MATHEMATICS LEVEL IIC
Time—60 minutes

For each of the following problems, decide which is the BEST of the choices given. If the exact numerical value is not one of the choices, select the choice that best approximates this value. Then fill in the corresponding oval on the answer sheet.

Notes: (1) A calculator will be necessary for answering some (but not all) of the questions in this test. For each question you will have to decide whether or not you should use a calculator. The calculator you use must be at least a scientific calculator; programmable calculators and calculators that can display graphs are permitted.

(2) For some questions in this test you may have to decide whether your calculator should be in the radian mode or the degree mode.

(3) Figures that accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated.

(4) Unless otherwise specified, the domain of any function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number.

(5) Reference information that may be useful in answering the questions in this test can be found on the page preceding question 1.*

USE THIS SPACE FOR SCRATCHWORK.

1. If $\sqrt[5]{4 - 3x} = 3$, what is the value of x?

(A) -82.33
(B) -79.67
(C) -1.75
(D) 0.92
(E) 82.33

2. If $f(a, b) = \dfrac{a + b}{2}$, which of the following is equal to $f(4, 8)$?

(A) $f(0, 6)$
(B) $f(1, 6)$
(C) $f(2, 4)$
(D) $f(2, 16)$
(E) $f(3, 9)$

*In the actual test, the reference information is located on the page preceding question 1. In this book, the reference information can be found on page 135.

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MATHEMATICS LEVEL IIC TEST—*Continued*

USE THIS SPACE FOR SCRATCHWORK.

3. $\frac{6!}{3!5!} =$

   (A) 60   (B) 24   (C) 6   (D) 1   (E) $\frac{1}{60}$

4. The graph of which of the following equations has a slope of $\frac{1}{2}$?

   (A) $y = \frac{1}{2}$

   (B) $y = 2x$

   (C) $y = 2x + 1$

   (D) $y = x + \frac{1}{2}$

   (E) $y = \frac{x}{2} + 1$

5. If $f(x) = x + \sqrt{x}$ and $g(x) = f(f(x))$, then $g(1.7) =$

   (A) 1.7
   (B) 3.0
   (C) 4.7
   (D) 6.9
   (E) 9.0

GO ON TO THE NEXT PAGE

USE THIS SPACE FOR SCRATCHWORK.

6. For all $m \neq 0, \dfrac{1 - \frac{1}{m}}{\frac{1}{m}} =$

(A) 1

(B) $m - 1$

(C) $\dfrac{m - 1}{m}$

(D) $\dfrac{1 - m}{m}$

(E) $m - \dfrac{1}{m}$

7. The graph of $y = bx - 1$ has points in the first quadrant if and only if

(A) $b \neq 0$
(B) $b < -1$
(C) $-1 < b < 1$
(D) $0 < b < 1$
(E) $b > 0$

8. If $\tan x = 5$, then $\dfrac{\tan x}{\cot x} =$

(A) $\dfrac{1}{5}$ (B) 1   (C) 5   (D) 10   (E) 25

GO ON TO THE NEXT PAGE

MATHEMATICS LEVEL IIC TEST—*Continued*

9. If $\dfrac{a + bc}{we + f} = g$ and if $efg \neq 0$, which of the following is equal to w?

(A) $\dfrac{a + bc - fg}{eg}$

(B) $\dfrac{a + bc - g}{e}$

(C) $\dfrac{a - bc + fg}{eg}$

(D) $\dfrac{a + bc - f}{eg}$

(E) $\dfrac{a + bc - eg}{fg}$

10. If the probability of a certain event occurring is $\dfrac{4}{9}$, what is the probability of this event <u>not</u> occurring?

(A) $\dfrac{4}{13}$ (B) $\dfrac{4}{9}$ (C) $\dfrac{5}{9}$ (D) $\dfrac{9}{13}$ (E) $\dfrac{9}{4}$

11. If $x^4 - 19 = 19$ and $x \geq 0$, then $x =$

(A) 0
(B) 2.08
(C) 2.48
(D) 4.36
(E) 6.16

MATHEMATICS LEVEL IIC TEST—*Continued*

USE THIS SPACE FOR SCRATCHWORK.

12. In Figure 1, if $\theta = 38°$, what is the value of t ?

   (A) 0.15
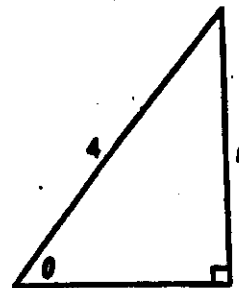   (B) 0.20
   (C) 2.46
   (D) 3.13
   (E) 3.15

Figure 1

Note: Figure not drawn to scale.

13. Joe has a test average of 87 in mathematics. If his test average makes up 70 percent of his overall grade and the final exam makes up the remaining 30 percent, what must be his final exam score to give him an overall grade of exactly 90 ?

   (A) 91
   (B) 93
   (C) 95
   (D) 97
   (E) 99

14. An operation is defined on pairs of integers by $(a, b) \triangledown (c, e) = (a - c, b - e)$. If $[(1, 2) \triangledown (-3, 6)] \triangledown (x, y) = (1, 1)$, then $(x, y) =$

   (A) $(5, -5)$
   (B) $(3, -7)$
   (C) $(3, -5)$
   (D) $(3, 5)$
   (E) $(-3, 5)$

GO ON TO THE NEXT PAGE

MATHEMATICS LEVEL IIC TEST—*Continued*

USE THIS SPACE FOR SCRATCHWORK.

15. If $\cos t = \frac{5}{6}$, what is the value of $\cos 2t$?

   (A)   0.92
   (B)   0.39
   (C)   0.28
   (D)   0.15
   (E) −0.83

16. Which of the following is a zero of $f(x) = 2x^2 - 3x - 1$?

   (A) −1.00
   (B)   0.28
   (C)   0.50
   (D)   1.78
   (E)   3.56

17. What is the number of digits in the number obtained by multiplying 12,121,212 by 3,579 ?

   (A) 4
   (B) 9
   (C) 10
   (D) 11
   (E) 12

GO ON TO THE NEXT PAGE →

USE THIS SPACE FOR SCRATCHWORK

18. If $\log_x 3 = 9$, then $x =$

(A) 0.50
(B) 1.13
(C) 1.22
(D) 2.00
(E) 2.08

19. Which of the following is a point at which the ellipse

$\frac{x^2}{5} + \frac{y^2}{15} = 1$ intersects the x-axis ?

(A) (2.2, 0)
(B) (3.9, 0)
(C) (4.5, 0)
(D) (5.0, 0)
(E) (15.0, 0)

20. The function f is given by $f(x) = x - [x]$, where $[x]$ is defined to be the greatest integer that is less than or equal to x. If $1 \leq x < 2$, then f is also given by $f(x) =$

(A) $x - 2$ (B) $x - 1$ (C) x (D) $x + 1$ (E) $x + 2$

MATHEMATICS LEVEL IIC TEST—*Continued*

USE THIS SPACE FOR SCRATCHWORK.

21. In Figure 2, $r \sin \theta =$

  (A) x

  (B) y

  (C) $\frac{x}{y}$

  (D) $\frac{y}{x}$

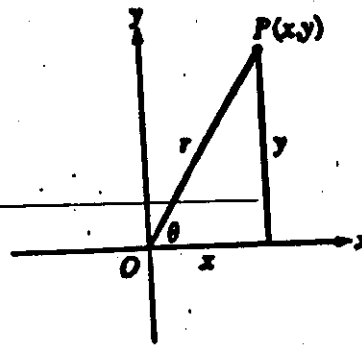 (E) $x + y$

Figure 2

22. What is the remainder when $2x^4 - 3x^2 - x + 3$ is divided by $x + 1$?

  (A) -3
  (B) -1
  (C) 1
  (D) 2
  (E) 3

23. In Figure 3, what is the length of segment AC?
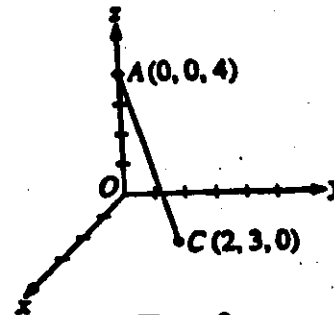
  (A) 4.47
  (B) 5.00
  (C) 5.39
  (D) 6.23
  (E) 9.00

Figure 3

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MATHEMATICS LEVEL IIC TEST—*Continued*

24. What is a value of cos(arcsin 0.90) ?

   (A) 0.44
   (B) 0.58
   (C) 0.67
   (D) 0.71
   (E) 0.90

25. What is the area of a triangle whose vertices are $(\sqrt{2}, 0)$, $(2, \sqrt{10})$, and $(5, 0)$?

   (A) 3.59
   (B) 5.67
   (C) 7.91
   (D) 11.18
   (E) 11.34

26. If $x = \sqrt{t} - 1$ and $y = t^2$, what is y in terms of x ?

   (A) $(x + 1)^4$
   (B) $(x - 1)^4$
   (C) $(x + 1)^2$
   (D) $(x - 1)^2$
   (E) $x^2 + 1$

MATHEMATICS LEVEL IIC TEST—*Continued*

27. What is the maximum value of $f(x) = 4 - (x - 1)^2$?

    (A) 1
    (B) 3
    (C) 4
    (D) 5
    (E) 16

28. If a certain product now worth $450 increases in value at the rate of 8 percent per year, how much will it be worth 6 years from now?

    (A) $630
    (B) $661
    (C) $666
    (D) $714
    (E) $771

29. The 1st term of an arithmetic sequence is 3 and the 5th term is 17. What is the 150th term of the sequence?

    (A) 420.2
    (B) 521.5
    (C) 524.5
    (D) 528.0
    (E) 698.3

USE THIS SPACE FOR SCRATCHWORK.

30. The cosine of an angle is one-half the sine of the same angle. What is the tangent of this angle?

(A) 0

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

(C) 1

(D) 2

(E) It cannot be determined from the information given.

31. The graph in Figure 4 could be a portion of the graph of which of the following functions?

    I. $f(x) = x^3 + ax^2 + bx + c$

    II. $g(x) = x^5 + ax^3 + bx + c$

    III. $h(x) = x^7 + ax^6 + bx^5 + cx^4 + dx^3 + ex^2 + fx + g$

(A) I only
(B) II only
(C) III only
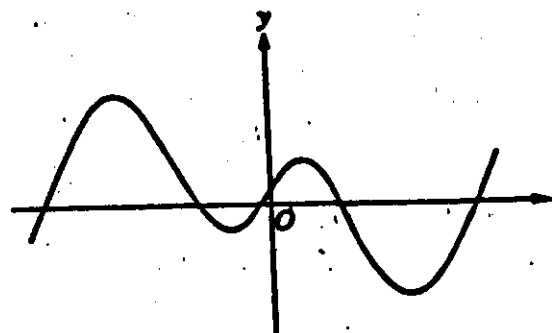(D) II and III only
(E) I, II, and III

Figure 4

32. A right circular cylinder has radius 3 and height 3. If A and B are two points on its surface, what is the maximum straight-line distance between A and B?

(A) $3\sqrt{6}$ (B) $3\sqrt{5}$ (C) 6   (D) $3\sqrt{3}$ (E) $3\sqrt{2}$

USE THIS SPACE FOR SCRATCHWORK.

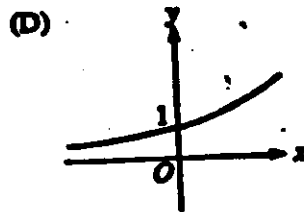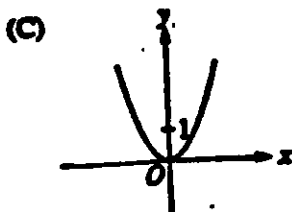33. What is the degree measure of the smallest positive angle θ for which $6 \sin^2\theta - \sin\theta - 2 = 0$?

    (A) 9.6°
    (B) 19.5°
    (C) 30°
    (D) 41.8°
    (E) 90°

34. The graph of $x^2 - y^2 - 2x - 4y - 4 = 0$ is a hyperbola centered at

    (A) $(-1, -2)$
    (B) $(-1, 2)$
    (C) $(1, -2)$
    (D) $(1, 2)$
    (E) $(2, 1)$

35. Which of the following could be a portion of the graph of $f(x) = \dfrac{e^x + e^{-x}}{2}$?
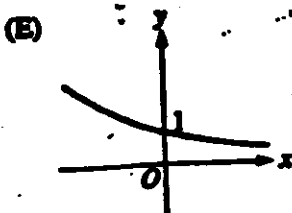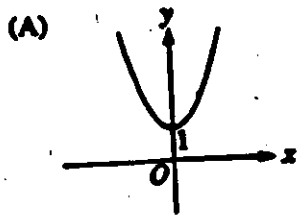
    (A)

    (B)

    (C)

    (D)

    (E)

17

MATHEMATICS LEVEL IIC TEST—*Continued*
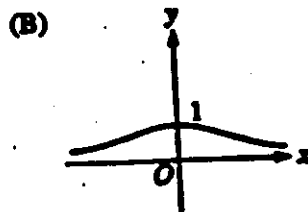
USE THIS SPACE FOR SCRATCHWORK.

36. If $\frac{p}{r}$ is an integer, which of the following must also be an integer?

(A) $p - r$ (B) $p + 2r$ (C) $\frac{r}{p}$ (D) pr (E) $\frac{2p}{r}$

37. A function f has the property that whenever $x_2 > x_1$, then $f(x_2) \geq f(x_1)$. Which of the following could be the graph of f?
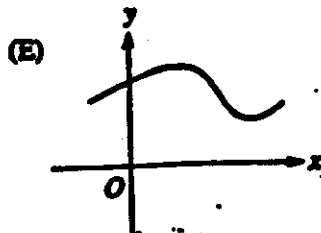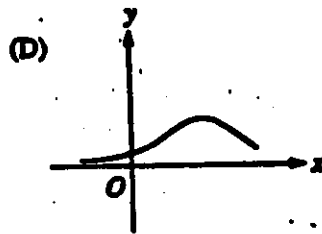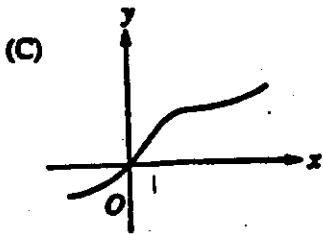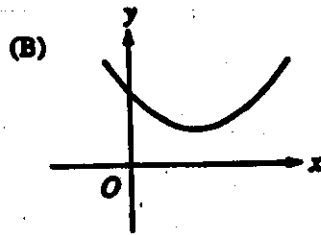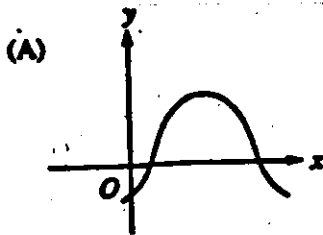
(A)

(B)

(C)

(D)

(E)

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MATHEMATICS LEVEL IIC TEST—*Continued*

USE THIS SPACE FOR SCRATCHWORK.

38. The two circles $x^2 + y^2 = 1$ and
$(x - \sqrt{2})^2 + (y - \sqrt{2})^2 = 1$ are tangent to each other.
What are the coordinates of the point of tangency?

(A) $(0, 0.71)$
(B) $(0.5, 0.5)$
(C) $(0.71, 0)$
(D) $(0.71, 0.71)$
(E) $(1.41, 1.41)$

39. What is $\displaystyle\lim_{x \to -2} \frac{2x^2 + 3x - 2}{x^2 - 4}$?

(A) 1.25
(B) 1.0
(C) 0.5
(D) 0
(E) The limit does not exist.

40. A function f is an even function if, for all values of x in
the domain, $f(-x) = f(x)$. Which of the following is
an even function?

(A) $f(x) = 2^x$
(B) $f(x) = x^2 + x$
(C) $f(x) = x$
(D) $f(x) = \sin x$
(E) $f(x) = \cos x$

MATHEMATICS LEVEL IIC TEST—*Continued*

USE THIS SPACE FOR SCRATCHWORK.

41. Two cars start from the same point P and travel along separate straight highways. If these two highways originate at P, forming an angle of 80°, how many miles apart are the two cars after each has traveled 110 miles?

    (A) 86
    (B) 141
    (C) 156
    (D) 191
    (E) 220

42. The shaded portion in Figure 5 shows the graph of

    (A) $(y - \frac{1}{2}x)(y + x) \geq 0$

    (B) $(y - 2x)(y + x) \leq 0$

    (C) $(y - 2x)(y + x) \geq 0$

    (D) $(y + 2x)(y - x) \leq 0$

    (E) $(y + 2x)(y - x) \geq 0$
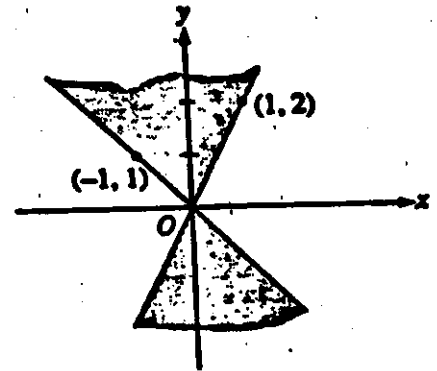
Figure 5

43. If $f(n) = \frac{1}{e^n}$, what is the least integer n such that
$f(n) < 0.0001$?

    (A) 9
    (B) 10
    (C) 11
    (D) 12
    (E) 13

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MATHEMATICS LEVEL IIC TEST—*Continued*

44. In right $\triangle ABC$ in Figure 6, $\dfrac{\sin A + \cos B}{\cos B}$ is equal to which of the following?

    (A) 2 (B) $\dfrac{a+c}{c}$ (C) $\dfrac{2a}{b}$ (D) $\dfrac{2b}{c}$ (E) $\dfrac{2a}{c}$
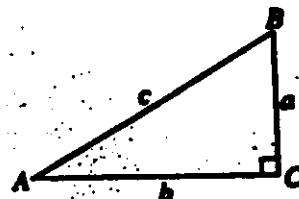
Figure 6

45. What is the volume, in cubic centimeters, of a rectangular solid that has faces with areas 2, 4, and 8 square centimeters?

    (A) 128 (B) 64 (C) 32 (D) 16 (E) 8

46. For every positive number t, a function f_t is defined by

$$f_t(x) = \begin{cases} 1, & x < 0 \\ 1 - \left(\dfrac{1}{t}\right)x, & 0 \le x \le t \\ 0, & x > t. \end{cases}$$

    If $t > 5$, then $f_t(2) =$

    (A) 0 (B) 1 (C) $\dfrac{5-t}{t}$ (D) $\dfrac{t+5}{t}$ (E) $\dfrac{t-2}{t}$

47. In Figure 7, $ABCDE$ is a regular pentagon with side of length 2. What is the x-coordinate of D?

    (A) 2.62
    (B) 3.62
    (C) 3.73
    (D) 3.90
    (E) 4.90
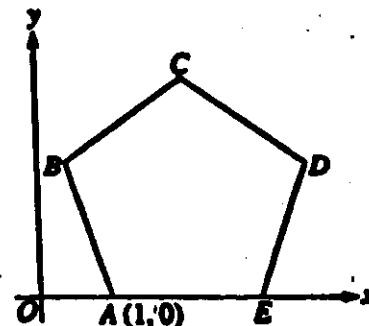
Figure 7

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MATHEMATICS LEVEL IIC TEST—*Continued*

USE THIS SPACE FOR SCRATCHWORK.

48. If f is the function with domain $[0, 12]$ and range $[0, 1]$ whose graph is the line segment shown in Figure 8, what is $f^{-1}(0.4)$?

    (A) 30
    (B) 4.8
    (C) 2.5
    (D) 0.25
    (E) 0.033
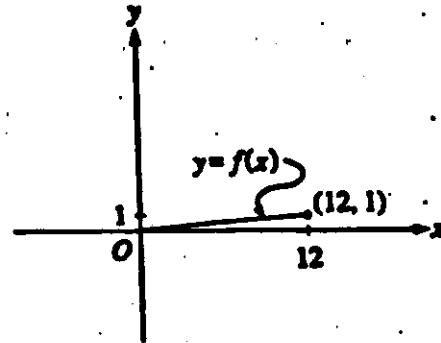
Figure 8

49. What does $|3 + 5i|$ equal ?

    . (A) 0.80
    (B) 1.67
    (C) 3.97
    (D) 5.83
    (E) .8.00

50. A committee of 3 mathematics majors and 4 history majors is to be chosen from a group of 20 mathematics majors and 16 history majors, respectively. How many different committees can be formed?

    (A)   12
    (B)   320
    (C)   2,960
    (D) 2,074,800
    (E) 2.86×10^{15}

S T O P

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS TEST ONLY
DO NOT TURN TO ANY OTHER TEST IN THIS BOOK.

TABLE B

Score Conversion Table
Mathematics Level IIC Subject Test, Form 3PBC

Raw Score	College Board Scaled Score	Raw Score	College Board Scaled Score
50	800	15	560
49	800	14	540
48	800	13	530
47	800	12	520
46	800	11	500
45	800	10	490
44	800	9	470
43	800	8	460
42	790	7	440
41	780	6	430
40	770	5	410
39	760	4	400
38	750	3	380
37	740	2	370
36	730	1	360
35	720	0	340
34	710	−1	330
33	700	−2	310
32	690	−3	300
31	690	−4	280
30	680	−5	270
29	670	−6	250
28	660	−7	240
27	650	−8	220
26	640	−9	210
25	630	−10	200
24	630	−11	200
23	620	−12	200
22	610		
21	600		
20	590		
19	590		
18	580		
17	570		
16	560		

Reviewing Your Test Performance

After you have scored your test, you should take some time to consider the following points in relation to your performance on the test.

● *Did you run out of time before you reached the end of the test?*

If you did, you may want to consider pacing yourself better. For example, you may have spent too much time working on one or two difficult questions. A better approach might have been to continue the test and return to those questions after you had attempted to answer the remaining questions on the test.

● *Did you take a long time reading the directions for the test?*

The directions in this test are the same as those in the Mathematics Level IIC Subject Tests now being administered. You will save time when you take the test if you become thoroughly familiar with them in advance.

● *How did you handle questions you were unsure of?*

If you were able to eliminate one or more of the answer choices and you guessed from the remaining choices, then your approach probably worked to your advantage. On the other hand, omitting questions about which you have some knowledge or guessing answers haphazardly would probably be a mistake.

● *How difficult were the questions for you compared with other students who took the test?*

By referring to Table A, you can find out how difficult each question was for the group of students who took this test. The right-hand column in the table tells you what percentage of this group answered the question correctly. A question that was answered correctly by almost everyone in the group is obviously an easy question. Question 3, for example, was answered correctly by 93 percent of the students in the sample. On the other hand, question 31 was answered correctly by only 40 percent.

It is important to remember that these percentages are based on only one particular group of students; had this edition of the test been given to other groups of students at the time, the percentages would probably have been different.

If you find that you missed several questions that would be considered easy, you may want to review those questions carefully. They may cover some aspects of the subject that you need to review. Perhaps you misunderstood the directions for one part of the test or you thought the questions were so easy that you did not spend as much time on them as you might have.

TABLE A

Answers to the SAT II: Mathematics Level IIC Subject Test, Form 3PBC, and Percentage of Students Answering Each Question Correctly

Question Number	Correct Answer	Right	Wrong	Percentage of Students Answering the Question Correctly*	Question Number	Correct Answer	Right	Wrong	Percentage of Students Answering the Question Correctly*
1	B			86	26	A			69
2	B			86	27	C			65
3	D			93	28	D			66
4	E			94	29	C			44
5	C			80	30	D			61
6	B			90	31	D			40
7	E			77	32	B			47
8	E			84	33	D			60
9	A			70	34	C			38
10	C			95	35	A			33
11	C			91	36	E			63
12	C			92	37	C			48
13	D			82	38	D			43
14	C			80	39	A			37
15	B			80	40	E			61
16	D			72	41	B			61
17	D			69	42	C			23
18	B			76	43	B			46
19	A			74	44	A			72
20	B			70	45	E			45
21	B			88	46	E			39
22	E			59	47	B			32
23	C			65	48	B			27
24	A			86	49	D			16
25	B			54	50	D			27

*These percentages are based on an analysis of the answer sheets for a random sample of 3,040 students who took this form of the test in June 1993 and whose mean score was 670. They may be used as an indication of the relative difficulty of a particular question. Each percentage may also be used to predict the likelihood that a typical SAT II: Mathematics Level IIC Subject Test candidates will answer correctly that question on this edition of this test.

Finding Your College Board Scaled Score

When you take SAT II: Subject Tests, the scores sent to the colleges you specify are reported on the College Board scale, which ranges from 200 to 800. You can convert your practice test score to a scaled score by using Table B. To find your scaled score, locate your raw score in the left-hand column of Table B; the corresponding score in the right-hand column is your College Board scaled score. For example, a raw score of 40 on this particular edition of the SAT II: Mathematics Level IIC Subject Test corresponds to a College Board scaled score of 770.

Raw scores are converted to scaled scores to ensure that a score earned on any one edition of a particular Subject Test is comparable to the same scaled score earned on any other edition of the same Subject Test. Because some questions of tests may be slightly easier or more difficult than others, College Board scaled scores are adjusted so they indicate the same level of performance regardless of the edition of the test taken and the ability of the group that takes it. Thus, for example, a score of 400 on one edition of a test taken at a particular administration indicates the same level of achievement as a score of 400 on a different edition of the test taken at a different administration.

When you take the SAT II: Subject Tests during a national administration, your scores are likely to differ somewhat from the scores you obtain on the tests in this book. People perform at different levels at different times for reasons unrelated to the tests themselves. The precision of any test also limited because it represents only a sample of all possible questions that could be asked.