The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

THREE-YEAR SEQUENCE FOR HIGH SCHOOL MATHEMATICS

COURSE III

Thursday, August 16, 2001 — 8:30 to 11:30 a.m., only

Notice . . .

Scientific calculators must be available to all students taking this examination.

The formulas that you may need to answer some questions in this examination are found on page 2. 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 the answer sheet.

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. The answer sheet cannot be accepted if you fail to sign this declaration.

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

Part I

Answer 30 questions from this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Write your answers in the spaces provided on the separate answer sheet. Where applicable, answers may be left in terms of ≠ or in radical form. [60]

1 Solve for the negative value of x: $|3x - 1| = 19$

2 In $\triangle ABC$, $a = 24$, $\sin A = \frac{3}{4}$, and $\sin B = \frac{1}{2}$. Find b.

3 Express 198° in radian measure.

4 Evaluate: $\sum_{k=1}^{3} (3k-1)^2$

5 If $f(x) = 2x - 5$ and $g(x) = \sqrt{x}$, evaluate $(f \circ g)(36)$.

6 If $9^{x+1} = 27^x$, what is the value of x?

7 Express $\frac{1}{2}\sqrt{48} - (2\sqrt{12} - \sqrt{27})$ in simplest radical form.

8 In a circle whose radius is 2, a central angle intercepts an arc whose length is 6. What is the number of radians in the central angle of the arc?

9 If point $P(3,-2)$ is rotated 90° about the origin, what is the image of P?

10 The probability of winning a game is $\frac{3}{5}$ and the probability of losing a game is $\frac{2}{5}$. If the game is played three times, what is the probability of winning *exactly* two games?

Directions (11–35): For *each* question chosen, write on the separate answer sheet the *numeral* preceding the word or expression that best completes the statement or answers the question.

11 The expression $\cos 80° \cos 70° + \sin 80° \sin 70°$ is equivalent to

(1) $\cos 10°$ (3) $\sin 10°$
(2) $\cos 150°$ (4) $\sin 150°$

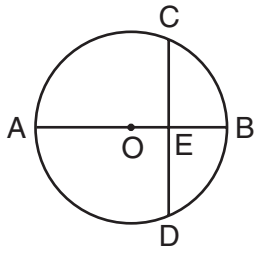
12 If $\sin A < 0$ and $\tan A > 0$, in which quadrant does the terminal side of $\angle A$ lie?

(1) I (3) III
(2) II (4) IV

13 For which value of x is the fraction $\frac{6}{\sin x - 1}$ undefined?

(1) 270° (3) 45°
(2) 90° (4) 0°

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



What is ED?

(1) 8 (3) 6
(2) 7 (4) 4

15 The graph of the equation $y = 3 \sin 2x$ is dilated using a factor of 2. The amplitude of the dilated graph is

(1) 1 (3) $\frac{3}{2}$
(2) 6 (4) 4

16 If $f(x) = x^{-\frac{1}{3}}$, then $f(64)$ is equal to

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

17 The expression $(1 - \cos x)(1 + \cos x)$ is equivalent to

(1) $\sin x$ (3) $\sin^2 x$
(2) $-\sin x$ (4) $-\sin^2 x$

18 If $\tan(x + 20) = \cot x$, a value of x is

(1) 35 (3) 55
(2) 45 (4) 70

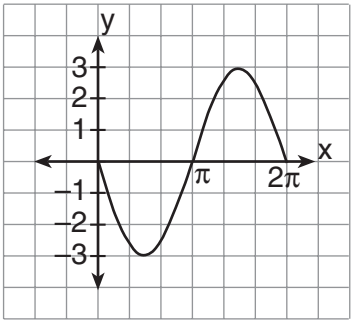
19 The expression $\dfrac{\frac{x^2}{y} - y}{\frac{x}{y} + 1}$ is equivalent to

(1) $x^2 - y^2$ (3) $x + y$
(2) $\dfrac{x^2 - y^2}{x + 1}$ (4) $x - y$

20 In $\triangle ABC$, $m\angle C = 30$ and $a = 8$. If the area of the triangle is 12, what is the length of side b?

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

21 Which equation is represented on the graph shown below?



(1) $y = 3 \sin x$ (3) $y = 3 \cos x$
(2) $y = -3 \sin x$ (4) $y = -\sin 3x$

22 The expression $\log \dfrac{\sqrt{x^2y^3}}{z}$ is equivalent to

(1) $\frac{1}{2}(2 \log x + 3 \log y - \log z)$
(2) $\frac{1}{2}(2 \log x + 3 \log y) - \log z$
(3) $2 \log x + 3 \log y - \log z$
(4) $\dfrac{x^2y^3}{z}$

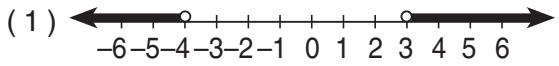
23 What is the value of $\tan\left(\text{Arc}\cos -\frac{3}{5}\right)$?

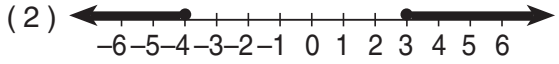
(1) $\frac{5}{3}$ (3) $-\frac{3}{4}$
(2) $\frac{4}{3}$ (4) $-\frac{4}{3}$

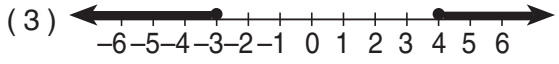
24 On a standardized test, the mean is 83 and the standard deviation is 3.5. What is the best approximation of the percentage of scores that fall in the range 76–90?

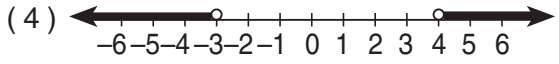
(1) 34 (3) 95
(2) 68 (4) 99

25 Which graph represents the solution set for $x^2 + x > 12$?

(1)


(2)


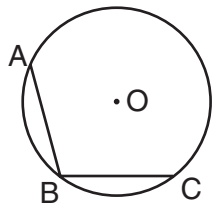
(3)


(4)


26 The equation $\sqrt{x + 6} + x = 6$ has for its roots

(1) neither 3 nor 10 (3) 3, only
(2) 10, only (4) both 3 and 10

27 In the accompanying diagram of circle O, $m\overset{\frown}{ABC} = 150$.



What is $m\angle ABC$?

(1) 210 (3) 95
(2) 105 (4) 75

28 If $f(x) = x^2$, what is the value of $f(2i)$?

(1) –2 (3) –4
(2) 2 (4) 4

29 What is the sum of the roots of the equation $3x^2 - 2x + 5 = 0$?

(1) $-\frac{2}{3}$ (3) $-\frac{5}{3}$

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

30 In the interval $90° < x < 270°$, what is the solution to $\csc x = -2$?

(1) 120° (3) 210°

(2) 150° (4) 240°

31 Which field property is illustrated by the expression $(\tan \theta)(\cot \theta) = 1$?

(1) closure (3) commutative

(2) identity (4) inverse

32 If the domain of $f(x) = 2x + 1$ is $\{-2 \leq x \leq 3\}$, which integer is *not* in the range?

(1) –4 (3) 0

(2) –2 (4) 7

33 In $\triangle ABC$, $a = 6$, $b = 7$, and $c = 8$. What is $\cos A$ in simplest fractional form?

(1) $\frac{3}{16}$ (3) $\frac{77}{96}$

(2) $\frac{11}{16}$ (4) $\frac{51}{112}$

34 If $m\angle ABC = 135$, $AC = 9$, and $AB = 10$, what is the maximum number of distinct triangles that can be constructed?

(1) 1 (3) 3

(2) 2 (4) 0

35 If x is a positive acute angle and $\cos x = \frac{1}{9}$, what is the value of $\cos \frac{1}{2}x$?

(1) $\frac{2}{3}$ (3) $\frac{2\sqrt{5}}{3}$

(2) $\frac{1}{3}$ (4) $\frac{\sqrt{5}}{3}$

Answers to the following questions are to be written on paper provided by the school.

Part II

Answer four questions from this part. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Calculations that may be obtained by mental arithmetic or the calculator do not need to be shown. [40]

36 *a* On the same set of axes, sketch and label the graphs of the equations $y = -3 \cos 2x$ and $y = 2 \sin \frac{1}{2}x$ in the interval $-\pi \leq x \leq \pi$. [8]

b Using the graphs drawn in part *a,* find the number of values of x in the interval $-\pi \leq x \leq \pi$ that satisfy the equation $-3 \cos 2x = 2 \sin \frac{1}{2}x$. [2]

37 Two forces are applied to an object. The measure of the angle between the 30.2-pound applied force and the 50.1-pound resultant is 25°.

a Find the magnitude of the second applied force to the *nearest tenth of a pound.* [5]

b Using the answer found in part *a,* find the measure of the angle between the second applied force and the resultant to the *nearest degree.* [5]

38 *a* Sketch and label the graph of the equation $\log_3 x = -y$. [5]

b On the same set of axes used in part *a*, sketch the equation $\log_3 x = -y$ reflected in the x-axis and label it b. [3]

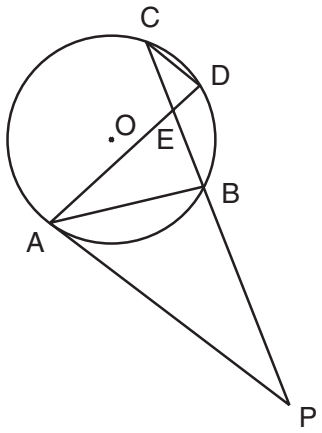
c Write the equation of the reflection sketched in part *b*. [2]

39 *a* Find all values of x in the interval $0° \leq x < 360°$ that satisfy the equation $\cos x \tan x + \cos x = 0$. [5]

b Express in simplest form:

$$\frac{64 - \cos^2 x}{\cos^2 x + 8 \cos x} \div \frac{2 \cos x - 16}{8 \cos x} \quad [5]$$

40 In the accompanying diagram of circle O, tangent $\overline{PA}$, secant $\overline{PBEC}$, and chords $\overline{AB}$, $\overline{AD}$, and $\overline{CD}$ are drawn; $m\angle C = 30$; $m\overset{\frown}{AB} = 100$; and $m\overset{\frown}{AC} : m\overset{\frown}{CD} = 4:1$.



Find:

a $m\overset{\frown}{CD}$ [2]
b $m\angle BAP$ [2]
c $m\angle CDA$ [2]
d $m\angle AEB$ [2]
e $m\angle P$ [2]

41 *a* Given $\triangle ABC$ with points $A(4,3)$, $B(4,-2)$, and $C(2,3)$.

(1) On graph paper, sketch $\triangle ABC$. [1]

(2) On the same set of axes, graph and state the coordinates of $\triangle A'B'C'$, the image of $\triangle ABC$ after a reflection in the line $y = x$. [3]

(3) On the same set of axes, graph and state the coordinates of $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after the translation $T_{-4,3}$. [2]

b Where i is the imaginary unit, expand and simplify completely $(3 - i)^4$. [4]

42 *a* The table below shows the age at inauguration of ten presidents of the United States.

President	Age at Inauguration
Harry Truman	60
Dwight D. Eisenhower	62
John F. Kennedy	43
Lyndon B. Johnson	55
Richard M. Nixon	56
Gerald R. Ford	61
Jimmy Carter	52
Ronald Reagan	69
George Bush	64
Bill Clinton	46

Find, to the *nearest tenth*, the standard deviation of the age at inauguration of these ten presidents. [4]

b Solve for x and express your answer in simplest $a + bi$ form:

$$16x = 16 - \frac{13}{x} \quad [6]$$

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SEQUENTIAL MATH – COURSE III

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

ANSWER SHEET

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

Teacher . . . . . School . . . . .

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

Part I

Answer 30 questions from this part.

1	11	21	31 . . . . .
2	12	22	32 . . . . .
3	13	23	33 . . . . .
4	14	24	34 . . . . .
5	15	25	35 . . . . .
6	16	26	
7	17	27	
8	18	28	
9	19	29	
10	20	30	

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

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Tear Here

Tear Here