The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

# TENTH YEAR
# MATHEMATICS

Tuesday, January 26, 1988 — 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**

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.  [60]

1 In an isosceles triangle, the measure of the vertex angle is 8 times the measure of one of the base angles. Find the number of degrees in the measure of a base angle of the triangle.

2 The length of one side of a polygon is 3 and the length of the corresponding side of a similar polygon is 5. Find the ratio of the perimeter of the smaller polygon to the perimeter of the larger polygon.

3 In the accompanying diagram of circle $O$, chord $\overline{AB}$ is parallel to diameter $\overline{CD}$ and chord $\overline{CB}$ is drawn. If m$\angle B = 20$, find m$\overarc{AB}$.
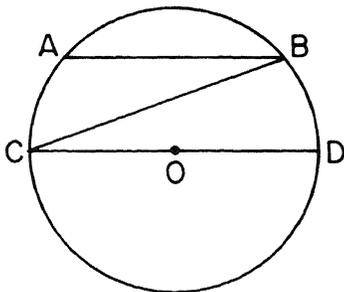


4 As shown in the accompanying diagram, a circle is inscribed in quadrilateral $ABCD$ and $W$, $X$, $Y$, and $Z$ are the points of tangency of the sides. If $DZ = 3$, $CY = 2$, $BX = 2$, and $AW = 1$, find the perimeter of the quadrilateral.
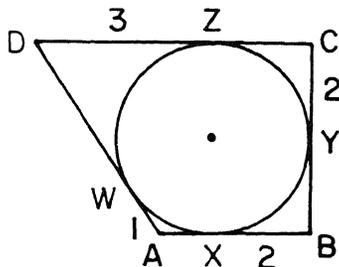


5 The length of a rectangle is one more than the width. If the perimeter of the rectangle is 34, find the width.

6 In the accompanying diagram of $\triangle ABC$, $\overline{DE} \parallel \overrightarrow{AB}$, $AB = 10$, $DE = 5$, and $AD = 3$. Find $AC$.
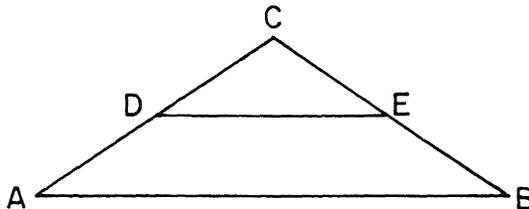


7 In the accompanying diagram, parallel lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are intersected by transversal $\overleftrightarrow{EF}$ at points $G$ and $H$, respectively. If m$\angle GHC = x$ and m$\angle AGH = 4x$, find $x$.
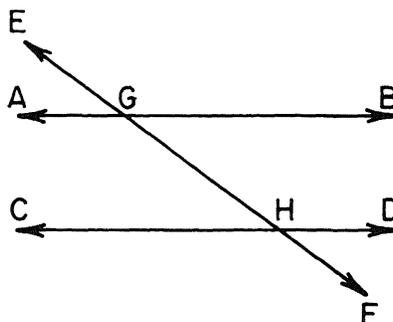


8 In the accompanying diagram of circle $O$, chord $\overline{CD}$ is perpendicular to diameter $\overline{AB}$ at $E$. If $AE = 4$ and $EB = 9$, find $CE$.
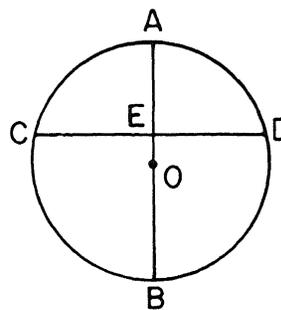


9 Find the number of degrees in the measure of an exterior angle of a regular hexagon.

10 The measure of one angle of a rhombus is 60°. If the length of the shorter diagonal is 10, what is the length of a side of the rhombus?

11 In the accompanying figure, the altitude to the hypotenuse of right triangle ABC divides the hypotenuse into segments whose lengths are represented by $4x$ and $x$. If the length of the altitude is 2, find $x$.
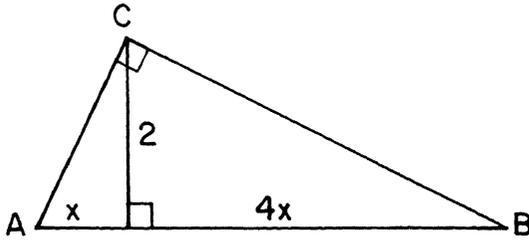


12 A ladder 50 feet long leans against a building so that the top of the ladder is 48 feet above level ground. Find, to the *nearest degree*, the measure of the angle the ladder makes with the ground.

13 In right triangle RST, m∠R = 90, RS = 6, RT = 8, and ST = 10. Find the length of median $\overline{RQ}$.

*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 the accompanying diagram, altitudes $\overline{AD}$ and $\overline{BE}$ of △ABC intersect at point F. If m∠ACB = 50, what is m∠CAD?
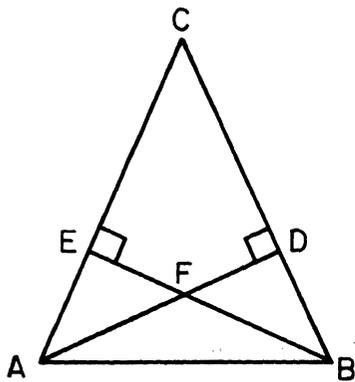


(1) 40　　　　　　　(3) 60
(2) 50　　　　　　　(4) 140

15 The coordinates of the vertices of △ABC are A(−4,0), B(4,0), and C(0,4). The area of △ABC is
(1) 6　　　　　　　(3) 16
(2) 12　　　　　　(4) 32

16 The locus of points in a plane equidistant from two concentric circles having radii of 4 and 10 is a circle whose radius is
(1) 1　　　　　　　(3) 3
(2) 7　　　　　　　(4) 14

17 Which set of numbers could represent the lengths of the sides of a triangle?
(1) {4,5,6}　　　　(3) {5,15,20}
(2) {3,3,6}　　　　(4) {4,8,16}

18 Which is the length of the diagonal of a square whose side is 3?
(1) 18　　　　　　(3) $2\sqrt{3}$
(2) $3\sqrt{3}$　　　　(4) $3\sqrt{2}$

19 The diagonals of a rhombus have lengths 10 and 20. The area of the rhombus is
(1) 30　　　　　　(3) 100
(2) 50　　　　　　(4) 200

20 A circle is circumscribed about a triangle. If the center of the circle is on one side of the triangle, then the triangle must be
(1) acute　　　　　(3) isosceles
(2) obtuse　　　　　(4) right

21 Which figure must be a regular quadrilateral?
(1) square　　　　　(3) rhombus
(2) rectangle　　　　(4) parallelogram

22 If the circumference of a circle is 16π, the area of the circle is
(1) 256π　　　　　(3) 8π
(2) 64π　　　　　　(4) 4π

23 Point M(1,−1) is the midpoint of $\overline{AB}$. If the coordinates of A are (−1,−2), the coordinates of B are
(1) (3,0)　　　　　(3) (0,−3)
(2) (2,1)　　　　　(4) (−2,1)

24 In the accompanying diagram, the coordinates of △ABC are A(0,0), B(2a,0), and C(a,b). What is the slope of $\overline{BC}$?



(1) $\frac{a}{b}$

(3) $\frac{b}{a}$

(2) 0

(4) $-\frac{b}{a}$

25 For which value of x will the distance between (x,8) and (0,2) be equal to 10?
(1) 64
(3) 0
(2) 8
(4) −26

26 Which statement regarding the bisector of an angle of a scalene triangle is true?
(1) It is also the median from that vertex.
(2) It contains points which are equidistant from the sides of the angle.
(3) It is perpendicular to the opposite side.
(4) It divides the triangle into two triangles equal in area.

27 Which is an equation of the locus of points that are equidistant from the points (2,1) and (4,1)?
(1) x = 1
(3) x = 3
(2) x = 2
(4) x = 4

28 Given the statement: "If a quadrilateral is a rectangle, then it is a parallelogram." Which statement is the converse of the given statement?
(1) If a quadrilateral is a rectangle, then it is a parallelogram.
(2) If a quadrilateral is not a parallelogram, then it is not a rectangle.
(3) If a quadrilateral is not a rectangle, then it is not a parallelogram.
(4) If a quadrilateral is a parallelogram, then it is a rectangle.

29 In the accompanying diagram, trapezoid ABCD, $\overline{AB}$ ∥ $\overline{DC}$, DC = 4, AB = 20, AD = 12, and m∠A = 30. What is the area of trapezoid ABCD?



(1) 36
(3) 72
(2) $60\sqrt{3}$
(4) 144

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

30 *On the answer sheet*, construct an apothem of regular pentagon ABCDE, whose center is the point O.

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* The measure of an angle inscribed in a circle is equal to one-half the measure of its intercepted arc. [*Consider only the case where one side of the angle is a diameter.*] [10]

### OR

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

32 In the accompanying diagram, quadrilateral *ABCD* is inscribed in circle *O*, $m\widehat{AD}:m\widehat{DC} = 1:3$, diameter $\overline{AB} \parallel \overline{CDF}$, tangent $\overleftrightarrow{GAFH}$ intersects circle *O* at *A*, $\overline{AC}$ and $\overline{BD}$ intersect at *E*, and secants $\overline{PDA}$ and $\overline{PCB}$ are drawn.
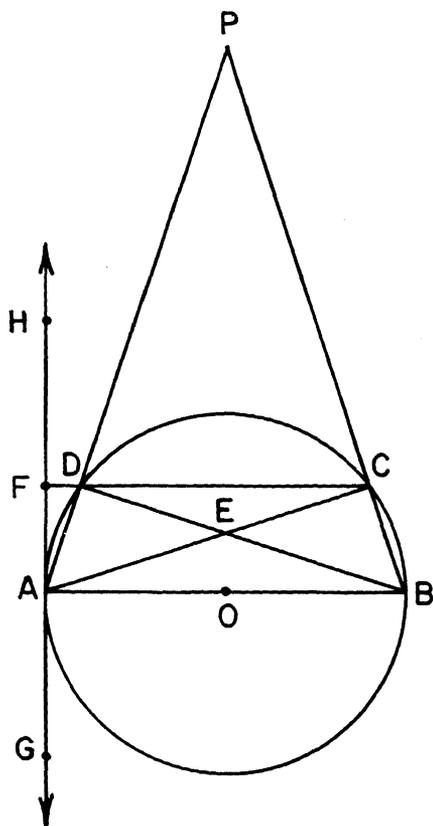


Find:   *a* $m\widehat{BC}$   [2]
         *b* m∠*DAH*   [2]
         *c* m∠*AEB*   [2]
         *d* m∠*P*   [2]
         *e* m∠*ADF*   [2]

33 Point *P* is 5 centimeters from line ℓ.

 *a* Describe fully the locus of points in a plane that are 2 centimeters from line ℓ. [3]

 *b* Describe fully the locus of points in a plane that are *k* centimeters from point *P*. [3]

 *c* How many points satisfy the conditions given in both parts *a* and *b* if

 (1) *k* = 3   [2]
 (2) *k* = 5   [2]

34 Given: △*ABC*, $\overline{ADB}$, $\overline{AEC}$, ∠*B* ≅ ∠*C*, and $\overline{DB} ≅ \overline{EC}$.
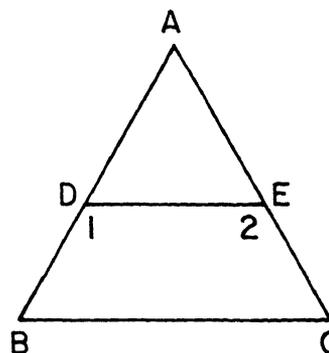


Prove: ∠1 ≅ ∠2   [10]

35 Given: a circle with secants $\overline{PAB}$ and $\overline{PCD}$, chord $\overline{BC}$ is extended to *R*, and $\overline{PR}$ is parallel to chord $\overline{AD}$.
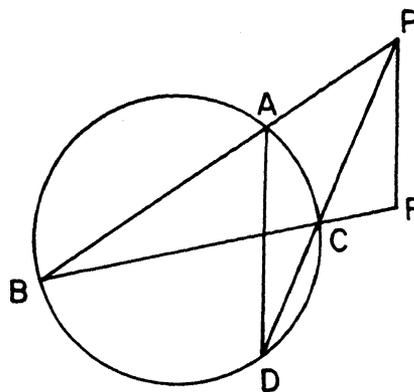


Prove: $(PR)^2 = BR \times CR$   [10]

36 The coordinates of the vertices of quadrilateral ABCD are A(-2,8), B(-4,2), C(8,6), and D(4,10).

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

   b Show, by means of coordinate geometry, that quadrilateral ABCD is *not* an isosceles trapezoid.    [4]

37 Given: quadrilateral BCDE, $\overline{BE}$ bisects $\angle ABD$, $\angle BDC \cong \angle C$, and $m\angle E > m\angle ABE$.
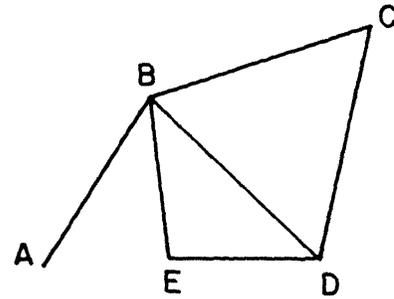


Prove: $BC > ED$    [10]

## 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 | |

Math. 10–Jan. '88

[9]

| Part I Score.......... .............. |
|---|
| Part II Score......... ............ |
| Total .......... .............. |
| Rater's Initials: ............................ |

### 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 ..........................

2 ..........................

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29 ..........................

30 Answer question 30 on the
other side of this sheet.
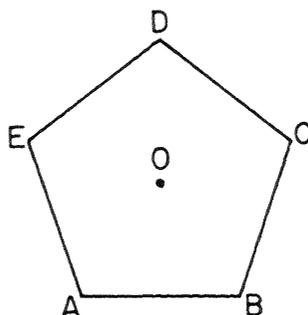
Your answers for Part II should be placed on paper provided by the school.

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

# FOR TEACHERS ONLY

## 10

### SCORING KEY

### TENTH YEAR MATHEMATICS

Tuesday, January 26, 1988 — 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) 18 | (11) 1 | (21) 1 |
| (2) 3:5 *or* $\frac{3}{5}$ | (12) 74 | (22) 2 |
| (3) 100 | (13) 5 | (23) 1 |
| (4) 16 | (14) 1 | (24) 4 |
| (5) 8 | (15) 3 | (25) 2 |
| (6) 6 | (16) 2 | (26) 2 |
| (7) 36 | (17) 1 | (27) 3 |
| (8) 6 | (18) 4 | (28) 4 |
| (9) 60 | (19) 3 | (29) 3 |
| (10) 10 | (20) 4 | (30) construction |

[OVER]

## Part II

Please refer to the Department publication *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) $a$ 36    [2]
     $b$ 18    [2]
     $c$ 144    [2]
     $d$ 36    [2]
     $e$ 72    [2]

(33) $a$ two lines parallel to line $\ell$, 2 units from line $\ell$, and on either side of line $\ell$    [3]
     $b$ a circle with radius $k$ and center at point $P$    [3]
     $c$ (1) 1    [2]
        (2) 2    [2]

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**As a reminder . . .**

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

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