The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA 2/TRIGONOMETRY

Wednesday, January 25, 2012 — 1:15 to 4:15 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 39 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 and a straightedge (ruler) 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 27 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. [54]

Use this space for computations.

1 The yearbook staff has designed a survey to learn student opinions on how the yearbook could be improved for this year. If they want to distribute this survey to 100 students and obtain the most reliable data, they should survey

(1) every third student sent to the office

(2) every third student to enter the library

(3) every third student to enter the gym for the basketball game

(4) every third student arriving at school in the morning

2 What is the sum of the first 19 terms of the sequence 3, 10, 17, 24, 31, …?

(1) 1188

(2) 1197

(3) 1254

(4) 1292

3 Which expression, when rounded to three decimal places, is equal to -1.155?

(1) $\sec\left(\frac{5\pi}{6}\right)$

(2) $\tan(49°20')$

(3) $\sin\left(-\frac{3\pi}{5}\right)$

(4) $\csc(-118°)$

4 If $f(x) = 4x - x^2$ and $g(x) = \frac{1}{x}$, then $(f \circ g)\left(\frac{1}{2}\right)$ is equal to

(1) $\frac{4}{7}$

(2) -2

(3) $\frac{7}{2}$

(4) 4

Use this space for computations.

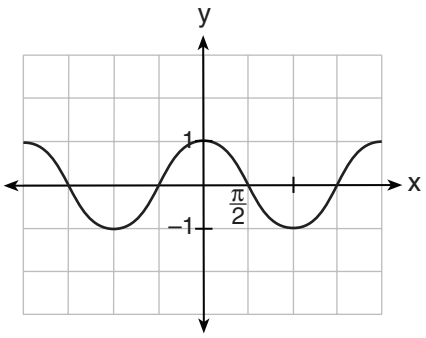
5 A population of rabbits doubles every 60 days according to the formula $P = 10(2)^{\frac{t}{60}}$, where P is the population of rabbits on day t. What is the value of t when the population is 320?

(1) 240
(2) 300
(3) 660
(4) 960

6 What is the product of $\left(\frac{x}{4} - \frac{1}{3}\right)$ and $\left(\frac{x}{4} + \frac{1}{3}\right)$?

(1) $\frac{x^2}{8} - \frac{1}{9}$
(2) $\frac{x^2}{16} - \frac{1}{9}$
(3) $\frac{x^2}{8} - \frac{x}{6} - \frac{1}{9}$
(4) $\frac{x^2}{16} - \frac{x}{6} - \frac{1}{9}$

7 Which is a graph of $y = \cot x$?



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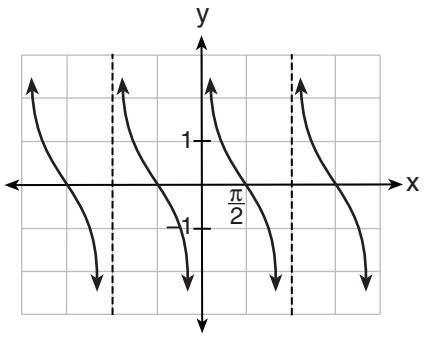

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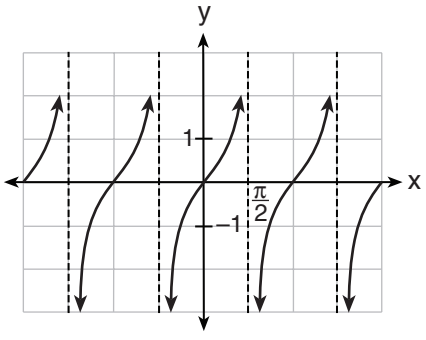

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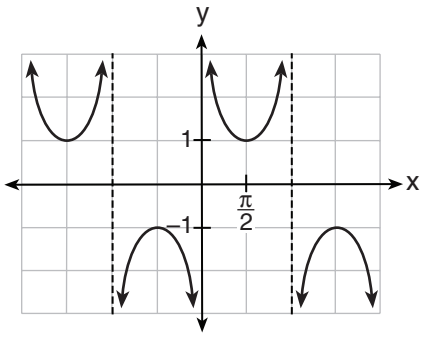


(4)

Use this space for computations.

8 Which expression always equals 1?

(1) $\cos^2 x - \sin^2 x$

(2) $\cos^2 x + \sin^2 x$

(3) $\cos x - \sin x$

(4) $\cos x + \sin x$

9 What are the sum and product of the roots of the equation $6x^2 - 4x - 12 = 0$?

(1) sum $= -\frac{2}{3}$; product $= -2$

(2) sum $= \frac{2}{3}$; product $= -2$

(3) sum $= -2$; product $= \frac{2}{3}$

(4) sum $= -2$; product $= -\frac{2}{3}$

10 Given $\triangle ABC$ with $a = 9$, $b = 10$, and $m\angle B = 70$, what type of triangle can be drawn?

(1) an acute triangle, only

(2) an obtuse triangle, only

(3) both an acute triangle and an obtuse triangle

(4) neither an acute triangle nor an obtuse triangle

11 When $x^{-1} + 1$ is divided by $x + 1$, the quotient equals

(1) 1

(2) $\frac{1}{x}$

(3) x

(4) $-\frac{1}{x}$

Use this space for computations.

12 If the amount of time students work in any given week is normally distributed with a mean of 10 hours per week and a standard deviation of 2 hours, what is the probability a student works between 8 and 11 hours per week?

(1) 34.1%
(2) 38.2%
(3) 53.2%
(4) 68.2%

13 What is the conjugate of $\frac{1}{2} + \frac{3}{2}i$?

(1) $-\frac{1}{2} + \frac{3}{2}i$
(2) $\frac{1}{2} - \frac{3}{2}i$
(3) $\frac{3}{2} + \frac{1}{2}i$
(4) $-\frac{1}{2} - \frac{3}{2}i$

14 Given angle A in Quadrant I with $\sin A = \frac{12}{13}$ and angle B in Quadrant II with $\cos B = -\frac{3}{5}$, what is the value of $\cos (A - B)$?

(1) $\frac{33}{65}$
(2) $-\frac{33}{65}$
(3) $\frac{63}{65}$
(4) $-\frac{63}{65}$

15 Which expression represents the third term in the expansion of $(2x^4 - y)^3$?

(1) $-y^3$
(2) $-6x^4y^2$
(3) $6x^4y^2$
(4) $2x^4y^2$

Use this space for computations.

16 What is the solution set of the equation $3x^5 - 48x = 0$?

(1) $\{0, \pm 2\}$
(2) $\{0, \pm 2, 3\}$
(3) $\{0, \pm 2, \pm 2i\}$
(4) $\{\pm 2, \pm 2i\}$

17 A sequence has the following terms: $a_1 = 4, a_2 = 10, a_3 = 25, a_4 = 62.5$. Which formula represents the nth term in this sequence?

(1) $a_n = 4 + 2.5n$
(2) $a_n = 4 + 2.5(n - 1)$
(3) $a_n = 4(2.5)^n$
(4) $a_n = 4(2.5)^{n-1}$

18 In parallelogram $BFLO$, $OL = 3.8$, $LF = 7.4$, and $m\angle O = 126$. If diagonal $\overline{BL}$ is drawn, what is the area of $\triangle BLF$?

(1) 11.4
(2) 14.1
(3) 22.7
(4) 28.1

19 Which statement about the graph of the equation $y = e^x$ is *not* true?

(1) It is asymptotic to the x-axis.
(2) The domain is the set of all real numbers.
(3) It lies in Quadrants I and II.
(4) It passes through the point $(e,1)$.

20 What is the number of degrees in an angle whose measure is 2 radians?

(1) $\frac{360}{\pi}$
(2) $\frac{\pi}{360}$
(3) 360
(4) 90

Use this space for computations.

21 A spinner is divided into eight equal sections. Five sections are red and three are green. If the spinner is spun three times, what is the probability that it lands on red *exactly* twice?

(1) $\frac{25}{64}$

(2) $\frac{45}{512}$

(3) $\frac{75}{512}$

(4) $\frac{225}{512}$

22 What is the range of $f(x) = |x - 3| + 2$?

(1) $\{x|x \geq 3\}$

(2) $\{y|y \geq 2\}$

(3) $\{x|x \in \text{real numbers}\}$

(4) $\{y|y \in \text{real numbers}\}$

23 Which calculator output shows the strongest linear relationship between x and y?

(1) Lin Reg
$y = a + bx$
$a = 59.026$
$b = 6.767$
$r = .8643$

(2) Lin Reg
$y = a + bx$
$a = .7$
$b = 24.2$
$r = .8361$

(3) Lin Reg
$y = a + bx$
$a = 2.45$
$b = .95$
$r = .6022$

(4) Lin Reg
$y = a + bx$
$a = -2.9$
$b = 24.1$
$r = -.8924$

24 If $\log x^2 - \log 2a = \log 3a$, then $\log x$ expressed in terms of $\log a$ is equivalent to

(1) $\frac{1}{2}\log 5a$

(2) $\frac{1}{2}\log 6 + \log a$

(3) $\log 6 + \log a$

(4) $\log 6 + 2\log a$

Use this space for computations.

25 Which function is one-to-one?

(1) $f(x) = |x|$ (3) $f(x) = x^2$

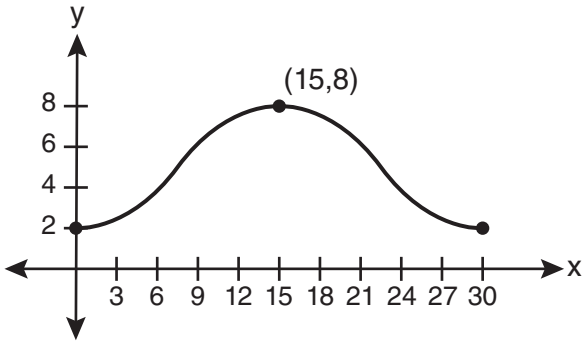
(2) $f(x) = 2^x$ (4) $f(x) = \sin x$

26 If p varies inversely as q, and $p = 10$ when $q = \frac{3}{2}$, what is the value of p when $q = \frac{3}{5}$?

(1) 25 (3) 9

(2) 15 (4) 4

27 Which equation is graphed in the diagram below?



(1) $y = 3\cos\left(\frac{\pi}{30}x\right) + 8$ (3) $y = -3\cos\left(\frac{\pi}{30}x\right) + 8$

(2) $y = 3\cos\left(\frac{\pi}{15}x\right) + 5$ (4) $y = -3\cos\left(\frac{\pi}{15}x\right) + 5$

Part II

Answer all 8 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. [16]

28 Find the solution of the inequality $x^2 - 4x > 5$, algebraically.

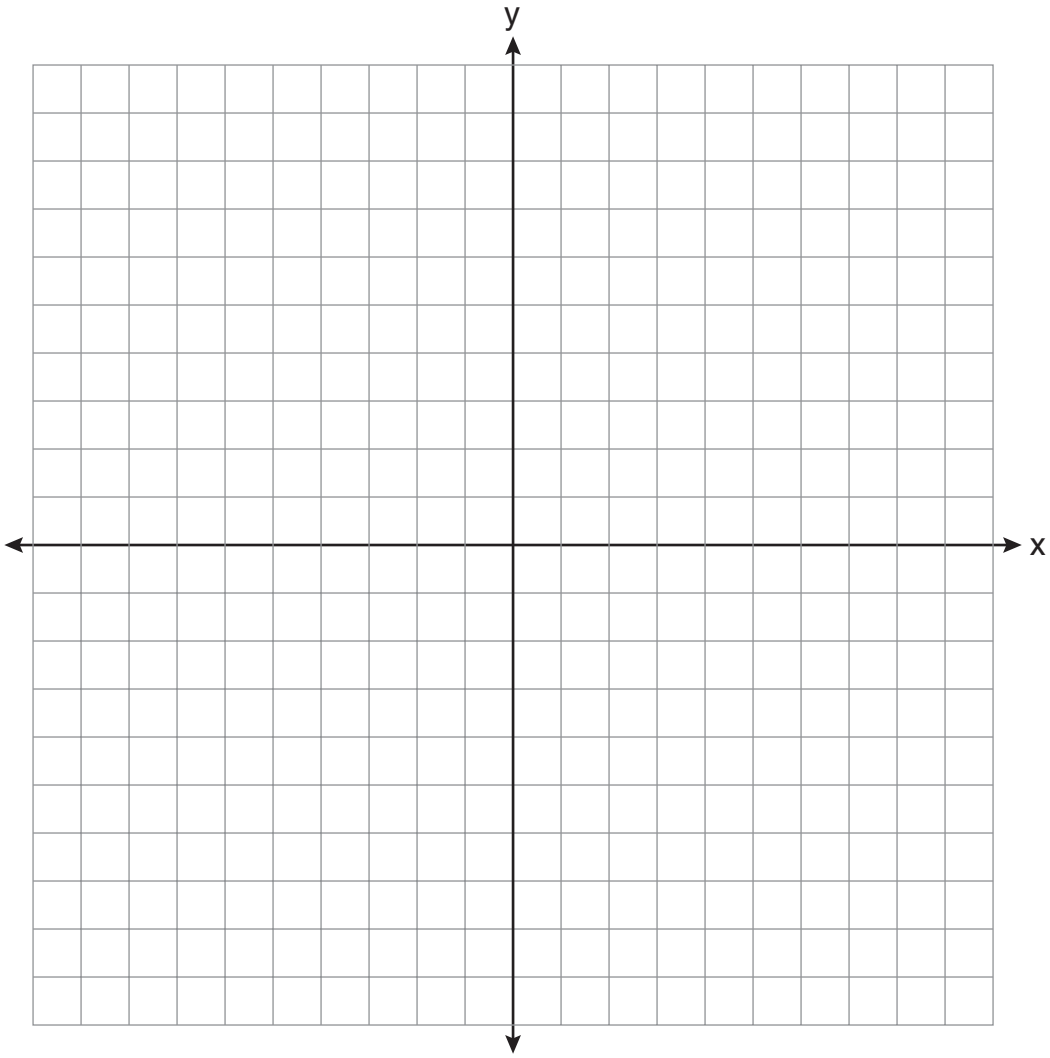
29 Solve algebraically for x: $4 - \sqrt{2x - 5} = 1$

30 Evaluate: $\sum_{n=1}^{3} (-n^4 - n)$

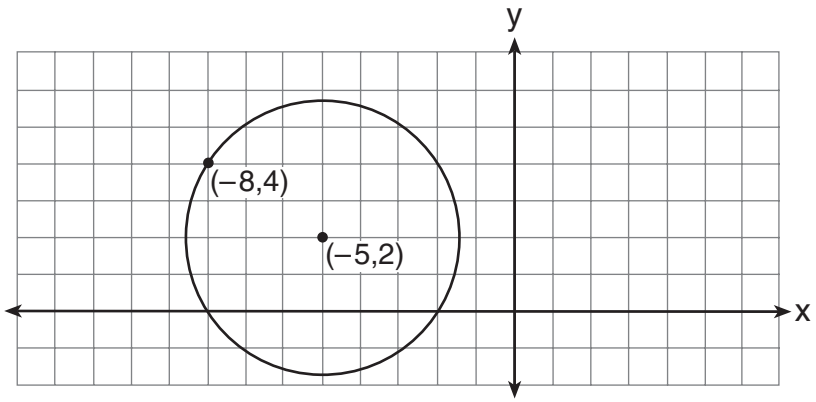
31 Express in simplest form: $\sqrt[3]{\frac{a^6b^9}{-64}}$

32 A blood bank needs twenty people to help with a blood drive. Twenty-five people have volunteered. Find how many different groups of twenty can be formed from the twenty-five volunteers.

33 On the axes below, for $-2 \leq x \leq 2$, graph $y = 2^{x+1} - 3$.



34 Write an equation of the circle shown in the diagram below.

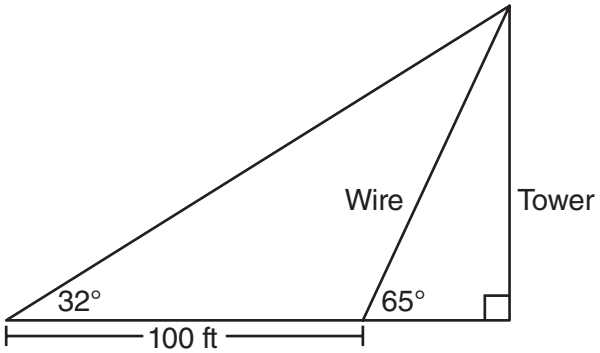


35 Express the exact value of csc 60°, with a rational denominator.

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]

36 The diagram below shows the plans for a cell phone tower. A guy wire attached to the top of the tower makes an angle of 65 degrees with the ground. From a point on the ground 100 feet from the end of the guy wire, the angle of elevation to the top of the tower is 32 degrees. Find the height of the tower, to the *nearest foot*.



37 If $\log_4 x = 2.5$ and $\log_y 125 = -\frac{3}{2}$, find the numerical value of $\frac{x}{y}$, in simplest form.

38 A population of single-celled organisms was grown in a Petri dish over a period of 16 hours. The number of organisms at a given time is recorded in the table below.

Time, hrs (x)	**Number of Organisms** (y)
0	25
2	36
4	52
6	68
8	85
10	104
12	142
16	260

Determine the exponential regression equation model for these data, rounding all values to the *nearest ten-thousandth*.

Using this equation, predict the number of single-celled organisms, to the *nearest whole number*, at the end of the 18th hour.

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]

39 Perform the indicated operations and simplify completely:

$$\frac{x^3 - 3x^2 + 6x - 18}{x^2 - 4x} \bullet \frac{2x - 4}{x^4 - 3x^3} \div \frac{x^2 + 2x - 8}{16 - x^2}$$

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Reference Sheet

Area of a Triangle

$$K = \frac{1}{2}ab \sin C$$

Functions of the Sum of Two Angles

$$\sin (A + B) = \sin A \cos B + \cos A \sin B$$
$$\cos (A + B) = \cos A \cos B - \sin A \sin B$$
$$\tan (A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

Functions of the Difference of Two Angles

$$\sin (A - B) = \sin A \cos B - \cos A \sin B$$
$$\cos (A - B) = \cos A \cos B + \sin A \sin B$$
$$\tan (A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Law of Sines

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Sum of a Finite Arithmetic Series

$$S_n = \frac{n(a_1 + a_n)}{2}$$

Binomial Theorem

$$(a + b)^n = {}_nC_0a^nb^0 + {}_nC_1a^{n-1}b^1 + {}_nC_2a^{n-2}b^2 + \ldots + {}_nC_na^0b^n$$
$$(a + b)^n = \sum_{r=0}^{n} {}_nC_r a^{n-r}b^r$$

Law of Cosines

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Functions of the Double Angle

$$\sin 2A = 2 \sin A \cos A$$
$$\cos 2A = \cos^2 A - \sin^2 A$$
$$\cos 2A = 2 \cos^2 A - 1$$
$$\cos 2A = 1 - 2 \sin^2 A$$
$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

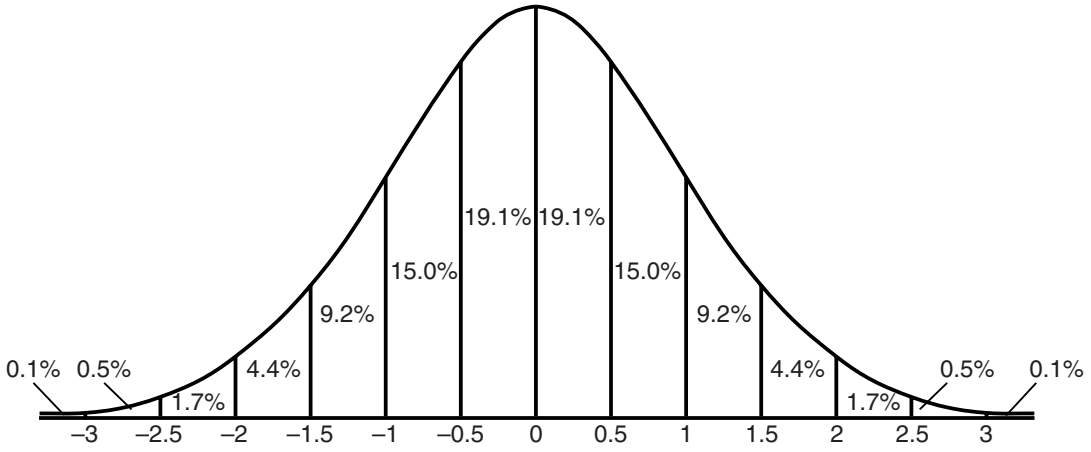
Functions of the Half Angle

$$\sin \frac{1}{2}A = \pm\sqrt{\frac{1 - \cos A}{2}}$$
$$\cos \frac{1}{2}A = \pm\sqrt{\frac{1 + \cos A}{2}}$$
$$\tan \frac{1}{2}A = \pm\sqrt{\frac{1 - \cos A}{1 + \cos A}}$$

Sum of a Finite Geometric Series

$$S_n = \frac{a_1(1 - r^n)}{1 - r}$$

Normal Curve
Standard Deviation



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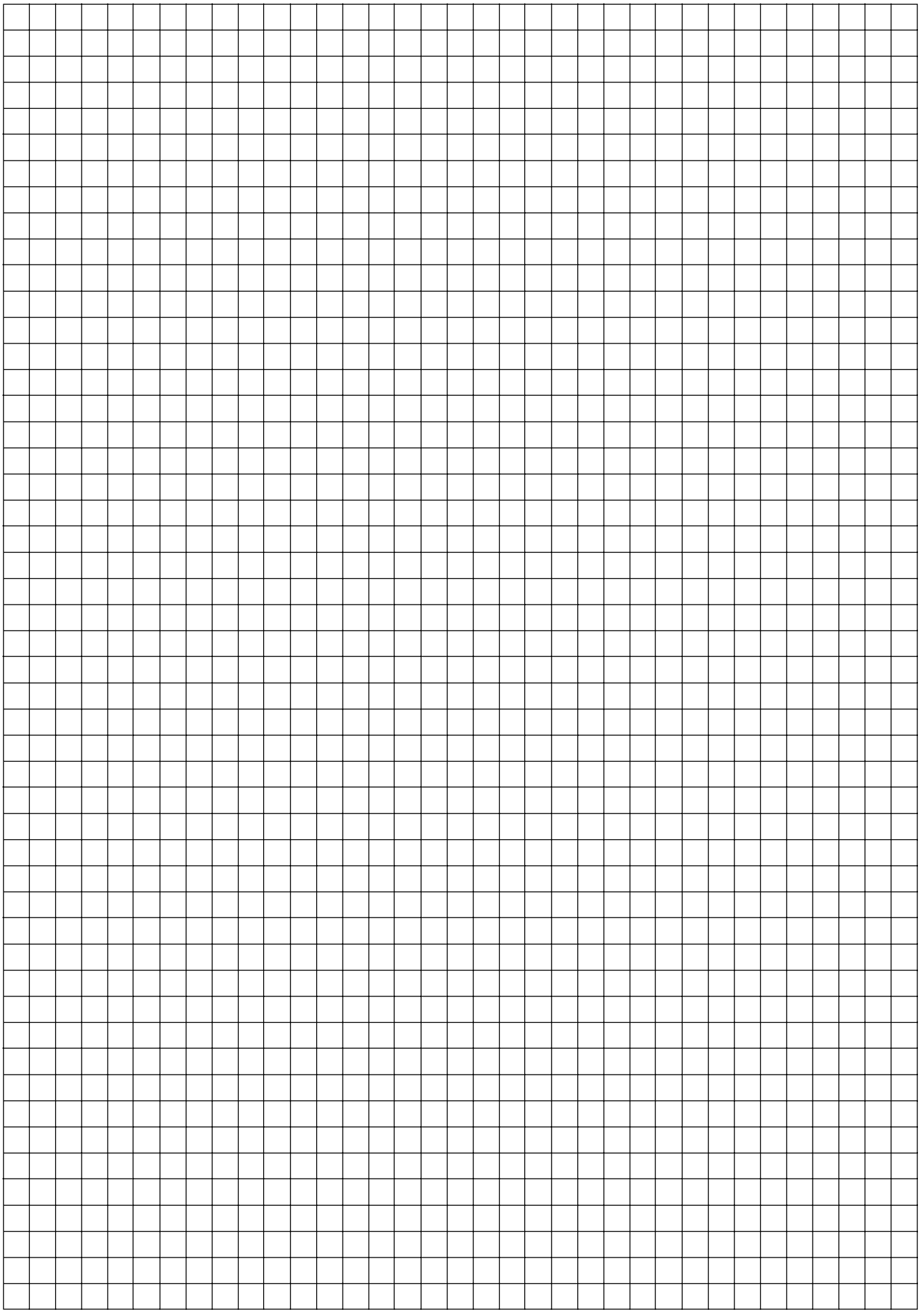

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ALGEBRA 2/TRIGONOMETRY

Wednesday, January 25, 2012 — 1:15 to 4:15 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 27 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	

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.

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Signature

ALGEBRA 2/TRIGONOMETRY			
Question	**Maximum Credit**	**Credits Earned**	**Rater's/Scorer's Initials**
Part I 1–27	**54**		
Part II 28	**2**		
29	**2**		
30	**2**		
31	**2**		
32	**2**		
33	**2**		
34	**2**		
35	**2**		
Part III 36	**4**		
37	**4**		
38	**4**		
Part IV 39	**6**		
Maximum Total	**88**		

Rater's/Scorer's Name (minimum of three)

Total Raw Score | **Checked by** | **Scale Score** (from conversion chart)

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