

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

# ELEVENTH YEAR MATHEMATICS

Wednesday, June 18, 1980 — 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.

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**

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed.

Directions (1–20): Write in the space provided on the separate answer sheet the numeral preceding the expression that best completes each statement or answers each question.

1 The sum of  $\sqrt{-2}$  and  $\sqrt{-18}$  is

- (1)  $6i$  (3)  $5i\sqrt{2}$   
 (2)  $2i\sqrt{5}$  (4)  $4i\sqrt{2}$

2 What is the solution set of the equation

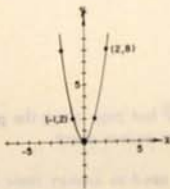
- $\frac{1}{15} + \frac{1}{10} = \frac{1}{x}$ ?  
 (1)  $\{12, 5\}$  (3)  $\{3\}$   
 (2)  $\{25\}$  (4)  $\{6\}$

3 If  $x = \frac{a\sqrt{b}}{c}$ , then  $\log x$  is equal to

- (1)  $\log a + \frac{1}{2} \log b - \log c$   
 (2)  $\log a + 2 \log b - \log c$   
 (3)  $\log a - \frac{1}{2} \log b + \log c$   
 (4)  $\log a - 2 \log b - \log c$

4 Which is an equation of the quadratic function shown in the accompanying graph?

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



5 If the product of two consecutive integers is 0, one of the integers may be

- (1) 1 (3) 3  
 (2) 2 (4) 4

6 The function  $\sin \frac{9\pi}{4}$  has the same value as

- (1)  $\sin 90^\circ$  (3)  $\sin 45^\circ$   
 (2)  $\sin 60^\circ$  (4)  $\sin 30^\circ$

7 What is the amplitude of the graph of

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

8 What is the numerical value of  $3^{-1} + 4^{-1}$ ?

- (1)  $\frac{1}{7}$  (3)  $\frac{1}{12}$   
 (2)  $7^{-1}$  (4)  $\frac{7}{12}$

9 The solution set of  $2^{3x+2x} = 2^{-1}$  is

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

10 Which value of  $B$  is in the solution set of the equation  $\sin 2B = 0$ ?

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

11 Which represents the solution set for  $x$  in the inequality  $|2x - 1| < 7$ ?

- (1)  $\{x|x < -3 \text{ or } x > 4\}$  (3)  $\{x|-3 < x < 4\}$   
 (2)  $\{x|x < -4 \text{ or } x > 3\}$  (4)  $\{x|-4 < x < 3\}$

12 If  $\sin(A - 30^\circ) = \cos 60^\circ$ , the number of degrees the measure of angle  $A$  is

- (1) 30 (3) 90  
 (2) 60 (4) 120

13 The expression  $(\cot \theta)/(\sec \theta)$  is equivalent to

- (1)  $\csc \theta$  (3)  $\cos \theta$   
 (2)  $\sin \theta$  (4)  $\tan \theta$

14 Given the equation:  $x^2 + bx + x + b = 0$

One value of  $x$  which satisfies the equation is  $x = -b$ . Which is another value of  $x$  that satisfies the equation?

- (1) 1 (3) -1  
 (2) 2 (4) -2

15 If  $b$  is a positive real number, then  $\frac{b}{\sqrt{b}}$  is equivalent to

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

16 If  $\sin \theta = \frac{1 - \sqrt{17}}{4}$ , then angle  $\theta$  lies in which quadrants?

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

17 If  $x$  varies directly with  $y$ , then when  $x$  is

- (1) multiplied by 2,  $y$  is multiplied by 2  
(2) multiplied by 2,  $y$  is divided by 2  
(3) increased by 2,  $y$  is increased by 2  
(4) increased by 2,  $y$  is decreased by 2

18 Which value of  $k$  will make the roots of the equation  $x^2 - 2kx + 16 = 0$  real, rational, and equal?

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

19 What is the domain of the function  $f(x) = \sqrt{x-2}$ ?

- (1)  $\{x|x \geq 0\}$                         (3)  $\{x|x \geq 2\}$   
(2)  $\{x|x \geq 2\}$                         (4)  $\{x|x \geq -2\}$

20 In triangle  $ABC$ ,  $a = 2$ ,  $b = 3$ , and  $c = 4$ . What is the value of  $\cos C$ ?

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

Directions (21-30): Write your answers in the spaces provided on the separate answer sheet. Unless otherwise specified, answers may be left in terms of  $\pi$  or in radical form.

21 If  $f(x) = x^{\frac{3}{2}}$ , find  $f(-27)$ .

22 Factor completely:  $6t^2 - 7t - 3$ .

23 What is the additive inverse of  $2 - 3i$ ?

24 In triangle  $ABC$ ,  $\sin A = 0.8$ ,  $\sin B = 0.3$ , and  $a = 24$ . Find the length of side  $b$ .

25 Express  $72^\circ$  in radian measure. [Answer may be left in terms of  $\pi$ .]

26 Solve the following system of equations for  $x$  in terms of  $a$  and  $b$ , where  $a \neq 0$  and  $b \neq 0$ .

$$\begin{aligned}ax + y &= b \\ 2ax + y &= 2b\end{aligned}$$

27 If  $\sin x = -\frac{3}{5}$ , what is the value of  $\cos 2x$ ?

28 If  $\theta = \text{Arc cos}\left(\frac{\sqrt{3}}{2}\right)$ , what is the measure of angle  $\theta$ ?

29 What is the slope of a line that is perpendicular to the line which passes through the points  $(0,0)$  and  $(3,3)$ ?

30 Find the value of  $\cos 55^\circ 23'$ .

**STOP GO RIGHT ON TO THE NEXT PAGE.**

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

$$3x = 2 + \frac{2}{x} \quad [8]$$

- b If  $x = \sin \theta$ , use the answers obtained in part a to determine the quadrant(s) in which angle  $\theta$  may lie. [2]

- 32 a Starting with the formulas for  $\sin(A - B)$  and for  $\cos(A - B)$ , derive the formula for  $\tan(A - B)$  in terms of  $\tan A$  and  $\tan B$ . [5]

- b For all values of  $B$  for which the expressions are defined, prove the following is an identity:

$$\tan(45^\circ - B) = \frac{\cos B - \sin B}{\cos B + \sin B} \quad [5]$$

- 33 A shopkeeper bought a shipment of identical dresses for a total of \$800. She sold all but 4 of the dresses for \$10 more than each dress cost her, and had total receipts of \$980. How many dresses were in the original shipment? [Only an algebraic solution will be accepted.] [5,5]

- 34 a The volume of a cylinder is found by the formula  $V = \pi r^2 h$ . If the volume ( $V$ ) equals 142 and the radius ( $r$ ) equals 5.2, use logarithms to find  $h$  to the nearest tenth. [Use  $\pi = 3.14$ .] [8]

- b The graph of  $y = \log_5 x$  lies in quadrants

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

- 35 a Two consecutive sides of a parallelogram are 1 centimeters and 10 centimeters long, respectively. If the length of the longer diagonal of the parallelogram is 14 centimeters, find the measure of the largest angle of the parallelogram to the nearest degree. [7]

- b Using your answer to part a, find the area of the parallelogram to the nearest square centimeter. [3]

- 36 a On the same set of axes, sketch the graphs of  $y = 2 \sin x$  and  $y = \cos \frac{1}{2}x$  as  $x$  varies from 0 to  $2\pi$  radians. [8]

- b State the number of values of  $x$  in the interval  $0 \leq x \leq 2\pi$  that satisfy the equation  $2 \sin x = \cos \frac{1}{2}x$ . [2]

- \*37 a On a graph, indicate the solution set of  $\{(x,y) | xy \geq 12 \text{ and } x - 2y < 2\}$ . [8]

- b From your graph in part a, give the coordinates of a point which does not satisfy either inequality. [2]

- \* This question is based on an optional topic in the syllabus.

# FOR TEACHERS ONLY

## SCORING KEY

# 11

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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 1-20, allow credit if the pupil has written the correct answer instead of the numeral 1, 2, 3, or 4.

- |        |        |                            |
|--------|--------|----------------------------|
| (1) 4  | (11) 3 | (21) 9                     |
| (2) 4  | (12) 2 | (22) $(3t + 1)(2t - 3)$    |
| (3) 1  | (13) 1 | (23) $-2 + 3i$             |
| (4) 3  | (14) 3 | (24) 9                     |
| (5) 1  | (15) 4 | (25) $\frac{2\pi}{5}$      |
| (6) 3  | (16) 3 | (26) $\frac{b}{a}$         |
| (7) 2  | (17) 1 | (27) $\frac{1}{23}$        |
| (8) 4  | (18) 4 | (28) 30 or $\frac{\pi}{6}$ |
| (9) 2  | (19) 2 | (29) -1                    |
| (10) 2 | (20) 3 | (30) 0.5681                |

## 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.

$$(31) \begin{array}{l} a \ 1.2, -0.5 \quad [8] \\ b \text{ III and IV} \quad [2] \end{array}$$

$$(35) \begin{array}{l} a \ 102 \quad [7] \\ b \ 78 \quad [3] \end{array}$$

$$(33) \ 32 \quad [5,5]$$

$$(36) \ b \ 3 \quad [2]$$

$$(34) \begin{array}{l} a \ 1.7 \quad [8] \\ b \ 4 \quad [2] \end{array}$$