The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ELEVENTH YEAR MATHEMATICS

Tuesday, January 25, 1972 — 1:15 to 4:15 p.m., only

The last page of the booklet is the answer sheet, which is perforated. Fold the last page along the perforation and then, slowly and carefully, tear off the answer sheet. Now fill in the heading of your answer sheet. When you have finished the heading, you may begin the examination immediately.

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 on the separate answer sheet.

1 Factor: $2x^2 - 13x + 18$

2 Solve for x: $2^{x+5} = 8$

3 Express 240° in radian measure.

4 Find the solution set of the inequality $4x - 3 \geqq x + 3$.

5 The graphs of $y = \sin x$ and $y = \frac{1}{2}$ are drawn on the same axes in the interval from 0 to 2π radians. In how many points will these graphs intersect?

6 Find the value of x: $\sqrt{3x - 2} = 4$

7 In $\triangle RST$, side $r = 9$, side $s = 8$, and $\sin S = \frac{2}{3}$. Find the value of $\sin R$.

8 Find the positive value of $\tan\left(\arccos \frac{\sqrt{2}}{2}\right)$.

9 Solve for x: $\frac{3}{x} + \frac{5}{2x} = 1$

10 How many values of x between 0° and 360° satisfy the equation $4 \cos x - 3 = 0$?

11 In triangle ABC, $a = 8$, $b = 15$, and $c = 17$. Find the measure of $\angle C$.

12 Find the logarithm of 6,729.

13 A rectangle is twice as long as it is wide. If its diagonal is $\sqrt{45}$ inches long, find the number of inches in its width.

14 If the area of acute triangle ABC is 24 and if $a = 12$ and $b = 8$, find the number of degrees in angle C.

Directions (15–30): Write in the space provided on the separate answer sheet the *numeral* preceding the expression that best completes *each* statement or answers *each* question.

15 In the formula $A = bh$, if b is halved and h is multiplied by 8, then A

1 is halved
2 is multiplied by 2
3 is multiplied by 4
4 remains the same

16 If a and b are real numbers and $ab > 0$, which is *never* true?

(1) $a > b$
(2) $a > 0$ and $b < 0$
(3) $a > 0$ and $b > 0$
(4) $a < 0$ and $b < 0$

17 For the set of integers, which operations are commutative?

(1) addition and multiplication
(2) addition and subtraction
(3) subtraction and division
(4) multiplication and division

18 If $\tan x = \frac{1}{2}$ and $\tan y = \frac{1}{3}$, then the value of $\tan (x + y)$ is

(1) 1
(2) $\frac{5}{7}$
(3) $\frac{1}{5}$
(4) $\frac{1}{7}$

19 Given $a^2 + b^2 = 9$. If the replacement set for a and b is the set of complex numbers, and if $a = 5$, then a value of b is

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

20 In which quadrant are the cotangent and cosecant both negative?

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

21 If the universal set is the set of all integers, then the solution set of $|x| < 2$ is

(1) {0,1}
(2) {0,1,2}
(3) {—2,—1,0}
(4) {—1,0,1}

22 Given the set $A = \{(1,2), (3,4), (5,1), (2,5)\}$ and its inverse, A^{-1}. Which describes the two sets?

(1) Both A and A^{-1} are functions.
(2) Neither A nor A^{-1} is a function.
(3) A is a function and A^{-1} is not a function.
(4) A is not a function and A^{-1} is a function.

23 The expression $\frac{\sqrt{5} + \sqrt{2}}{\sqrt{5} - \sqrt{2}}$ is equivalent to

(1) -1
(2) $\frac{29 + 2\sqrt{10}}{21}$
(3) $\frac{7 + 2\sqrt{10}}{3}$
(4) $\frac{7}{3}$

24 If the units digit of a two-digit number is represented by a and the tens digit is represented by $3a$, what is the value of the number expressed in terms of a?

(1) $4a$
(2) $13a$
(3) $31a$
(4) $40a$

25 Which is the value of $\cos(-120°)$?

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

26 The expression $\sqrt{\frac{2\cos^2\theta}{\sin^2\theta}}$ is equivalent to

(1) $2\tan\theta$
(2) $\sqrt{2}\tan\theta$
(3) $2\cot\theta$
(4) $\sqrt{2}\cot\theta$

27 When $\sin\frac{5\pi}{6}$ is expressed as a function of a positive acute angle, it is equivalent to

(1) $\cos\frac{\pi}{6}$
(2) $\sin\frac{\pi}{6}$
(3) $\csc\frac{\pi}{6}$
(4) $\sec\frac{\pi}{6}$

28 An equation of the straight line which is perpendicular to $y = -2x + 4$ and which contains the point $(0,-1)$ is

(1) $y = \frac{1}{2}x$
(2) $y = \frac{1}{2}x + 2$
(3) $y = \frac{1}{2}x - 1$
(4) $y = x - 1$

29 The axis of symmetry of the graph of $y = -x^2 - 2x$ is

(1) $x = -1$
(2) $x = 1$
(3) $y = -1$
(4) $y = 1$

30 If $\log x^2 = 16a$, $\log 100x$ equals

(1) $2 + 4a$
(2) $2 + 8a$
(3) $16a$
(4) $800a$

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.

31 *a* Find, to the *nearest tenth,* the roots of the equation $2x + \frac{4}{x} = 7$. [8]

b If x were replaced by $\sin A$ in part (a), determine the quadrant(s) in which $\angle A$ would lie. [2]

32 *a* Draw the graph of $y = x^2 - 6x + 7$ in the interval $0 \leq x \leq 6$. [6]

b Sketch and label with its equation the axis of symmetry. [3]

c What is the minimum value of the function defined by $y = x^2 - 6x + 7$? [1]

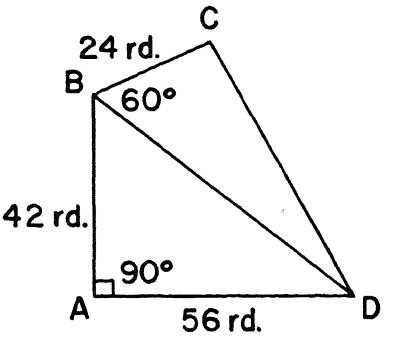
33 *a* Using a formula for $\cos 2y$, derive a formula for $\sin \frac{1}{2}x$ in terms of $\cos x$. [5]

b For all values of x for which the expression is defined, show that the following equality is an identity: [5]

$$\frac{2 \tan x - \sin 2x}{2 \sin^2 x} = \tan x$$

34 Using logarithms, find to the *nearest integer* the value of n if $n = \frac{154\sqrt{.888}}{\cos 35^\circ\ 20'}$. [10]

35 Answer either *a* or *b,* but *not* both:



a A plot of ground has the shape of the figure shown above. Side $AB = 42$ rods, side $AD = 56$ rods, side $BC = 24$ rods, $\text{m}\angle DAB = 90$, and $\text{m}\angle CBD = 60$. Find, to the *nearest hundred square rods,* the area of the plot of ground $ABCD$. [10]

OR

b From the top of a tower 265 feet high, the angle of depression of the top of a flagpole on level ground is 62° 20′. From the foot of the tower, the angle of elevation of the top of the flagpole is 32° 10′. Find the height of the flagpole to the *nearest tenth* of a foot. [4,6]

36 *a* On the same set of axes sketch the graphs of $y = \cos \frac{1}{2}x$ and $y = 2 \sin x$ for all values of x in the interval $0 \leq x \leq 2\pi$. [4,4]

b How many values of x in the interval defined in (a) satisfy the equation $\cos \frac{1}{2}x = 2 \sin x$? [2]

*37 Solve the following system of equations, and check. [8,2]

$$x + 2y - z = 5$$
$$2x + z = -1$$
$$3x - 4y - 2z = 7$$

* This question is based on one of the optional topics in the syllabus.

FOR TEACHERS ONLY

11

SCORING KEY

ELEVENTH YEAR MATHEMATICS

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Use only *red* ink or 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 15–30, allow credit if the pupil has written the correct answer instead of the number 1, 2, 3, or 4.

(1) $(x - 2)(2x - 9)$

(2) -2

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

(4) $\{x \geq 2\}$

(5) 2

(6) 6

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

(8) 1

(9) $\frac{11}{2}$

(10) 2

(11) 90°

(12) 3.8279

(13) 3

(14) 30

(15) 3

(16) 2

(17) 1

(18) 1

(19) 3

(20) 4

(21) 4

(22) 1

(23) 3

(24) 3

(25) 1

(26) 4

(27) 2

(28) 3

(29) 1

(30) 2

[OVER]

Part II

Please refer to the Department's pamphlet *Suggestions on the Rating of Regents Examination Papers 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* 0.7, 2.8 [8]
b I and II [2]

(32) *c* —2 [1]

(34) 178 [10]

(35) *a* 1,900 [10]
OR
b Analysis [4]
65.7 [6]

(36) *b* 3 [2]

*(37) $x = 1$, $y = \frac{1}{2}$, $z = -3$ [8]

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