The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA 2/TRIGONOMETRY

Wednesday, August 12, 2015 — 12:30 to 3:30 p.m., only

Student Name: *Mr. Sibol*

School Name: *JMAP*

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

Print your name and the name of your school on the lines above.

A separate answer sheet for Part I has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 39 questions. You must answer all questions in this examination. Record 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 for 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.

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

Answer all 27 questions in this part. Each correct answer will receive 2 credits. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers on your separate answer sheet. [54]

Use this space for computations.

1 What are the zeros of the polynomial function graphed below?

(1) {−3, −1, 2}

(2) {3, 1, −2}

(3) {4, −8}
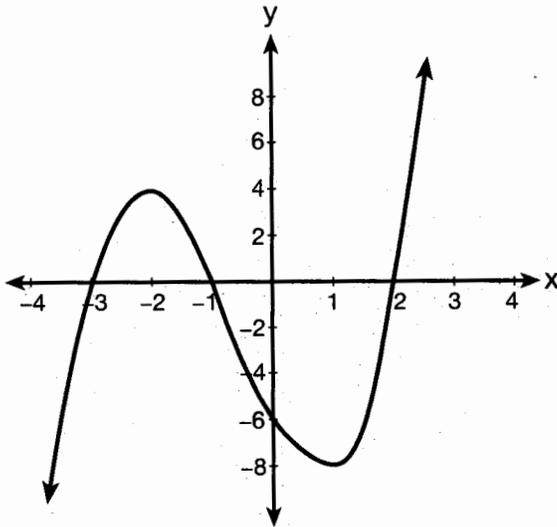
(4) {−6}

2 A study compared the number of years of education a person received and that person's average yearly salary. It was determined that the relationship between these two quantities was linear and the correlation coefficient was 0.91. Which conclusion can be made based on the findings of this study?

(1) There was a weak relationship.

(2) There was a strong relationship.

(3) There was no relationship.

(4) There was an unpredictable relationship.

3 What is the value of $4x^{\frac{1}{2}} + x^0 + x^{-\frac{1}{4}}$ when $x = 16$?

(1) $7\frac{1}{2}$

(3) $16\frac{1}{2}$

(2) $9\frac{1}{2}$

(4) $17\frac{1}{2}$ ✓

[handwritten:] $-\frac{1}{4}$

$4(16)^{\frac{1}{2}} + (16)^0 + (16)^{-\frac{1}{4}}$

$4(4) + 1 + \frac{1}{2}$

4 The expression $\sqrt[4]{81x^2y^5}$ is equivalent to

(1) $3x^{\frac{1}{2}}y^{\frac{5}{4}}$ ✓

(3) $9xy^{\frac{5}{2}}$

(2) $3x^{\frac{1}{2}}y^{\frac{4}{5}}$

(4) $9xy^{\frac{2}{5}}$

5 The exact value of csc 120° is

(1) $\frac{2\sqrt{3}}{3}$ ✓

(3) $-\frac{2\sqrt{3}}{3}$

(2) 2

(4) -2

[handwritten:] $\sin 120 = \frac{\sqrt{3}}{2}$

$\csc 120 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$

6 Which statement about the equation $3x^2 + 9x - 12 = 0$ is true?

(1) The product of the roots is -12.

(2) The product of the roots is -4. ✓

(3) The sum of the roots is 3.

(4) The sum of the roots is -9.

[handwritten:] $P = \frac{c}{a} = \frac{-12}{3} = -4$

$S = \frac{-b}{a} = \frac{-9}{3} = -3$

7 A scholarship committee rewards the school's top math students. The amount of money each winner receives is inversely proportional to the number of scholarship recipients. If there are three winners, they each receive \$400. If there are eight winners, how much money will each winner receive?

(1) \$1067

(3) \$240

(2) \$400

(4) \$150 ✓

[handwritten:] $\frac{3 \cdot 400}{8} = \frac{8x}{8}$

8 What is the value of $\tan\left(\text{Arc}\cos\frac{15}{17}\right)$?

(1) $\frac{8}{15}$ (3) $\frac{15}{8}$

(2) $\frac{8}{17}$ (4) $\frac{17}{8}$

Use this space for computations.

8-15-17 △

If $\cos\theta = \frac{15}{17}$, $\sin\theta = \frac{8}{17}$

$\tan\theta = \frac{8/17}{15/17}$

9 The table below displays the number of siblings of each of the 20 students in a class.

Number of Siblings	Frequency
0	2
1	5
2	7
3	4
4	2

What is the population standard deviation, to the *nearest hundredth*, for this group?

(1) 1.11   (3) 1.14

(2) 1.12   (4) 1.15

10 An arithmetic sequence has a first term of 10 and a sixth term of 40. What is the 20th term of this sequence?

(1) 105   (3) 124

(2) 110   (4) 130

$\frac{40-10}{6-1} = \frac{30}{5} = 6$

$a_n = 6n + 4$

$a_{20} = 6(20) + 4$

11 Yusef deposits $50 into a savings account that pays 3.25% interest compounded quarterly. The amount, A, in his account can be determined by the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$, where P is the initial amount invested, r is the interest rate, n is the number of times per year the money is compounded, and t is the number of years for which the money is invested. What will his investment be worth in 12 years if he makes no other deposits or withdrawals?

(1) $55.10   (3) $232.11

(2) $73.73   (4) $619.74

$$A = 50\left(1 + \frac{.0325}{4}\right)^{4 \cdot 12}$$

$$\approx 73.73$$

12 How many distinct ways can the eleven letters in the word "TALLAHASSEE" be arranged?

(1) 831,600   (3) 3,326,400

(2) 1,663,200   (4) 5,702,400

$$\frac{11!}{3! \cdot 2! \, 2! \, 2!} = 831,600$$

13 A customer will select three different toppings for a supreme pizza. If there are nine different toppings to choose from, how many different supreme pizzas can be made?

(1) 12   (3) 84

(2) 27   (4) 504

$$_9C_3 = 84$$

14 Which values of x in the interval $0° \le x < 360°$ satisfy the equation $2\sin^2 x + \sin x - 1 = 0$?

(1) {30°, 270°}   (3) {90°, 210°, 330°}

(2) {30°, 150°, 270°}   (4) {90°, 210°, 270°, 330°}

$$(2\sin x - 1)(\sin x + 1) = 0$$

$$\sin x = \tfrac{1}{2}, \; -1$$

$$30, 150 \qquad 270$$

15 Expressed as a function of a positive acute angle, sin 230° is

(1) $-\sin 40°$ (3) $\sin 40°$

(2) $-\sin 50°$ (4) $\sin 50°$

16 Which equation represents a circle with its center at $(2,-3)$ and that passes through the point $(6,2)$?

(1) $(x - 2)^2 + (y + 3)^2 = \sqrt{41}$ (3) $(x - 2)^2 + (y + 3)^2 = 41$

(2) $(x + 2)^2 + (y - 3)^2 = \sqrt{41}$ (4) $(x + 2)^2 + (y - 3)^2 = 41$

$r = \sqrt{(6-2)^2 + (2--3)^2}$

$\sqrt{16 + 25}$

$r = \sqrt{41}$

$r^2 = 41$

17 What is the domain of the function $g(x) = 3^x - 1$?

(1) $(-\infty, 3]$ (3) $(-\infty, \infty)$

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

18 The expression $\dfrac{3 - \sqrt{8}}{\sqrt{3}}$ is equivalent to

$\dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{3\sqrt{3} - \sqrt{24}}{3} = \dfrac{3\sqrt{3} - 2\sqrt{6}}{3}$

(1) $\dfrac{\sqrt{3} - 2\sqrt{6}}{3}$ (3) $\dfrac{3 - \sqrt{24}}{3}$

(2) $-\sqrt{3} + \dfrac{2}{3}\sqrt{6}$ (4) $\sqrt{3} - \dfrac{2}{3}\sqrt{6}$

19 What is the period of the graph of the equation $y = \dfrac{1}{3} \sin 2x$?

(1) $\dfrac{1}{3}$ (3) π

(2) 2 (4) 6π

$\dfrac{2\pi}{2} = \pi$

20 The first four terms of the sequence defined by $a_1 = \frac{1}{2}$ and $a_{n+1} = 1 - a_n$ are

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

(3) $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$

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

(4) $\frac{1}{2}, 1\frac{1}{2}, 2\frac{1}{2}, 3\frac{1}{2}$

21 The scores on a standardized exam have a mean of 82 and a standard deviation of 3.6. Assuming a normal distribution, a student's score of 91 would rank

$\dfrac{91-82}{3.6}$, $2.5 \ sds$

(1) below the 75th percentile

(2) between the 75th and 85th percentile

(3) between the 85th and 95th percentile

(4) above the 95th percentile

22 If $\cos\theta = \frac{3}{4}$, then what is $\cos 2\theta$?

$2\left(\frac{3}{4}\right)^2 - 1$

(1) $\frac{1}{8}$

(3) $-\frac{1}{8}$

$2\left(\frac{9}{16}\right) - 1$

(2) $\frac{9}{16}$

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

$\frac{9}{8} - \frac{8}{8}$

$\frac{1}{8}$

23 If $m = \{(-1,1), (1,1), (-2,4), (2,4), (-3,9), (3,9)\}$, which statement is true?

(1) m and its inverse are both functions.

(2) m is a function and its inverse is not a function.

(3) m is not a function and its inverse is a function.

(4) Neither m nor its inverse is a function.

24 The expression $\sqrt{-180x^{16}}$ is equivalent to

(1) $-6x^4\sqrt{5}$ (3) $6x^4i\sqrt{5}$

(2) $-6x^8\sqrt{5}$ (4) $6x^8i\sqrt{5}$

25 The ninth term of the expansion of $(3x + 2y)^{15}$ is

(1) $_{15}C_9(3x)^6(2y)^9$ (3) $_{15}C_8(3x)^7(2y)^8$

(2) $_{15}C_9(3x)^9(2y)^6$ (4) $_{15}C_8(3x)^8(2y)^7$

26 Six people met at a dinner party, and each person shook hands once with everyone there. Which expression represents the total number of handshakes?

(1) $6!$ (3) $\dfrac{6!}{2!}$

(2) $6! \cdot 2!$ (4) $\dfrac{6!}{4! \cdot 2!}$

27 Which value of k will make $x^2 - \dfrac{1}{4}x + k$ a perfect square trinomial?

(1) $\dfrac{1}{64}$ (3) $\dfrac{1}{8}$

(2) $\dfrac{1}{16}$ (4) $\dfrac{1}{4}$

$$\left(\frac{1}{2}\left(-\frac{1}{4}\right)\right)^2 = \frac{1}{64}$$

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 Determine, to the *nearest minute*, the number of degrees in an angle whose measure is 2.5 radians.

$$2.5 \cdot \frac{180}{\pi} \approx 143° 14'$$

$$.2394 \cdot 60 \approx 14$$

29 Solve for x: $\frac{1}{16} = 2^{3x-1}$

$$2^{-4} = 2^{3x-1}$$

$$-4 = 3x-1$$

$$-3 = 3x$$

$$-1 = x$$

30 If $f(x) = x^2 - x$ and $g(x) = x + 1$, determine $f(g(x))$ in simplest form.

$$(x+1)^2 - (x+1)$$

$$x^2 + 2x + 1 - x - 1$$

$$x^2 + x$$

31 The probability of winning a game is $\frac{2}{3}$. Determine the probability, expressed as a fraction, of winning *exactly* four games if seven games are played.

$$_7C_4 \left(\frac{2}{3}\right)^4 \left(\frac{1}{3}\right)^3$$

$$35 \cdot \frac{16}{81} \cdot \frac{1}{27}$$

$$\frac{560}{2187}$$

32 In a circle, an arc length of 6.6 is intercepted by a central angle of $\frac{2}{3}$ radians. Determine the length of the radius.

$$r = \frac{s}{\theta} = \frac{6.6}{2/3} = 9.9$$

33 Show that $\dfrac{\sec^2 x - 1}{\sec^2 x}$ is equivalent to $\sin^2 x$.

$$\frac{\frac{1}{\cos^2 x} - 1}{\frac{1}{\cos^2 x}} \cdot \frac{\cos^2 x}{\cos^2 x}$$

$$\frac{1 - \cos^2 x}{1}$$

$$\sin^2 x$$

34 Solve algebraically for the exact values of x: $\left(\dfrac{5x}{2} = \dfrac{1}{x} + \dfrac{x}{4}\right)^{4x}$

$$10x^2 = 4 + x^2$$

$$9x^2 - 4 = 0$$

$$(3x + 2)(3x - 2) = 0$$

$$x = \pm \dfrac{2}{3}$$

35 Simplify $\displaystyle\sum_{a=1}^{4} (x - a^2)$.

$$X - 1$$
$$X - 4$$
$$X - 9$$
$$X - 16$$
$$\overline{4X - 30}$$

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 In a triangle, two sides that measure 8 centimeters and 11 centimeters form an angle that measures 82°. To the *nearest tenth of a degree*, determine the measure of the *smallest* angle in the triangle.

$$a = \sqrt{8^2 + 11^2 - 2(8)(11) \cos 82} \approx 12.67$$

$$\frac{12.67}{\sin 82} = \frac{8}{\sin x}$$

$$x \approx 38.7$$

37 Solve the equation $2x^3 - x^2 - 8x + 4 = 0$ algebraically for all values of x.

$$x^2(2x - 1)) - 4(2x-1) = 0$$
$$(x^2-4)(2x-1) = 0$$
$$(x+2)(x-2)(2x-1) = 0$$

$$\pm 2, \frac{1}{2}$$

38 Solve algebraically for x: $|3x - 5| - x < 17$

$$|3x - 5| < x + 17$$

$$3x - 5 < x + 17 \quad \text{and} \quad 3x - 5 > -x - 17$$
$$2x < 22 \qquad\qquad\qquad 4x > -12$$
$$x < 11 \qquad\qquad\qquad x > -3$$

$$-3 < x < 11$$

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 Solve algebraically, to the *nearest hundredth*, for all values of x:

$$\log_2 (x^2 - 7x + 12) - \log_2 (2x - 10) = 3$$

$$\log_2 \left(\frac{x^2 - 7x + 12}{2x - 10} \right) = 3$$

$$\frac{x^2 - 7x + 12}{2x - 10} = 8$$

$$x^2 - 7x + 12 = 16x - 80$$

$$x^2 - 23x + 92 = 0$$

$$x = \frac{23 \pm \sqrt{(-23)^2 - 4(1)(92)}}{2(1)}$$

$$x \approx 17.84, \ 5.16$$