The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA 2/TRIGONOMETRY

Friday, June 17, 2016 — 9:15 a.m. to 12:15 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.

Part I

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 The expression $\frac{3}{4}\sqrt{-80}$ is equivalent to

(1) $3i\sqrt{5}$

(2) $2i\sqrt{15}$

(3) $-3\sqrt{5}$

(4) $-2\sqrt{15}$

$\frac{3}{4}\sqrt{-1}\sqrt{16}\sqrt{5}$

$3i\sqrt{5}$

2 In $\triangle RST$, $m\angle S = 135$, $r = 27$, and $t = 19$. What is the area of $\triangle RST$ to the *nearest tenth of a square unit*?

(1) 90.7

(2) 181.4

(3) 256.5

(4) 362.7

$K = \frac{1}{2}(27)(19)\sin 135$

≈ 181.4

3 The expression $\frac{\sqrt{5}}{7-\sqrt{5}}$ is equivalent to

(1) $\frac{7\sqrt{5}+5}{54}$

(2) $\frac{7\sqrt{5}-5}{54}$

(3) $\frac{7\sqrt{5}+5}{44}$

(4) $\frac{7\sqrt{5}-5}{44}$

$\frac{\sqrt{5}}{7-\sqrt{5}} \cdot \frac{7+\sqrt{5}}{7+\sqrt{5}}$

$\frac{7\sqrt{5}+5}{49-5}$

$\frac{7\sqrt{5}+5}{44}$

Use this space for computations.

4 A multiple-choice test has 4 possible choices for each question. A person guesses on 10 questions. What is the probability the person gets *exactly* 8 questions correct?

(1) ${}_{10}C_8\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^8$

(2) ${}_{10}C_8\left(\frac{1}{4}\right)^8\left(\frac{3}{4}\right)^2$

(3) ${}_{10}C_8\left(\frac{1}{10}\right)^2\left(\frac{9}{10}\right)^8$

(4) ${}_{10}C_8\left(\frac{1}{10}\right)^8\left(\frac{9}{10}\right)^2$

5 The summation $2\sum_{n=3}^{6}\cos\left(\frac{\pi}{n-2}\right)$ equals

(1) $-\frac{2+\sqrt{2}}{2}$

(2) $-2+\sqrt{2}$

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

(4) $-1+\sqrt{2}$

$\cos\frac{\pi}{3-2} = -1$

$\cos\frac{\pi}{4-2} = 0$

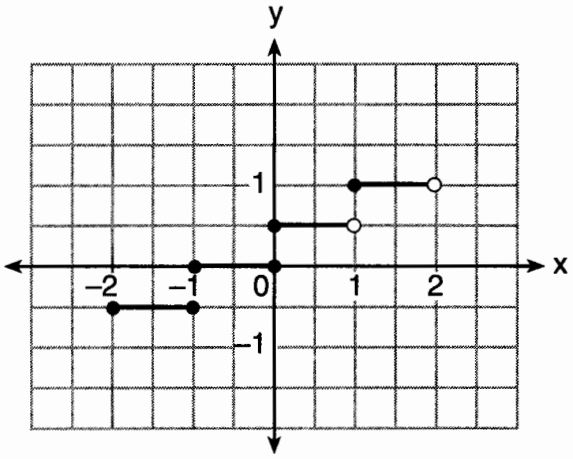
$\cos\frac{\pi}{5-2} = \frac{1}{2}$

$\cos\frac{\pi}{6-2} = \frac{\sqrt{2}}{2}$

$2\left(-\frac{1}{2}+\frac{\sqrt{2}}{2}\right)$

$-1+\sqrt{2}$

6 The graph of a relation is shown below.



What is the domain of this relation?

(1) $\{-2,-1,0,1\}$

(2) $\left\{-\frac{1}{2},0,\frac{1}{2},1\right\}$

(3) $\{x \mid -2 \le x < 2\}$

(4) $\{x \mid -2 \le x \le 2\}$

Use this space for computations.

7 The Mathematics Club will select a president, a vice president, and a treasurer for the club. If there are 15 members in the club, how many different selections of a president, a vice president, and a treasurer are possible if each club member can be selected to only one position?

(1) 42
(2) 455
(3) 2730
(4) 3375

$15 P_3$

8 For which equation will $f(-2) = -6$?

(1) $f(x) = x^3 + x$
(2) $f(x) = x^4 - 5x$
(3) $f(x) = 4x^3 + 6x^2 - x$
(4) $f(x) = -3x^3 - 4x^2 + 4x$

$4(-2)^3+6(-2)^2-(-2)$
$4(-8)+6(4)+2$
$-32+24+2$
-6

9 What is the product of $x^2 - 2x + 3$ and $x + 1$?

(1) $x^3 - x^2 + x + 3$
(2) $x^3 - 2x^2 + 3x$
(3) $x^2 - 3x + 2$
(4) $x^2 - x + 4$

$(x^2-2x+3)(x+1)$
$x^3+x^2-2x^2-2x+3x+3$
x^3-x^2+x+3

10 A principal is concerned about the decline in the number of students who purchase food from the cafeteria. A survey was developed to assist the principal. The most appropriate method would be for the principal to randomly select 100 students from

(1) the junior class
(2) the student directory
(3) the Algebra 2/Trigonometry classes
(4) the students who are eating during fourth period lunch in the cafeteria

Use this space for computations.

11 The solution of $8^{1-p} = 16^{2p-1}$ is

(1) $\frac{7}{11}$ (3) $\frac{4}{9}$

(2) $\frac{3}{5}$ (4) $\frac{2}{5}$

$(2^3)^{1-p} = (2^4)^{2p-1}$

$3 \cdot 3p = 8p - 4$

$7 = 11p$

$\frac{7}{11} \quad \frac{11}{11}$

12 Which relation is *not* a function?

(1) $\{(x,y):y = |x|\}$ (3) $\{(x,y):y = x\}$

(2) $\{(x,y):y = -x^2\}$ (4) $\{(x,y):y = \pm\sqrt{x}\}$

13 What does the correlation coefficient of -0.975 on a linear regression indicate?

(1) The slope is positive.

(2) One variable causes the other.

(3) The scatterplot shows no association of the variables.

(4) One variable has a strong relationship with the other.

14 Which angle has the same terminal side as an angle of 155°?

(1) $-205°$ (3) 25°

(2) $-155°$ (4) 335°

$-205° + 360° = 155°$

Use this space for computations.

15 For any power of i, the imaginary unit, where b is a whole number, i^{4b+3} equals $i^3 = -i$

(1) 1
(3) -1
(2) i
(4) $-i$

16 What is the solution set of $\left(x - \frac{10}{x} + 3 = 0\right)x$

$x^2 - 10 + 3x = 0$
$x^2 + 3x - 10 = 0$
$(x+5)(x-2) = 0$
$-5 \quad 2$

(1) $\{-5, 2\}$
(3) $\{-1, 10\}$
(2) $\{-2, 5\}$
(4) $\{-10, 1\}$

17 In triangle ABC, if $m\angle A = 40$, $BC = 10$, and $AB = 12$, then $m\angle C$ can be

$\frac{10}{\sin 40} = \frac{12}{\sin C}$

$C = \sin^{-1}\frac{12 \sin 40}{10} = 50.5$

$+40$
$\Delta 90.5$

$180 - 50.5 = 129.5$

$+40$
$\Delta 169.5$

(1) an acute angle, only
(2) a right angle, only
(3) an obtuse angle, only
(4) either an acute or an obtuse angle

18 To the *nearest thousandth*, what is 23°50′, in radian measure?

$23°50' \cdot \frac{\pi}{180} \approx 0.416$

(1) 0.416
(3) 0.410
(2) 0.415
(4) 0.409

Use this space for computations.

19 When $f(x) = \frac{x-7}{2}$, what is the value of $(f \circ f^{-1})(3)$?

(1) $2x + 7$

(2) -2

(3) 3

(4) x

$F(13) = \frac{13-7}{2}$

$= \frac{6}{2}$

$= 3$

$F^{-1}(x): x = \frac{y-7}{2}$

$2x+7 = y$ $F'(3) = 2(3)+7 = 13$

20 What is the equation of the circle passing through the point $(-5,-2)$ whose center is at $(-2,3)$?

(1) $(x+5)^2 + (y+2)^2 = 34$

(2) $(x+5)^2 + (y+2)^2 = 50$

(3) $(x+2)^2 + (y-3)^2 = 34$

(4) $(x+2)^2 + (y-3)^2 = 50$

$r = \sqrt{(-5--2)^2+(-2-3)^2}$

$= \sqrt{9+25}$

$r^2 = 34$

21 If $a = -2$ and $b = -3$, what is the value of the expression $\frac{c^a}{c^b} - \frac{c^b}{c^a}$, when $c \neq 0$?

(1) 0

(2) $\frac{c^2+1}{c}$

(3) $2c$

(4) $\frac{c^2-1}{c}$

$\frac{c^{-2}}{c^{-3}} - \frac{c^{-3}}{c^{-2}}$

$c - \frac{1}{c}$

$\frac{c^2-1}{c}$

22 What is the fourth term in the expansion of $(2x-1)^6$?

(1) $-160x^3$

(2) $-40x^3$

(3) $16x^4$

(4) $240x^4$

${}_6C_3(2x)^3(-1)^3$

$20 \cdot 8x^3(-1)$

$-160x^3$

Use this space for computations.

23 If the roots of a quadratic equation are real, irrational, and unequal, the discriminant could have a value of

(1) 1 rational
(2) 0 equal
(3) 8
(4) −6 imaginary

24 What is the nth term of the sequence $-1,3,7,11,\ldots$?

(1) $a_n = -1 - 4(n - 1)$
(2) $a_n = -1 + 4(n - 1)$
(3) $a_n = 4 - (n - 1)$
(4) $a_n = 4 + (n - 1)$

25 What is the sample standard deviation of the data in the table below, rounded to the *nearest tenth*?

Scores	Frequency
50	1
60	2
70	7
80	6
90	3
100	2

(1) 12.5
(2) 12.8
(3) 17.1
(4) 18.7

Use this space for computations.

26 Which equation is *not* true?

(1) $\cot^2\theta = 1 - \sec^2\theta$

(2) $\sin^2\theta = 1 - \cos^2\theta$

(3) $\sec^2\theta = \tan^2\theta + 1$

(4) $\csc^2\theta = 1 + \cot^2\theta$

$\frac{\cos^2\theta}{\sin^2\theta} = 1 - \frac{1}{\cos^2\theta}$ $\quad \frac{\cos^2\theta}{\sin^2\theta} = \frac{\cos^2\theta - 1}{\cos^2\theta}$

$\frac{\cos^2\theta}{\sin^2\theta} = \frac{-\sin^2\theta}{\cos^2\theta}$

27 Which quadratic equation has roots whose sum is $-\frac{9}{4}$ and product is $\frac{2}{3}$?

(1) $12x^2 + 8x + 27 = 0$

(2) $12x^2 - 27x + 8 = 0$

(3) $12x^2 - 8x - 27 = 0$

(4) $12x^2 + 27x + 8 = 0$

$S = \frac{-b}{a} = \frac{-27}{12} = \frac{-9}{4}$

$P = \frac{c}{a} = \frac{8}{12} = \frac{2}{3}$

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 Factor $6x^3 + 33x^2 - 63x$ completely.

$3x(2x^2+11x-21)$

$3x(x+7)(2x-3)$

29 Five thousand dollars is invested at an interest rate of 3.5% compounded quarterly. No money is deposited or withdrawn from the account. Using the formula below, determine, to the *nearest cent*, how much this investment will be worth in 18 years.

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

A = amount
P = principal
r = interest rate
n = number of times the interest rate compounded annually
t = time in years

$A = 5000\left(1 + \frac{.035}{4}\right)^{4 \cdot 18}$

$A \approx 9362.36$

30 A colony of bacteria grows exponentially. The table below shows the data collected daily.

Day (x)	**Population** (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

$y = 239.21(1.48)^x$

31 Express $\dfrac{2 + \dfrac{6}{x-3}}{\dfrac{x}{x-3}}$ in simplest form, when $x \neq 0$ and $x \neq 3$.

$$\frac{2+\frac{6}{x-3}}{\frac{x}{x-3}} \quad \frac{x-3}{x-3}$$

$$\frac{2(x-3)+6}{x}$$

$$\frac{2x-6+6}{x}$$

$$2$$

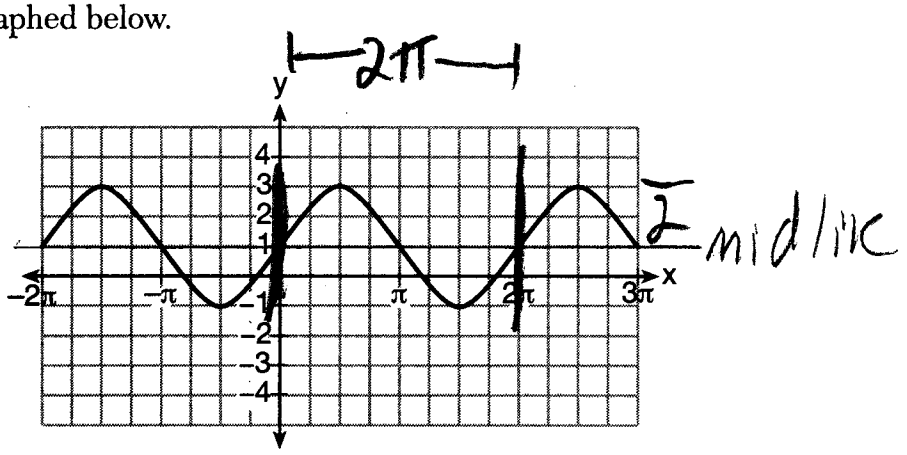
32 A central angle whose measure is $\frac{2\pi}{3}$ radians intercepts an arc with a length of 4π feet. Find the radius of the circle, *in feet*.

$s = \theta r$

$4\pi = \frac{2\pi}{3} r$

$6 = r$

33 A sine function is graphed below.

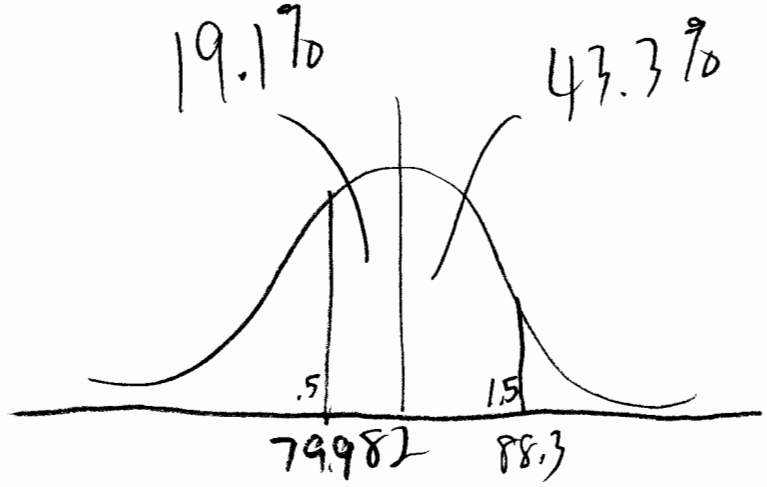


Determine and state the amplitude and period of this function.

2 2π

34 On the Algebra 2/Trigonometry midterm at Champion High School, the scores of 210 students were normally distributed with a mean of 82 and a standard deviation of 4.2.

Determine how many students scored between 79.9 and 88.3.



$62.4\% \cdot 210 \approx 131$

35 Given $\tan\theta = -\frac{5}{12}$ and $\frac{\pi}{2} < \theta < \pi$, determine the *exact* value of the expression $\sin\theta \cot\theta$.

$\cot\theta = \frac{-12}{5}$

$\sin\theta = \frac{5}{13}$

$\left(\frac{-12}{5}\right)\left(\frac{5}{13}\right)$

$\frac{-60}{65}$

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 lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the *nearest tenth of a degree*, the measure of the largest angle of the triangle.

$11^2 = 6^2 + 7^2 - 2(6)(7)\cos A$

$121 = 36 + 49 - 84\cos A$

$36 = -84\cos A$

$\cos^{-1}\frac{-36}{84} = A$

$115.4 \approx A$

37 Solve algebraically for c:

$$\left|\frac{3}{2}c - 10\right| - 9 \leq -1$$

$$\left|\frac{3}{2}c - 10\right| \leq 8$$

$$\frac{3}{2}c - 10 \leq 8 \qquad \frac{3}{2}c - 10 \geq -8$$

$$\frac{3}{2}c \leq 18 \qquad \frac{3}{2}c \geq 2$$

$$c \leq 12 \text{ and } c \geq \frac{4}{3}$$

38 Solve $2\cos^2 \theta = \cos \theta$ for all values of θ in the interval $0° \leq \theta < 360°$.

$2\cos^2\theta - \cos\theta = 0$

$\cos\theta(2\cos\theta - 1) = 0$

$\cos\theta = 0$ $\quad$ $\cos\theta = \frac{1}{2}$

90, 270 $\quad$ 60, 300

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 Solve for p algebraically: $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16}\frac{p^2-p+4}{2p+11} = \frac{3}{4}$$

$$\frac{p^2-p+4}{2p+11} = 16^{\frac{3}{4}}$$

$$\frac{p^2-p+4}{2p+11} = 8$$

$$p^2-p+4 = 16p+88$$

$$p^2-17p-84=0$$

$$(p-21)(p+4)=0$$

$$p = 21, -4$$