The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

TENTH YEAR MATHEMATICS

Thursday, January 25, 1973 — 1:15 to 4:15 p.m., only

The last page of the booklet is the answer sheet, which is perforated. Fold the last page along the perfora-
tion and then, slowly and carefully, tear off the answer sheet. Now fill in the heading of your answer sheet. On
page 5, which is perforated, you will find the " Tables of Natural Trigonometric Functions," which you will
need to answer some questions in this examination. Fold this page along the perforation, and tear it off. When
you have torn off these two pages and finished the heading, you may begin the examination immediately.

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.

1 In the figure, $\overline{OA}$ is perpendicular to $\overline{OB}$, and $\overline{OD}$ is perpendicular to $\overline{OC}$. If m$\angle 3 = 28$, find m$\angle 1$.
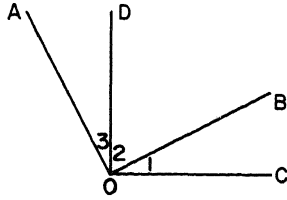
2 In rectangle $ABCD$, the bisectors of angles A and B meet at point E. Find m$\angle AEB$.

3 The measure of an exterior angle of a triangle is 110° and the measure of one angle of the triangle is 50°. Find the number of degrees in the measure of the *largest* angle of the triangle.

4 The length of a side of one square is 3 and that of another square is 4. What is the ratio of the length of a diagonal of the first square to the length of a diagonal of the second?

5 A circle is divided into 6 equal arcs and the points of division are joined in order. If the length of a diameter of the circle is 10, how long is a chord joining any two successive points of division?

6 If the length of the hypotenuse of a right triangle is 12, find the length of the median to the hypotenuse of the triangle.

7 The area of a circle is 16π. Find the length of a diameter of the circle.

8 In triangle ABC with vertices $A(-1,4)$, $B(5,2)$, and $C(-3,-2)$, median $\overline{AM}$ is drawn. What are the coordinates of M?

9 What is the distance between the point with coordinates $(-5,2)$ and the point with coordinates $(1,2)$?

10 Given trapezoid $ABCD$ in which $\overline{AB}$ and $\overline{CD}$ are the bases. If m$\angle B = 90$, $AB = 13$, $BC = 4$, $DC = 10$, and $DA = 5$, find the area of $ABCD$.

11 Quadrilateral $ABCD$ is inscribed in circle O. If m$\widehat{AB} = 70$, m$\widehat{BC} = 110$, and m$\widehat{CD} = 90$, find m$\angle DCB$.

12 In the accompanying figure, chord $\overline{AB}$ of circle O is perpendicular to diameter $\overline{CD}$ at E. If $CE = 18$ and $ED = 2$, find the length of chord $\overline{AB}$.

13 In circle O, chord $\overline{PQ}$ is perpendicular to diameter $\overline{RS}$ at T. If m$\widehat{PS} = 70$, find m$\widehat{QR}$.

14 The altitude to the base of an isosceles triangle measures 3 and each of the equal legs measures 10. Find to the *nearest degree* the measure of one of the base angles of the triangle.

15 From external point P, tangents $\overline{PA}$ and $\overline{PC}$ are drawn to circle O at A and C, respectively. If m$\angle APC = 40$, find the number of degrees in the measure of minor arc AC.
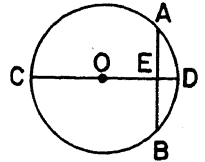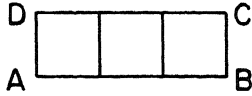
Directions (16–29): For *each* statement or question, write on the separate answer sheet the *numeral* preceding the word or expression that, of those given, best completes the statement or answers the question.

16 In a plane, if line a is perpendicular to line b and line c is parallel to line a, then b and c are
(1) parallel
(2) perpendicular
(3) the same line
(4) oblique to each other

17 Which point lies on the locus of points which are equidistant from the coordinate axes?
(1) $(1,0)$ (3) $(3,-3)$
(2) $(0,-2)$ (4) $(-2,\sqrt{2})$

18 Which statement is the converse of the statement, "Vertical angles are congruent."?
(1) Vertical angles are equal in degrees.
(2) Congruent angles are equal in degrees.
(3) Angles whose measures are equal in degrees are congruent.
(4) Congruent angles are vertical.

19 A quadrilateral which has all its sides congruent and has no right angle is called a
(1) regular polygon
(2) trapezoid
(3) rhombus
(4) square

20 Three congruent squares are arranged in a row as shown in the accompanying figure. If the perimeter of $ABCD$ is 80, then the area of $ABCD$ is
(1) 64
(2) 100
(3) 193
(4) 300

21 Two circles with radii 3 and 8, respectively, are internally tangent. The distance between their centers is
(1) 5
(2) 11
(3) 3
(4) 8

22 As P moves from A to B along side $\overline{AB}$ of parallelogram $ABCD$, the area of $\triangle PDC$ will
(1) increase at first, and then decrease
(2) increase continuously
(3) decrease continuously
(4) remain the same

23 In the accompanying figure, the two circles are internally tangent at point P. If $\overline{PA} \cong \overline{PB}$ and $m\overparen{PC} = 80$, then $m\angle APB$ is
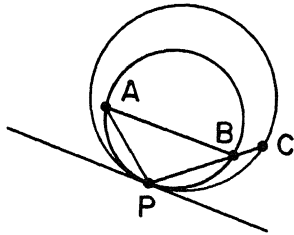
(1) 80
(2) 90
(3) 100
(4) 110

24 The perimeter of parallelogram $ABCD$ is 100. If $AB > AD$, then AB may be equal to
(1) 20
(2) 25
(3) 45
(4) 50

25 The center of a circle inscribed in a triangle must be the intersection of its
(1) medians
(2) altitudes
(3) angle bisectors
(4) perpendicular bisectors of the sides

26 If the lengths of the legs of a right triangle are 5 and 12, respectively, the diameter of the circle circumscribed about the triangle is
(1) 7
(2) 13
(3) $\sqrt{119}$
(4) 17

27 A square has a circle inscribed in it and a circle circumscribed about it. The ratio of the area of the inscribed circle to the area of the circumscribed circle is
(1) $\dfrac{1}{\sqrt{2}}$
(2) ½
(3) ¼
(4) ⅛

28 Altitude $\overline{CD}$ is drawn to the hypotenuse $\overline{AB}$ of right triangle ABC. If AD and BD are represented by p and q, respectively, then CD equals
(1) $p + q$
(2) $\frac{1}{2}(p + q)$
(3) pq
(4) $\sqrt{pq}$

29 For any circle with circumference c and diameter d, π is exactly equal to
(1) 22⁄7
(2) 3.14
(3) $\dfrac{c}{d}$
(4) $\dfrac{d}{c}$

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

30 *On the answer sheet,* construct an isosceles triangle with base b and altitude h to base b.

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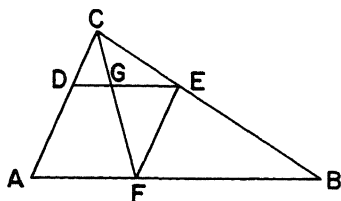
Part II

Answer four questions from this part.   Show all work unless otherwise directed.

31 Prove *either a* or *b,* but *not* both: [10]
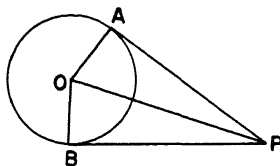   a The sum of the angles of a triangle is equal to a straight angle.

OR

   b A diameter perpendicular to a chord of a circle bisects the chord and its arcs.

32 Given: $\triangle ABC$ with $\overline{CDA}$, $\overline{CEB}$, $\overline{AFB}$, $\overline{DE} \parallel \overline{AB}$ and $\overline{EF} \parallel \overline{AC}$. $\overline{CF}$ intersects $\overline{DE}$ at G.

Prove: a $\triangle CAF \sim \triangle FEG$ [6]
   b $DG \times GF = EG \times GC$ [4]

33 Given: Circle O.   Tangents $\overline{PA}$ and $\overline{PB}$ are drawn from external point P to points A and B of circle O, respectively. $PA = 25$, $m\angle APB = 40$.


   a Find OA to the *nearest integer.*   [5]
   b Find $m\angle AOB$.   [2]
   c Using your answers to a and b, find the area of sector AOB.   [*Answer may be left in terms of* π.]   [3]

34 In trapezoid $ABCD$ with $\overline{AD} \parallel \overline{BC}$, diagonals $\overline{AC}$ and $\overline{BD}$ intersect at E.   Prove that area $\triangle AEB =$ area $\triangle DEC$.   [10]

35 The vertices of triangle ABC are $A(-3,-4)$, $B(3,4)$, and $C(3,-4)$.
   a Write an equation of the locus of points equidistant from B and C.   [2]
   b Write an equation of the line parallel to $\overline{BC}$ and passing through vertex A.   [2]
   c Find the coordinates of the point of intersection of the locus in part a and the line determined in part b.   [2]
   d Write an equation of the circle with center at the origin which passes through point C.   [2]
   e If point $D(-4,k)$ lies on the circle given in part d, what is a possible value of k?   [2]

36 Write the letters a through e on your answer paper. For *each* locus description in parts a through e below, write the *numeral* which corresponds to the graph that best fits that description.   [10]
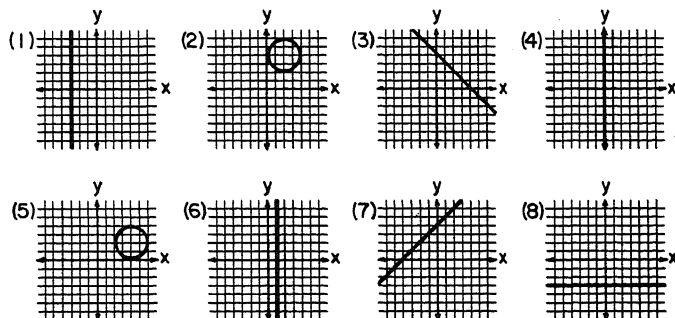
   a The locus of points the sum of whose coordinates is 4
   b The locus of points whose abscissas are equal to -3
   c The locus of points 2 units from the point whose coordinates are $(4,2)$
   d The locus of points equidistant from the points $(5,0)$ and $(-3,0)$
   e The locus of points equidistant from the lines whose equations are $x = 4$ and $x = -4$

*37 The coordinates of the vertices of quadrilateral $ABCD$ are $A(k,1)$, $B(7,3)$, $C(8,10)$, and $D(-2,5)$.
   a Find the slope of $\overline{CD}$.   [2]
   b Express in terms of k the slope of $\overline{AB}$.   [2]
   c Find the value of k if $\overline{AB} \parallel \overline{CD}$.   [3]
   d Write an equation of $\overleftrightarrow{CD}$.   [3]

* This question is based on an optional section of the syllabus.

Math. 10–Jan. '73   [4]

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	

FOR TEACHERS ONLY

10

SCORING KEY

TENTH YEAR MATHEMATICS

Thursday, January 25, 1973 — 1:15 to 4:15 p.m., only

Use only *red* ink or 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 number 1, 2, 3, or 4.

(1) 28	(11) 80	(21) 1
(2) 90	(12) 12	(22) 4
(3) 70	(13) 110	(23) 3
(4) ¾	(14) 17	(24) 3
(5) 5	(15) 140	(25) 3
(6) 6	(16) 2	(26) 2
(7) 8	(17) 3	(27) 2
(8) (1,0)	(18) 4	(28) 4
(9) 6	(19) 3	(29) 3
(10) 46	(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.

(33) *a* 9   [5]

      b 140   [2]

      c $\dfrac{63\pi}{2}$ [3]

(35) *a* $y = 0$ [2]

      b $x = -3$ [2]

      c $(-3,0)$ [2]

      d $x^2 + y^2 = 25$ [2]

      e 3 *or* -3 [2]

(36) *a* 3   [2]

      b 1   [2]

      c 5   [2]

      d 6   [2]

      e 4   [2]

(37) *a* ½   [2]

      b $\dfrac{2}{7 - k}$ [2]

      c 3   [3]

      d $2y = x + 12$ [3]

DO YOU KNOW . . .

     Who writes the questions used on Regents examinations?

     1 the members of the Board of Regents
     2 the subject supervisors in the State Education Department
     3 college professors in the various disciplines
     4 classroom teachers from schools throughout New York State

The correct answer is 4. Last year more than 400 classroom teachers were involved in the preparation of Regents examination questions, and many other teachers served on the committee that assembled the examinations.