the center of the circle that can be circumscribed about right triangle ABC.

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.   [40]

31 Prove either *a* or *b* but *not* both.

   a A diameter perpendicular to a chord of a circle bisects the chord and its arcs.   [10]

   OR

   b The area of a parallelogram is equal to the product of the length of one side and the length of the altitude drawn to that side.   [10]

32 Isosceles trapezoid $ABCD$ with bases $\overline{AB}$ and $\overline{DC}$ is inscribed in circle O. Secant $\overline{RCT}$ intersects $\overline{AB}$ at S, $\overline{RE}$ is tangent to the circle at B, chord $\overline{TB}$ is drawn, $m\angle AST = 50$, $m\angle ABR = 110$, and $m\widehat{AD} = 80$.
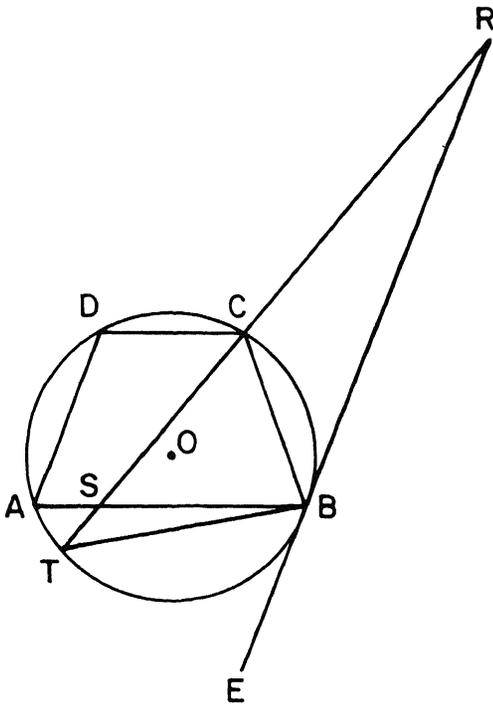
Find: *a* $m\widehat{DC}$ [2]

   b $m\widehat{AT}$ [2]

   c $m\angle TBE$ [2]

   d $m\angle R$ [2]

   e $m\angle ADC$ [2]

33 Given: $\overline{AEFC}$, $\overline{AD} \cong \overline{AB}$, $\overline{AC}$ bisects $\angle DAB$.
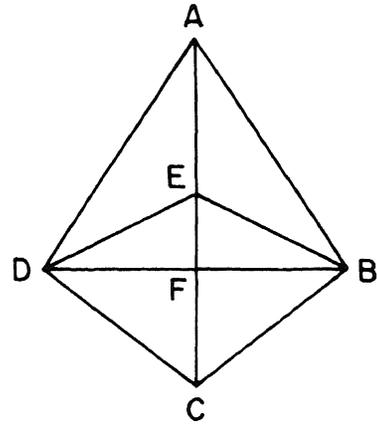
Prove: $\angle EDC \cong \angle EBC$ [10]

34 Given: $\overline{CD}$ intersects $\overline{EMB}$ at A, $\overline{CB}$ is drawn, $\overline{ED} \perp \overline{EB}$, $\overline{CD} \perp \overline{CB}$, and $\overline{CM}$ is the perpendicular bisector of $\overline{AB}$.
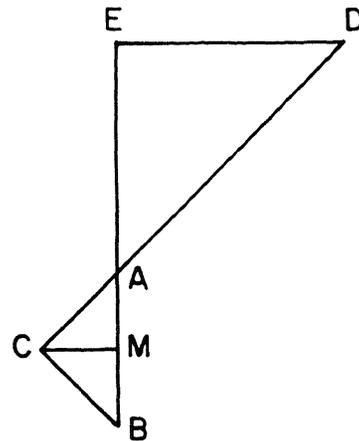
Prove: $\triangle CMB \sim \triangle DEA$ [10]

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Math. 10–June '87   [5]   [OVER]

35 The vertices of $\triangle ABC$ are $A(2,-1)$, $B(-4,7)$, and $C(6,5)$.

    a Find the coordinates of the midpoints of $\overline{AC}$ and $\overline{BC}$.   [4]

    b Show, by means of coordinate geometry, that the segment joining the midpoints of $\overline{AC}$ and $\overline{BC}$ is parallel to $\overline{AB}$ and state a reason for your conclusion.   [6]

36 Circle O circumscribes a regular hexagon with an apothem of 8.

    a Find the radius of circle O to the *nearest whole number*.   [6]

    b Using the result obtained in part *a*, find the area of a sector of circle O that is formed by two consecutive radii of the hexagon. [*Answer may be left in terms of π.*]   [4]

*37 Given: points $A(1,4)$, $B(-1,8)$, and $C(-4,0)$.

    a Show that points A, B, and C are *not* collinear.   [4]

    b Write an equation of the line that is perpendicular to $\overleftrightarrow{AB}$ and passes through point C.   [4]

    c Write an equation of the line that passes through point B and is parallel to the *x*-axis.   [2]

    * 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)

Angle	Sine	Cosine	Tangent	Angle	Sine	Cosine	Tangent
1°	.0175	.9998	.0175	46°	.7193	.6947	1.0355
2°	.0349	.9994	.0349	47°	.7314	.6820	1.0724
3°	.0523	.9986	.0524	48°	.7431	.6691	1.1106
4°	.0698	.9976	.0699	49°	.7547	.6561	1.1504
5°	.0872	.9962	.0875	50°	.7660	.6428	1.1918
6°	.1045	.9945	.1051	51°	.7771	.6293	1.2349
7°	.1219	.9925	.1228	52°	.7880	.6157	1.2799
8°	.1392	.9903	.1405	53°	.7986	.6018	1.3270
9°	.1564	.9877	.1584	54°	.8090	.5878	1.3764
10°	.1736	.9848	.1763	55°	.8192	.5736	1.4281
11°	.1908	.9816	.1944	56°	.8290	.5592	1.4826
12°	.2079	.9781	.2126	57°	.8387	.5446	1.5399
13°	.2250	.9744	.2309	58°	.8480	.5299	1.6003
14°	.2419	.9703	.2493	59°	.8572	.5150	1.6643
15°	.2588	.9659	.2679	60°	.8660	.5000	1.7321
16°	.2756	.9613	.2867	61°	.8746	.4848	1.8040
17°	.2924	.9563	.3057	62°	.8829	.4695	1.8807
18°	.3090	.9511	.3249	63°	.8910	.4540	1.9626
19°	.3256	.9455	.3443	64°	.8988	.4384	2.0503
20°	.3420	.9397	.3640	65°	.9063	.4226	2.1445
21°	.3584	.9336	.3839	66°	.9135	.4067	2.2460
22°	.3746	.9272	.4040	67°	.9205	.3907	2.3559
23°	.3907	.9205	.4245	68°	.9272	.3746	2.4751
24°	.4067	.9135	.4452	69°	.9336	.3584	2.6051
25°	.4226	.9063	.4663	70°	.9397	.3420	2.7475
26°	.4384	.8988	.4877	71°	.9455	.3256	2.9042
27°	.4540	.8910	.5095	72°	.9511	.3090	3.0777
28°	.4695	.8829	.5317	73°	.9563	.2924	3.2709
29°	.4848	.8746	.5543	74°	.9613	.2756	3.4874
30°	.5000	.8660	.5774	75°	.9659	.2588	3.7321
31°	.5150	.8572	.6009	76°	.9703	.2419	4.0108
32°	.5299	.8480	.6249	77°	.9744	.2250	4.3315
33°	.5446	.8387	.6494	78°	.9781	.2079	4.7046
34°	.5592	.8290	.6745	79°	.9816	.1908	5.1446
35°	.5736	.8192	.7002	80°	.9848	.1736	5.6713
36°	.5878	.8090	.7265	81°	.9877	.1564	6.3138
37°	.6018	.7986	.7536	82°	.9903	.1392	7.1154
38°	.6157	.7880	.7813	83°	.9925	.1219	8.1443
39°	.6293	.7771	.8098	84°	.9945	.1045	9.5144
40°	.6428	.7660	.8391	85°	.9962	.0872	11.4301
41°	.6561	.7547	.8693	86°	.9976	.0698	14.3007
42°	.6691	.7431	.9004	87°	.9986	.0523	19.0811
43°	.6820	.7314	.9325	88°	.9994	.0349	28.6363
44°	.6947	.7193	.9657	89°	.9998	.0175	57.2900
45°	.7071	.7071	1.0000	90°	1.0000	.0000	

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

TENTH YEAR MATHEMATICS

Tuesday, June 16, 1987 — 1:15 to 4:15 p.m., only

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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........................
4........................	14........................	24........................
5........................	15........................	25........................
6........................	16........................	26........................
7........................	17........................	27........................
8........................	18........................	28........................
9........................	19........................	29........................
10........................	20........................	30 Answer question 30 on the other side of this sheet.

Math. 10–June '87

[11]
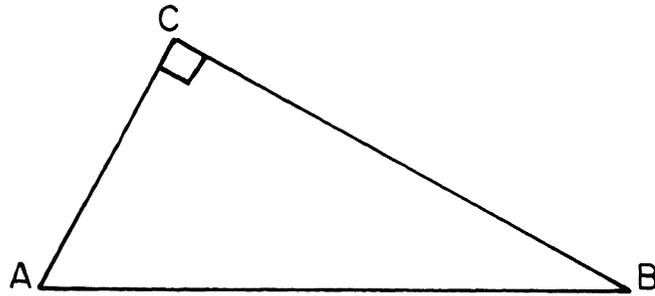
Your answers for Part II should be placed on paper provided by the school.

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

FOR TEACHERS ONLY

10

SCORING KEY

TENTH YEAR MATHEMATICS

Tuesday, June 16, 1987 — 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 14–29, allow credit if the pupil has written the correct answer instead of the numeral 1, 2, 3, or 4.

(1) 15	(11) 5	(21) 3
(2) 6	(12) 6	(22) 1
(3) 90	(13) $\overline{AB}$ or AB or c	(23) 1
(4) (3,8) or $\begin{array}{l}x = 3\\y = 8\end{array}$	(14) 2	(24) 3
(5) 6	(15) 4	(25) 4
(6) 8	(16) 3	(26) 3
(7) $\frac{5}{7}$	(17) 1	(27) 3
(8) 6	(18) 3	(28) 4
(9) 5	(19) 4	(29) 2
(10) 64	(20) 2	(30) construction

[OVER]

TENTH YEAR MATHEMATICS — *concluded*

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.

(32) *a* 60   [2]
      b 20   [2]
      c 60   [2]
      d 20   [2]
      e 110   [2]

(35) *a* (4,2) (1,6)
          or   [4]
     $x = 4$ $x = 1$
     $y = 2$ $y = 6$

(36) *a* 9   [6]

     b $\dfrac{27\pi}{2}$ [4]

(37) *b* $y = \frac{1}{2}x + 2$
           or   [4]
      $y = \frac{1}{2}(x + 4)$

     c $y = 8$ [2]

As a reminder . . .

Regents examinations based on the Tenth Year Mathematics syllabus will not be offered after January 1989.