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

GEOMETRY

Thursday, January 28, 2010—9:15 a.m. to 12:15 p.m., only

Student Name: ______________________________________________________________
School Name: _______________________________________________________________

Print your name and the name of your school on the lines above. Then turn to the last page of this booklet, which is the answer sheet for Part I. 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.

This examination has four parts, with a total of 38 questions. You must answer all questions in this examination. Write your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in Parts II, III, and IV directly in this booklet. All work should be written in pen, except graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc.

The formulas that you may need to answer some questions in this examination are found at the end of the examination. This sheet is perforated so you may remove it from this booklet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A perforated sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will not be scored.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, 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 sheet cannot be accepted if you fail to sign this declaration.

Notice...
A graphing calculator, a straightedge (ruler), and a compass must be available for you to use while taking this examination.

The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.
Part I

Answer all 28 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the separate answer sheet the numeral preceding the word or expression that best completes the statement or answers the question. [56]

1 In the diagram below of trapezoid $RSUT$, $RS \parallel TU$, $X$ is the midpoint of $RT$, and $V$ is the midpoint of $SU$.

If $RS = 30$ and $XV = 44$, what is the length of $TU$?

(1) 37  
(2) 58  
(3) 74  
(4) 118

2 In $\triangle ABC$, $m\angle A = x$, $m\angle B = 2x + 2$, and $m\angle C = 3x + 4$. What is the value of $x$?

(1) 29  
(2) 31  
(3) 59  
(4) 61
3 Which expression best describes the transformation shown in the diagram below?

(1) same orientation; reflection
(2) opposite orientation; reflection
(3) same orientation; translation
(4) opposite orientation; translation

4 Based on the construction below, which statement must be true?

(1) \( m\angle ABD = \frac{1}{2} m\angle CBD \)
(2) \( m\angle ABD = m\angle CBD \)
(3) \( m\angle ABD = m\angle ABC \)
(4) \( m\angle CBD = \frac{1}{2} m\angle ABD \)
5 In the diagram below, \( \triangle ABC \) is inscribed in circle \( P \). The distances from the center of circle \( P \) to each side of the triangle are shown.

Which statement about the sides of the triangle is true?

(1) \( AB > AC > BC \)  
(2) \( AB < AC \) and \( AC > BC \)  
(3) \( AC > AB > BC \)  
(4) \( AC = AB \) and \( AB > BC \)

6 Which transformation is not always an isometry?

(1) rotation  
(2) dilation  
(3) reflection  
(4) translation

7 In \( \triangle ABC \), \( \overline{AB} \cong \overline{BC} \). An altitude is drawn from \( B \) to \( \overline{AC} \) and intersects \( \overline{AC} \) at \( D \). Which statement is not always true?

(1) \( \angle ABD \cong \angle CBD \)  
(2) \( \angle BDA \cong \angle BDC \)  
(3) \( \overline{AD} \cong \overline{BD} \)  
(4) \( \overline{AD} \cong \overline{DC} \)
In the diagram below, tangent $\overline{PA}$ and secant $\overline{PBC}$ are drawn to circle $O$ from external point $P$.

If $PB = 4$ and $BC = 5$, what is the length of $\overline{PA}$?

(1) 20  (3) 8
(2) 9    (4) 6

Which geometric principle is used to justify the construction below?

(1) A line perpendicular to one of two parallel lines is perpendicular to the other.
(2) Two lines are perpendicular if they intersect to form congruent adjacent angles.
(3) When two lines are intersected by a transversal and alternate interior angles are congruent, the lines are parallel.
(4) When two lines are intersected by a transversal and the corresponding angles are congruent, the lines are parallel.
10 Which equation represents the circle whose center is \((-2, 3)\) and whose radius is 5?

(1) \((x - 2)^2 + (y + 3)^2 = 5\)
(2) \((x + 2)^2 + (y - 3)^2 = 5\)
(3) \((x + 2)^2 + (y - 3)^2 = 25\)
(4) \((x - 2)^2 + (y + 3)^2 = 25\)

11 Towns A and B are 16 miles apart. How many points are 10 miles from town A and 12 miles from town B?

(1) 1
(2) 2
(3) 3
(4) 0

12 Lines \(j\) and \(k\) intersect at point \(P\). Line \(m\) is drawn so that it is perpendicular to lines \(j\) and \(k\) at point \(P\). Which statement is correct?

(1) Lines \(j\) and \(k\) are in perpendicular planes.
(2) Line \(m\) is in the same plane as lines \(j\) and \(k\).
(3) Line \(m\) is parallel to the plane containing lines \(j\) and \(k\).
(4) Line \(m\) is perpendicular to the plane containing lines \(j\) and \(k\).
13 In the diagram below of parallelogram $STUV$, $SV = x + 3$, $VU = 2x - 1$, and $TU = 4x - 3$.

What is the length of $\overline{SV}$?

(1) 5  (3) 7
(2) 2  (4) 4

14 Which equation represents a line parallel to the line whose equation is $2y - 5x = 10$?

(1) $5y - 2x = 25$  (3) $4y - 10x = 12$
(2) $5y + 2x = 10$  (4) $2y + 10x = 8$
15 In the diagram below of circle $O$, chords $\overline{AD}$ and $\overline{BC}$ intersect at $E$, $m\overarc{AC} = 87$, and $m\overarc{BD} = 35$.

What is the degree measure of $\angle CEA$?

(1) 87  
(2) 61  
(3) 43.5  
(4) 26

16 In the diagram below of $\triangle ADB$, $m\angle BDA = 90$, $AD = 5\sqrt{2}$, and $AB = 2\sqrt{15}$.

What is the length of $\overline{BD}$?

(1) $\sqrt{10}$  
(2) $\sqrt{20}$  
(3) $\sqrt{50}$  
(4) $\sqrt{110}$
17 What is the distance between the points \((-3,2)\) and \((1,0)\)?

- (1) \(2\sqrt{2}\)
- (2) \(2\sqrt{3}\)
- (3) \(5\sqrt{2}\)
- (4) \(2\sqrt{5}\)

18 What is an equation of the line that contains the point \((3, -1)\) and is perpendicular to the line whose equation is \(y = -3x + 2\)?

- (1) \(y = -3x + 8\)
- (2) \(y = -3x\)
- (3) \(y = \frac{1}{3}x\)
- (4) \(y = \frac{1}{3}x - 2\)

19 In the diagram below, \(\overline{SQ}\) and \(\overline{PR}\) intersect at \(T\), \(\overline{PQ}\) is drawn, and \(\overline{PS} \parallel \overline{QR}\).

Which technique can be used to prove \(\triangle PST \sim \triangle RQT\)?

- (1) SAS
- (2) SSS
- (3) ASA
- (4) AA
20 The equation of a circle is \((x - 2)^2 + (y + 4)^2 = 4\). Which diagram is the graph of the circle?
21 In the diagram below, \( \triangle ABC \) is shown with \( \overline{AC} \) extended through point \( D \).

\[
\begin{align*}
\text{If } m\angle BCD &= 6x + 2, \quad m\angle BAC = 3x + 15, \quad \text{and } m\angle ABC = 2x - 1, \\
\text{what is the value of } x? &
\end{align*}
\]

(1) 12  (3) 16  
(2) \( 14 \frac{10}{11} \)  (4) \( 18 \frac{1}{9} \)

22 Given \( \triangle ABC \sim \triangle DEF \) such that \( \frac{AB}{DE} = \frac{3}{2} \). Which statement is not true?

(1) \( \frac{BC}{EF} = \frac{3}{2} \)  (3) \( \frac{\text{area of } \triangle ABC}{\text{area of } \triangle DEF} = \frac{9}{4} \)
(2) \( \frac{m\angle A}{m\angle D} = \frac{3}{2} \)  (4) \( \frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF} = \frac{3}{2} \)
23 The pentagon in the diagram below is formed by five rays.

What is the degree measure of angle $x$?

(1) 72  (3) 108
(2) 96  (4) 112

24 Through a given point, $P$, on a plane, how many lines can be drawn that are perpendicular to that plane?

(1) 1  (3) more than 2
(2) 2  (4) none

25 What is the slope of a line that is perpendicular to the line whose equation is $3x + 4y = 12$?

(1) $\frac{3}{4}$  (3) $\frac{4}{3}$
(2) $-\frac{3}{4}$  (4) $-\frac{4}{3}$
26 What is the image of point \( A(4, 2) \) after the composition of transformations defined by \( R_{90^\circ} \circ r_y = x \)?

(1) \((-4, 2)\)  (3) \((-4, -2)\)
(2) \((4, -2)\)  (4) \((2, -4)\)

27 Which expression represents the volume, in cubic centimeters, of the cylinder represented in the diagram below?

![Cylinder Diagram]

(1) \(162\pi\)  (3) \(972\pi\)
(2) \(324\pi\)  (4) \(3,888\pi\)

28 What is the inverse of the statement “If two triangles are not similar, their corresponding angles are not congruent”?

(1) If two triangles are similar, their corresponding angles are not congruent.
(2) If corresponding angles of two triangles are not congruent, the triangles are not similar.
(3) If two triangles are similar, their corresponding angles are congruent.
(4) If corresponding angles of two triangles are congruent, the triangles are similar.
Part II

Answer all 6 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

29 In $\triangle RST$, $m\angle RST = 46$ and $RS \cong ST$. Find $m\angle STR$. 
30 Tim has a rectangular prism with a length of 10 centimeters, a width of 2 centimeters, and an unknown height. He needs to build another rectangular prism with a length of 5 centimeters and the same height as the original prism. The volume of the two prisms will be the same. Find the width, in centimeters, of the new prism.
In the diagram below of circle $C$, $\overline{QR}$ is a diameter, and $Q(1,8)$ and $C(3.5, 2)$ are points on a coordinate plane.

Find and state the coordinates of point $R$. 
32 Using a compass and straightedge, and $\overline{AB}$ below, construct an equilateral triangle with all sides congruent to $\overline{AB}$. [Leave all construction marks.]
In the diagram below of $\triangle ACD$, $E$ is a point on $\overline{AD}$ and $B$ is a point on $\overline{AC}$, such that $\overline{EB} \parallel \overline{DC}$. If $AE = 3$, $ED = 6$, and $DC = 15$, find the length of $\overline{EB}$. 
In the diagram below of $\triangle TEM$, medians $\overline{TB}$, $\overline{EC}$, and $\overline{MA}$ intersect at $D$, and $TB = 9$. Find the length of $TD$. 
Part III

Answer all 3 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

In $\triangle KLM$, $m\angle K = 36$ and $KM = 5$. The transformation $D_2$ is performed on $\triangle KLM$ to form $\triangle K'L'M'$.

Find $m\angle K'$. Justify your answer.

Find the length of $\overline{K'M'}$. Justify your answer.
36 Given: $JKLM$ is a parallelogram.

$JM \cong LN$

$\angle LMN \cong \angle LNM$

Prove: $JKLM$ is a rhombus.
37 On the grid below, graph the points that are equidistant from both the $x$ and $y$ axes and the points that are 5 units from the origin. Label with an $\times$ all points that satisfy both conditions.
Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. A correct numerical answer with no work shown will receive only 1 credit. The answer should be written in pen. [6]

38 On the set of axes below, solve the following system of equations graphically for all values of \( x \) and \( y \).

\[
\begin{align*}
y &= (x - 2)^2 + 4 \\
4x + 2y &= 14
\end{align*}
\]
## Reference Sheet

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<tbody>
<tr>
<td><strong>Volume</strong></td>
<td><strong>Cylinder</strong></td>
<td>$V = Bh$</td>
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<td></td>
<td><strong>Pyramid</strong></td>
<td>$V = \frac{1}{3}Bh$</td>
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<td></td>
<td><strong>Right Circular Cone</strong></td>
<td>$V = \frac{1}{3}Bh$</td>
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<tr>
<td></td>
<td><strong>Sphere</strong></td>
<td>$V = \frac{4}{3}\pi r^3$</td>
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<tr>
<th><strong>Lateral Area ($L$)</strong></th>
<th><strong>Right Circular Cylinder</strong></th>
<th>$L = 2\pi rh$</th>
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<tr>
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<td><strong>Right Circular Cone</strong></td>
<td>$L = \pi rl$</td>
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<td></td>
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<td>where $l$ is the slant height</td>
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| **Surface Area**       | **Sphere**                  | $SA = 4\pi r^2$                                                            |
Scrap Graph Paper — This sheet will not be scored.
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GEOMETRY

Thursday, January 28, 2010—9:15 a.m. to 12:15 p.m., only

ANSWER SHEET

Student ..................................................  Sex:  ☐ Male  ☐ Female  Grade .......
Teacher ..................................................  School  .................................

Your answers to Part I should be recorded on this answer sheet.

Part I
Answer all 28 questions in this part.

1 .................  8 .................  15 .................  22 .................
2 .................  9 .................  16 .................  23 .................
3 .................  10 .................  17 .................  24 .................
4 .................  11 .................  18 .................  25 .................
5 .................  12 .................  19 .................  26 .................
6 .................  13 .................  20 .................  27 .................
7 .................  14 .................  21 .................  28 .................

Your answers for Parts II, III, and IV should be written in the test booklet.

The declaration below must 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
<table>
<thead>
<tr>
<th>Question</th>
<th>Maximum Credit</th>
<th>Credits Earned</th>
<th>Rater's/Scorer's Initials</th>
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<tr>
<td>Part I 1–28</td>
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<td>Part II 29</td>
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**Total Raw Score**: [ ]

**Checked by**: [ ]

**Scaled Score** (from conversion chart): [ ]