



Chapter 3

Practice Test 1

MATHEMATICS LEVEL 2

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 scientific or graphing calculator will be necessary for answering some (but not all) of the questions on this test. For each question, you will have to decide whether or not you should use a calculator.

(2) The only angle measure used on this test is degree measure. Make sure that your calculator is in degree mode.

(3) Figures that accompany problems on 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. The range of f is assumed to be the set of all real numbers $f(x)$, where x is in the domain of f .

(5) Reference information that may be useful in answering the questions on this test can be found below.

THE FOLLOWING INFORMATION IS FOR YOUR REFERENCE IN ANSWERING SOME OF THE QUESTIONS ON THIS TEST.

Volume of a right circular cone with radius r and height h :

$$V = \frac{1}{3}\pi r^2 h$$

Lateral area of a right circular cone with circumference of

the base c and slant height ℓ : $S = \frac{1}{2}c\ell$

Volume of a sphere with radius r : $V = \frac{4}{3}\pi r^3$

Surface area of a sphere with radius r : $S = 4\pi r^2$

Volume of a pyramid with base area B and height h :

$$V = \frac{1}{3}Bh$$

USE THIS SPACE FOR SCRATCHWORK.

1. If $2y + 6 = \frac{c}{9}(y + 3)$ for all y , then $c =$
- (A) $\frac{1}{9}$
(B) 2
(C) 9
(D) 15
(E) 18

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MATHEMATICS LEVEL 2—Continued

2. The relationship between a temperature F in degrees Fahrenheit and a temperature C in degrees Celsius is defined by the equation $F = \frac{9}{5}C + 32$, and the relationship between a temperature in degrees Fahrenheit and a temperature R in degrees Rankine is defined by the equation $R = F + 460$. Which of the following expresses the relationship between temperatures in degree Rankine and degrees Celsius?

USE THIS SPACE FOR SCRATCHWORK.

- (A) $R = \frac{9}{5}C - 32 + 460$
- (B) $R = \frac{9}{5}C + 32 + 460$
- (C) $R = \frac{9}{5}C + 32 - 460$
- (D) $R = \frac{9}{5}C + 860$
- (E) $R = \frac{9}{5}C - 828$
3. What is the slope of a line containing the points (1, 13) and (-3, 6)?
- (A) 0.14
- (B) 0.57
- (C) 1.75
- (D) 1.83
- (E) 6
4. If $a + b + c = 12$, $a + b = 4$, and $a + c = 7$, what is the value of a ?
- (A) 2
- (B) 1
- (C) $\frac{3}{23}$
- (D) 2
- (E) $\frac{23}{3}$

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MATHEMATICS LEVEL 2—Continued

5. If $g(x) = 2e^x - 2$ and $h(x) = \ln(x)$, then $g(h(7)) =$

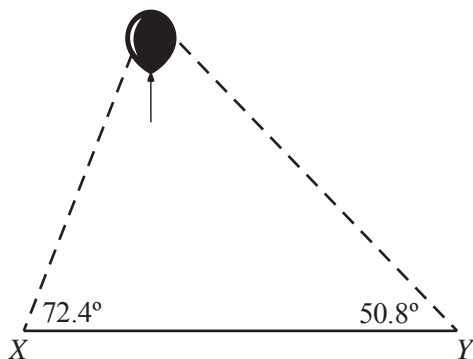
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- (A) 7.69
- (B) 12
- (C) 14
- (D) 26.43
- (E) 31.98

6. The intersection of a cylinder and a plane could be which of the following?

- I. A circle
- II. A triangle
- III. A rectangle

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



7. The figure above shows a helium balloon rising vertically. When the balloon reaches a height of 54 inches, the angles of elevation from points X and Y on the ground are 72.4° and 50.8° , respectively. What is the distance, in inches, between points X and Y?

- (A) 61.17
- (B) 72.29
- (C) 84.15
- (D) 124.72
- (E) 236.44

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MATHEMATICS LEVEL 2—Continued

USE THIS SPACE FOR SCRATCHWORK.

8. What is the value of y^2 if $y = \sqrt{34^2 - 30^2}$?

- (A) 256^2
- (B) 256
- (C) 16
- (D) 4
- (E) 2

9. The points in the xy -plane are transformed so that each point $A(x, y)$ is transformed to $A'(3x, 3y)$. If the distance between point A and the origin is c , then the distance between the point A' and the origin is

- (A) $\frac{1}{c}$
- (B) $\frac{c}{3}$
- (C) c
- (D) $c\sqrt{3}$
- (E) $3c$

10. If $p(q(x)) = \frac{3\sqrt{x^2 - 2 + 2}}{\sqrt{x^2 - 2 - 2}}$ and $p(x) = \frac{3x + 2}{x - 2}$,then $q(x) =$

- (A) $x^2 - 2$
- (B) x^2
- (C) x
- (D) $\sqrt{x^2 - 2}$
- (E) \sqrt{x}

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MATHEMATICS LEVEL 2—*Continued*

11. If x is the degree measure of an angle such that $0^\circ < x < 90^\circ$ and $\cos x = 0.6$, then $\sin(90^\circ - x) =$

(A) 0.4
(B) 0.5
(C) 0.6
(D) 0.7
(E) 0.8

USE THIS SPACE FOR SCRATCHWORK.

12. The set of points defined by the equation $x^2 + y^2 + z^2 = 4$ is

(A) a point
(B) a line
(C) a circle
(D) a plane
(E) a sphere

13. The graph of the function g , where

$$g(x) = \frac{7}{x^2 - 6x + 9}, \text{ has a vertical asymptote}$$

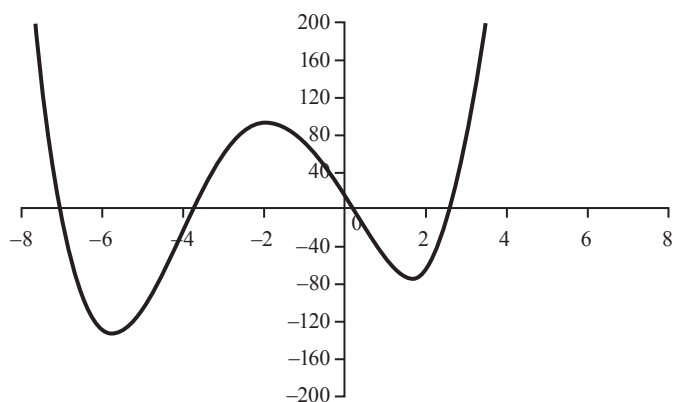
at $x =$

(A) 0 only
(B) 3 only
(C) 7 only
(D) 0 and 3 only
(E) 0, 3, and 7

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MATHEMATICS LEVEL 2—Continued

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14. The graph of $y = x^4 + 8x^3 - 4x^2 - 64x + k$ is shown above. Which of the following could be the value of k ?

(A) 1,240
(B) 520
(C) 14
(D) -14
(E) -1,240

15. If $\sin x = 0.6743$, then $\csc x =$

(A) 0.6481
(B) 0.8374
(C) 1.2953
(D) 1.4830
(E) 1.9637

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MATHEMATICS LEVEL 2—*Continued*

16. Sarah is planning a vacation at a hotel that costs \$80 per night. Sarah must also pay the \$170 airfare to get there and will also pay for an equally priced hotel room for a friend who will be visiting her on three of the nights. Which of the following correctly expresses the average cost, in dollars, for each night as a function of n , the number of nights of the vacation?

(A) $f(n) = \frac{80n + 410}{n - 3}$

(B) $f(n) = \frac{80n + 170}{n - 3}$

(C) $f(n) = \frac{80n + 410}{n + 3}$

(D) $f(n) = \frac{80n + 410}{n}$

(E) $f(n) = \frac{80n + 170}{n}$

17. Which of the following is an equation whose graph is a set of points equidistant from the points $(0, 0)$ and $(6, 0)$?
- (A) $x = 3$
(B) $y = 3$
(C) $x = 3y$
(D) $y = 3x$
(E) $y = 3x + 3$

USE THIS SPACE FOR SCRATCHWORK.

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MATHEMATICS LEVEL 2—Continued

18. What is the sum of the infinite geometric series

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$$\frac{1}{9} + \frac{1}{27} + \frac{1}{81} + \frac{1}{243} + \dots ?$$

- (A) $\frac{5}{36}$
(B) $\frac{1}{6}$
(C) $\frac{1}{3}$
(D) 1
(E) $\frac{4}{3}$
19. Which of the following is equivalent to $a - b \geq a + b$?
- (A) $a \leq b$
(B) $a \leq 0$
(C) $b \leq a$
(D) $b \leq 0$
(E) $b \geq 0$
20. If m and n are in the domain of a function g and $g(m) > g(n)$, which of the following must be true?
- (A) $mn \neq 0$
(B) $m > n$
(C) $m < n$
(D) $m = n$
(E) $m \neq n$

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MATHEMATICS LEVEL 2—*Continued*

21. In a certain office, the human resources department reports that 60% of the employees in the office commute over an hour on average each day, and that 25% of those employees who commute over an hour on average each day commute by train. If an employee at the office is selected at random, what is the probability that the employee commutes over an hour on average by train?

(A) 0.10
(B) 0.15
(C) 0.20
(D) 0.25
(E) 0.30

22. To the nearest degree, what is the measure of the second smallest angle in a right triangle with sides 5, 12, and 13 ?

(A) 23
(B) 45
(C) 47
(D) 60
(E) 67

23. Which of the following is an equation of a line perpendicular to $y = 3x - 5$?

(A) $y = 5x - 3$

(B) $y = 3x + 5$

(C) $y = \frac{1}{3}x + 5$

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

(E) $y = \frac{1}{-3x + 5}$

USE THIS SPACE FOR SCRATCHWORK.

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MATHEMATICS LEVEL 2—Continued

24. What is the range of the function $g(x) = -2 + 5\cos(3x + 7\pi)$?

(A) $-1 \leq g(x) \leq 1$
(B) $-5 \leq g(x) \leq -1$
(C) $-5 \leq g(x) \leq 5$
(D) $-7 \leq g(x) \leq 3$
(E) $-7 \leq g(x) \leq 5$

USE THIS SPACE FOR SCRATCHWORK.

25. Of the following list of numbers, which has the greatest standard deviation?

(A) 1, 2, 3
(B) 2, 2, 2
(C) 2, 4, 6
(D) 4, 7, 10
(E) 6, 8, 10

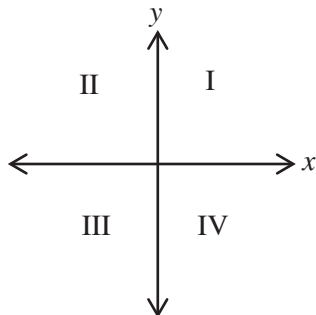
26. The formula $F = Ie^{0.06y}$ gives the final amount F that a bank account will contain if an initial investment I is compounded continuously at an annual interest of 6% for y years. Using this formula, after how many years will an initial investment of \$100 be worth approximately \$600?

(A) 5.2
(B) 6.0
(C) 13.0
(D) 22.4
(E) 29.7

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MATHEMATICS LEVEL 2—Continued

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27. If $\cos \theta < 0$ and $\frac{\sin \theta}{\cos \theta} > 0$, then θ must be in which quadrant in the figure above?
- (A) I
(B) II
(C) III
(D) IV
(E) There is no quadrant in which both conditions are true.
28. If $g(-x) = -g(x)$ for all real numbers x and if $(4, 9)$ is a point on the graph of g , which of the following points must also be on the graph of g ?
- (A) $(-9, -4)$
(B) $(-4, -9)$
(C) $(-4, 9)$
(D) $(4, -9)$
(E) $(9, 4)$

If a is a multiple of 10, then a is a multiple of 5.

29. If a is an integer, which of the following CANNOT be inferred from the statement above?
- (A) If a is a multiple of 5, then a is a multiple of 10.
(B) If a is not a multiple of 5, then a is not a multiple of 10.
(C) a is a multiple of 10 implies that a is a multiple of 5.
(D) A necessary condition for a to be a multiple of 10 is that a is a multiple of 5.
(E) In order for a to be a multiple of 5, it is sufficient that a be a multiple of 10.

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MATHEMATICS LEVEL 2—Continued

30. In how many different orders can 8 different colors of flowers be arranged in a straight line?

(A) 8
(B) 64
(C) 40,320
(D) 80,640
(E) 16,777,216

USE THIS SPACE FOR SCRATCHWORK.

31. What value does $\frac{2x}{\ln(x+1)}$ approach as x approaches 0?

(A) 0
(B) 0.5
(C) 1
(D) 2
(E) It does not approach a unique value

32. If $f(x) = |7 - 5x|$, then $f(1) =$

(A) $f(1)$
(B) $f(0)$
(C) $f\left(\frac{3}{5}\right)$
(D) $f(2)$
(E) $f\left(\frac{9}{5}\right)$

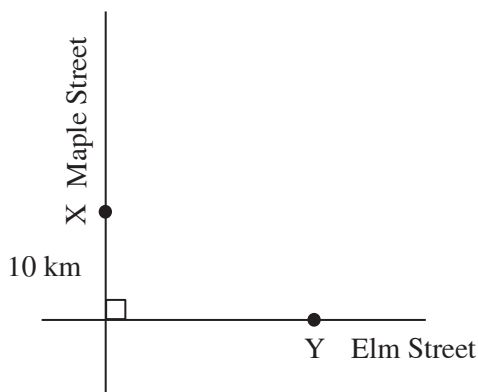
33. What is the period of the graph of $y = 3\tan(2\pi x + 9)$?

(A) $\frac{\pi}{2}$
(B) $\frac{1}{2}$
(C) 3
(D) $\frac{3}{2}$
(E) $\frac{3\pi}{2}$

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MATHEMATICS LEVEL 2—Continued

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34. The figure above shows a map of Maple Street and Elm Street. Katherine is biking from Point X to Point Y. The straight-line distance from Point X to Point Y is 40 kilometers. If Katherine bikes at an average speed of 15 km per hour along Maple Street and Elm Street, how long will it take Katherine to get to Point Y?
- (A) 40 minutes
 (B) 2 hours and 35 minutes
 (C) 2 hours and 40 minutes
 (D) 3 hours and 15 minutes
 (E) 3 hours and 35 minutes

x	$g(x)$
-2	0
-1	-3
0	2
1	0
2	0

35. If g is a polynomial of degree 4, five of whose values are shown in the table above, then $g(x)$ could equal

- (A) $g(x) = \left(x + \frac{1}{2}\right)(x + 1)(x + 2)^2$
 (B) $g(x) = (x - 2)(x - 1)(x + 2)(x + 3)$
 (C) $g(x) = (x - 2)\left(x + \frac{1}{2}\right)(x + 1)(x + 2)$
 (D) $g(x) = (x - 3)(x - 2)(x - 1)(x + 2)$
 (E) $g(x) = (x - 2)(x - 1)\left(x + \frac{1}{2}\right)(x + 2)$

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MATHEMATICS LEVEL 2—Continued

36. The only prime factors of an integer m are 2, 3, 5, and 13. Which of the following could NOT be a factor of m ?

(A) 6
(B) 9
(C) 12
(D) 26
(E) 35

USE THIS SPACE FOR SCRATCHWORK.

37. If $0 \leq x \leq \frac{\pi}{2}$ and $\cos x = 4\sin x$, what is the value of x ?

(A) 0.245
(B) 0.250
(C) 0.328
(D) 1.217
(E) 1.326

38. If $g(x) = 3\sqrt{5x}$, what is the value of $g^{-1}(15)$?

(A) 0.04
(B) 1.73
(C) 3.17
(D) 5.00
(E) 25.98

39. The Triangular Number Sequence T_n can be defined recursively as

$$\begin{aligned}T_1 &= 1 \\T_n &= T_{n-1} + n \text{ for } n > 1\end{aligned}$$

What is the 11th term of the sequence?

(A) 45
(B) 55
(C) 66
(D) 78
(E) 91

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MATHEMATICS LEVEL 2—*Continued*

40. If $f(x) = x^3 + x^2 - 16x + 12$, which of the following statements are true?

USE THIS SPACE FOR SCRATCHWORK.

- I. The equation $f(x) = 0$ has three real solutions
- II. $f(x) \geq -8$ for all $x \geq 0$
- III. The function is increasing for $x > 2$

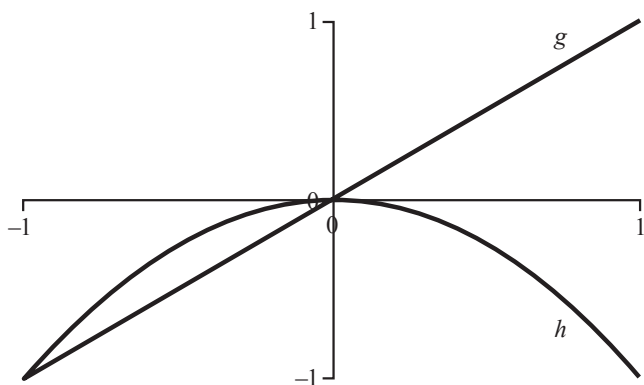
- (A) I only
- (B) III only
- (C) I and III only
- (D) II and III only
- (E) I, II, and III only



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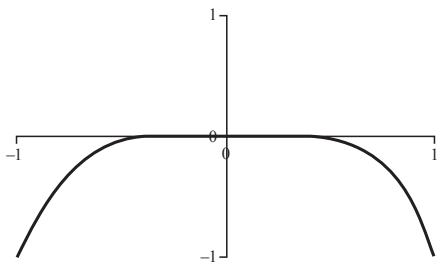
MATHEMATICS LEVEL 2—Continued

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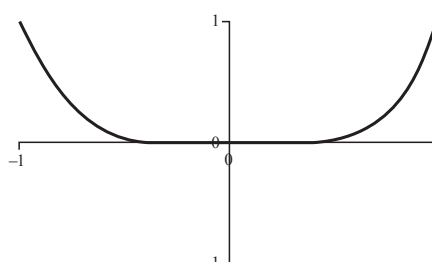


41. Portions of the graphs of g and h are shown above. Which of the following could be a portion of the graph of gh ?

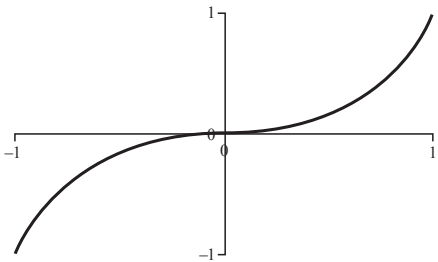
(A)



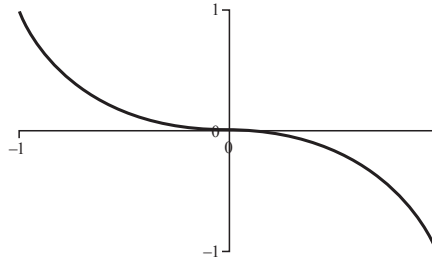
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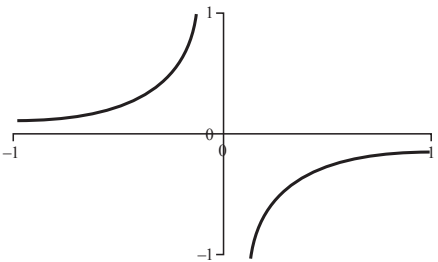
(C)



(D)



(E)

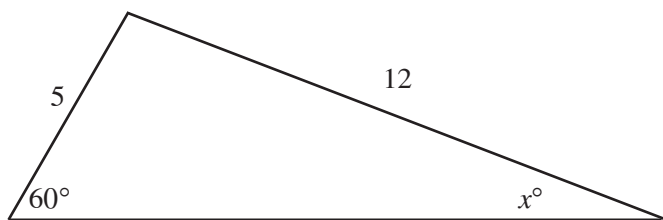


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MATHEMATICS LEVEL 2—Continued

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42. The set of all real numbers y such that $y = \sqrt{y^2}$ is
- (A) all real numbers
 - (B) no real numbers
 - (C) negative real numbers only
 - (D) nonnegative real numbers only
 - (E) zero only



43. In the triangle shown above, $\sin x =$
- (A) $\frac{5}{13}$
 - (B) $\frac{5}{12}$
 - (C) $\frac{5\sqrt{3}}{12}$
 - (D) $\frac{5\sqrt{3}}{24}$
 - (E) $\frac{12}{13}$
44. The length, width, and height of a rectangular solid are 6, 3, and 2. What is the length of the longest segment that can be drawn between two vertices of the solid?
- (A) 6
 - (B) $3\sqrt{5}$
 - (C) 7
 - (D) 12
 - (E) 18

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MATHEMATICS LEVEL 2—Continued

45. If $\log_n 2 = a$ and $\log_n 5 = b$, then $\log_n 50 =$

- (A) $a + b$
- (B) $a + b^2$
- (C) ab^2
- (D) $a + 2b$
- (E) $a + 5b$

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46. If $\cos x = a$, then, for all x , in the interval

$$0 < x < \frac{\pi}{2}, \tan x =$$

- (A) $a^2 + 1$
- (B) $\frac{1}{1 - a^2}$
- (C) $\frac{a}{1 - a^2}$
- (D) $\frac{1}{\sqrt{1 - a^2}}$
- (E) $\frac{\sqrt{1 - a^2}}{a}$

47. Which of the following shifts in the graph of $y = x^2$ would result in the graph of $y = x^2 + 4x + c$, where c is a constant greater than 5?

- (A) Left 2 units and up $c - 4$ units
- (B) Right 2 units and down $c - 4$ units
- (C) Right 2 units and down $c + 4$ units
- (D) Left 2 units and up $c + 4$ units
- (E) Right 4 units and up c units

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MATHEMATICS LEVEL 2—*Continued*

48. If the height of a right square pyramid is increased by 12%, by what percent must the side of the base be increased, so that the volume of the pyramid is increased by 28%?

- (A) 3%
- (B) 7%
- (C) 10%
- (D) 36%
- (E) 56%

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49. If Matrix X has dimensions $a \times b$ and Matrix Y has dimensions $b \times c$, where a , b , and c are distinct positive integers, which of the following must be true?

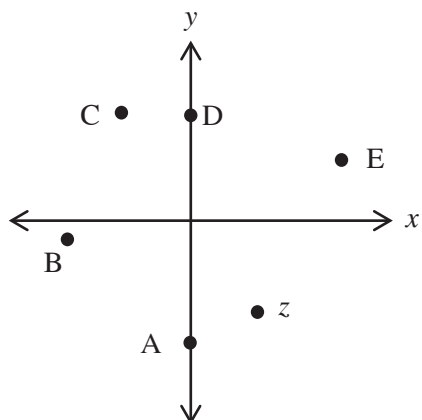
- I. The product XY exists and has dimensions $a \times c$.
- II. The product XY exists and has dimensions $b \times b$.
- III. The product YX does not exist.

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

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MATHEMATICS LEVEL 1—Continued

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50. If z is the complex number shown in the figure above, which of the following could be iz ?
- (A) A
 - (B) B
 - (C) C
 - (D) D
 - (E) E

STOP

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



Completely darken bubbles with a No. 2 pencil. If you make a mistake, be sure to erase mark completely. Erase all stray marks.

1. YOUR NAME: _____
(Print) Last First M.I.

SIGNATURE: _____ DATE: / /

HOME ADDRESS: _____
(Print) Number and Street

_____ City State Zip Code

PHONE NO.: _____
(Print)

5. YOUR NAME

First 4 letters of last name				FIRST INIT	MID INIT
(A)	(A)	(A)	(A)	(A)	(A)
(B)	(B)	(B)	(B)	(B)	(B)
(C)	(C)	(C)	(C)	(C)	(C)
(D)	(D)	(D)	(D)	(D)	(D)
(E)	(E)	(E)	(E)	(E)	(E)
(F)	(F)	(F)	(F)	(F)	(F)
(G)	(G)	(G)	(G)	(G)	(G)
(H)	(H)	(H)	(H)	(H)	(H)
(I)	(I)	(I)	(I)	(I)	(I)
(J)	(J)	(J)	(J)	(J)	(J)
(K)	(K)	(K)	(K)	(K)	(K)
(L)	(L)	(L)	(L)	(L)	(L)
(M)	(M)	(M)	(M)	(M)	(M)
(N)	(N)	(N)	(N)	(N)	(N)
(O)	(O)	(O)	(O)	(O)	(O)
(P)	(P)	(P)	(P)	(P)	(P)
(Q)	(Q)	(Q)	(Q)	(Q)	(Q)
(R)	(R)	(R)	(R)	(R)	(R)
(S)	(S)	(S)	(S)	(S)	(S)
(T)	(T)	(T)	(T)	(T)	(T)
(U)	(U)	(U)	(U)	(U)	(U)
(V)	(V)	(V)	(V)	(V)	(V)
(W)	(W)	(W)	(W)	(W)	(W)
(X)	(X)	(X)	(X)	(X)	(X)
(Y)	(Y)	(Y)	(Y)	(Y)	(Y)
(Z)	(Z)	(Z)	(Z)	(Z)	(Z)

IMPORTANT: Please fill in these boxes exactly as shown on the back cover of your test book.

2. TEST FORM

3. TEST CODE				4. REGISTRATION NUMBER								
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(1)	(B)	(K)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
(2)	(C)	(L)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
(3)	(D)	(M)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
(4)	(E)	(N)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
(5)	(F)	(O)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
(6)	(G)	(P)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)
(7)	(H)	(Q)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)
(8)	(I)	(R)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
(9)			(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)

6. DATE OF BIRTH

Month	Day		Year	
()	JAN			
()	FEB	(0)	(0)	(0)
()	MAR	(1)	(1)	(1)
()	APR	(2)	(2)	(2)
()	MAY	(3)	(3)	(3)
()	JUN		(4)	(4)
()	JUL		(5)	(5)
()	AUG		(6)	(6)
()	SEP		(7)	(7)
()	OCT		(8)	(8)
()	NOV		(9)	(9)
()	DEC			

7. SEX

() MALE

() FEMALE



Start with number 1 for each new section. If a section has fewer questions than answer spaces, leave the extra answer spaces blank.

1. (A) (B) (C) (D) (E)
2. (A) (B) (C) (D) (E)
3. (A) (B) (C) (D) (E)
4. (A) (B) (C) (D) (E)
5. (A) (B) (C) (D) (E)
6. (A) (B) (C) (D) (E)
7. (A) (B) (C) (D) (E)
8. (A) (B) (C) (D) (E)
9. (A) (B) (C) (D) (E)
10. (A) (B) (C) (D) (E)
11. (A) (B) (C) (D) (E)
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27. (A) (B) (C) (D) (E)
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31. (A) (B) (C) (D) (E)
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34. (A) (B) (C) (D) (E)
35. (A) (B) (C) (D) (E)
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37. (A) (B) (C) (D) (E)
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41. (A) (B) (C) (D) (E)
42. (A) (B) (C) (D) (E)
43. (A) (B) (C) (D) (E)
44. (A) (B) (C) (D) (E)
45. (A) (B) (C) (D) (E)
46. (A) (B) (C) (D) (E)
47. (A) (B) (C) (D) (E)
48. (A) (B) (C) (D) (E)
49. (A) (B) (C) (D) (E)
50. (A) (B) (C) (D) (E)