

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

**ELEVENTH YEAR
MATHEMATICS**

Tuesday, January 23, 1990 — 9:15 a.m. to 12:15 p.m., only

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 your answer sheet.

The "Reference Tables for Mathematics" which you may need to answer some questions in this examination are stapled in the center of this booklet. Open the booklet and carefully remove the reference tables.

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

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN

Part I

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Unless otherwise specified, answers may be left in terms of π or in radical form. Write your answers in the spaces provided on the separate answer sheet. [60]

1 If the number 93,000,000 is written in the form 9.3×10^n , what is the value of n ?

2 Express 140° in radian measure.

3 Solve for x : $2^{3x-2} = 4^{2x}$

4 If $f(x) = \cos 2x$, find $f(30^\circ)$.

5 Express in simplest form: $\frac{\frac{a}{4} - \frac{1}{2}}{\frac{a}{3} - 1}$

6 Find the slope of a line parallel to the line whose equation is $2x + 3y = 6$.

7 Express the product of $(3 - i)$ and $(3 + i)$ in simplest form.

8 If x varies inversely as y and $x = 4$ when $y = 5$, find x when $y = 10$.

9 Phil is three times as old as Carrie. Five years ago, Phil was four times as old as Carrie was at that time. How old is Carrie now?

10 Solve for x : $\sqrt{2x+1} = 3$

11 What is the total number of distinct triangles that can be constructed if $m\angle A = 60$, $a = 9$, and $b = 10$?

12 Find the numerical value of the expression

$$\sin \frac{\pi}{2} + \tan \frac{\pi}{4}$$

13 Find x if $\log_{16} x = \frac{3}{4}$.

14 In $\triangle ABC$, $a = 20$, $b = 12$, and $m\angle C = 150$. Find the area of the triangle.

15 Find the positive acute angle that satisfies the equation $2 \sin^2 \theta + \sin \theta - 1 = 0$.

16 Find the number of radians in a central angle that intercepts an arc of 28 centimeters in a circle whose radius is 7 centimeters.

17 If $\tan A = 1$, find the value of $\sin 2A$.

Directions (18–30): Write in the space provided on the separate answer sheet the numeral preceding the expression that best completes each statement or answers each question.

18 What is the sum of the roots of the equation $2x^2 = -x - 3$?

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

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

19 If $\log 3 = x$ and $\log 5 = y$, then $\log 15$ is equal to

(1) xy (3) $x + y$

(2) $\frac{x}{y}$ (4) $x - y$

20 In the system of real numbers, the domain of the relation $y = \frac{1}{\sqrt{x-1}}$ is

(1) $\{x|x > 1\}$ (3) $\{x|x < 1\}$

(2) $\{x|x \geq 1\}$ (4) $\{x|x \leq 1\}$

21 If a quadratic equation with real coefficients has a discriminant of 2, then its two roots must be

- (1) equal (3) real and rational
(2) imaginary (4) real and irrational

22 The value of $\cos(-60^\circ)$ is the same as the value of

- (1) $\cos 60^\circ$ (3) $\cos 30^\circ$
(2) $-\cos 60^\circ$ (4) $-\cos 30^\circ$

23 In which quadrant(s) does the solution set of the system of equations $xy = 8$ and $y = x$ lie?

- (1) I, only (3) I and III
(2) III, only (4) II and IV

24 Which is an equation of a circle?

- (1) $3x^2 = 3y - 16x$ (3) $3x^2 = 6 + 3y^2$
(2) $xy = 3$ (4) $3x^2 = 6 - 3y^2$

25 Given the formula $p = 2(\ell + w)$. Expressed in terms of p and w , ℓ is equal to

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

26 In $\triangle RST$, $r = 3$, $s = 4$, and $m\angle T = 120$. The value of t is

- (1) 37 (3) 13
(2) $\sqrt{37}$ (4) $\sqrt{13}$

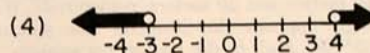
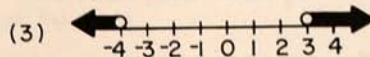
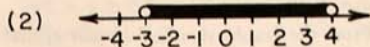
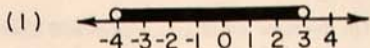
27 What is the period of the graph of the equation $y = 2 \cos \frac{1}{2}x^2$

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

28 The value of $\cos \left[\text{Arc sin} \left(\frac{2}{3} \right) \right]$ is

- (1) $\frac{5}{3}$ (3) $\frac{\sqrt{5}}{3}$
(2) $\frac{3}{13}$ (4) $\frac{3\sqrt{13}}{13}$

29 Which graph represents the solution set of the inequality $|2x + 1| < 7$?



30 As x increases from $-\frac{\pi}{2}$ to $\frac{\pi}{2}$ radians, the graph of the equation $y = \cos x$ will

- (1) decrease, then increase
(2) increase, then decrease
(3) increase throughout the interval
(4) decrease throughout the interval

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

Part II

Answer four questions from this part. Show all work unless otherwise directed. [40]

- 31 a Solve for all values of x to the nearest tenth:

$$2x^2 = 3(4x - 3) \quad [8]$$

- b If, in the equation given in part a, x is replaced with $\tan \theta$, in which quadrant(s) would angle θ lie? [2]

- 32 a On the same set of axes, sketch and label the graphs of the equations $y = \frac{1}{2} \cos x$ and

$$y = \sin 2x \text{ in the interval } 0 \leq x \leq 2\pi. \quad [8]$$

- b From the graphs sketched in part a, find the value of $\frac{1}{2} \cos x - \sin 2x$ when $x = 0$. [2]

- 33 a Two sides of a triangular garden measure 16 meters and 20 meters, respectively. If the angle opposite the 20-meter side measures $65^\circ 30'$, find, to the nearest ten minutes, the measure of the angle opposite the 16-meter side. [6]

- b Find the area of the garden to the nearest square meter. [4]

- 34 Solve the following system of equations graphically:

$$\begin{aligned} x^2 + y^2 &= 25 \\ 4x - 3y &= 0 \end{aligned} \quad [10]$$

- 35 Harold and Alfred made arrangements for a summer bus trip to a Mets baseball game. The cost of the bus was \$600, to be shared equally by all participants. The day before the trip, five more people obtained tickets for the game and wanted to go on the bus. This reduced the cost per person for the bus by \$4. How many people were in the final group? [10]

- 36 a Starting with the formula for $\sin(A + B)$, derive the formula for $\sin(A - B)$. [3]

- b Using the formula derived in part a, prove that $\sin(180^\circ - B) = \sin B$. [2]

- c For all values of x for which the expressions are defined, show that the following is an identity:

$$\frac{\sec x + \csc x}{\tan x + \cot x} = \sin x + \cos x \quad [5]$$

- 37 a Using logarithms, find the value of $\sqrt[3]{0.351}$ to the nearest thousandth. [4]

- b If $\log 2 = x$ and $\log 7 = y$, express $\log \sqrt{\frac{8}{7}}$ in terms of x and y . [2]

- c Find the value of $\frac{3}{2} \log_4 16 + \log_4 \frac{1}{4}$. [4]

FOR TEACHERS ONLY

SCORING KEY

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ELEVENTH YEAR MATHEMATICS

Tuesday, January 23, 1990 — 9:15 a.m. to 12:15 p.m., only

Use only *red* ink or *red* pencil in rating Regents papers. Do not attempt to correct the pupil's work by making insertions or changes of any kind. Use checkmarks to indicate pupil errors.

Unless otherwise specified, mathematically correct variations in the answers will be allowed. In problems involving logarithms, answers should be left correct to four significant digits unless directions say otherwise. Units need not be given when the wording of the questions allows such omissions.

Part I

Allow 2 credits for each correct answer; allow no partial credit. For questions 18–30, allow credit if the pupil has written the correct answer instead of the numeral 1, 2, 3, or 4.

- | | | |
|----------------------|------------------------------------|--------|
| (1) 7 | (11) 2 | (21) 4 |
| (2) $\frac{7\pi}{9}$ | (12) 2 | (22) 1 |
| (3) -2 | (13) 8 | (23) 3 |
| (4) $\frac{1}{2}$ | (14) 60 | (24) 4 |
| (5) $\frac{1}{a+2}$ | (15) 30° or $\frac{\pi}{6}$ | (25) 1 |
| (6) $-\frac{2}{3}$ | (16) 4 | (26) 2 |
| (7) 10 | (17) 1 | (27) 4 |
| (8) 2 | (18) 2 | (28) 3 |
| (9) 15 | (19) 3 | (29) 1 |
| (10) 4 | (20) 1 | (30) 2 |

Part II

Please refer to the Department publication *Guide for Rating Regents Examinations in Mathematics*. Care should be exercised in making deductions as to whether the error is purely a mechanical one or due to a violation of some principle. A mechanical error generally should receive a deduction of 10 percent, while an error due to a violation of some cardinal principle should receive a deduction ranging from 30 percent to 50 percent, depending on the relative importance of the principle in the solution of the problem.

(31) a 0.9, 5.1 [8]

b I, III [2]

(32) b $\frac{1}{2}$ [2]

(33) a $46^\circ 40'$ [6]

b 148 [4]

(34) (3,4) and (-3,-4) [10]

(35) 30 [10]

(37) a 0.705 [4]

b $\frac{1}{2}(x - y)$ [2]

c 2 [4]

As a reminder . . .

This is the *last* Regents examination based on the Eleventh Year Mathematics syllabus.