Practice Test 3

50 Questions (1 hour)

Directions: For each question, choose the BEST answer from the choices given. If the precise answer is not among the choices, choose the one that best approximates the answer. Then fill in the corresponding oval on the answer sheet.

Notes:

(1) To answer some of these questions, you will need a calculator. You must use at least a scientific calculator, but programmable and graphing calculators are also allowed.

(2) Make sure your calculator is in the correct mode (degree or radian) for the question being asked.

(3) Figures in this test are drawn as accurately as possible UNLESS it is stated in a specific question that the figure is not drawn to scale. All figures are assumed to lie in a plane unless otherwise specified.

(4) 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, unless otherwise indicated.

Reference Information: Use the following formulas as needed.

Right circular cone: If r = radius and h = height, then Volume = $\frac{1}{3}\pi r^2 h$; and if c = circumference of the base and ℓ = slant height, then Lateral Area = $\frac{1}{2}c\ell$.

Sphere: If r = radius, then Volume = $\frac{4}{3}\pi r^3$ and Surface Area = $4\pi r^2$.

Pyramid: If B = area of the base and h = height, then Volume = $\frac{1}{3}Bh$.

1. A certain type of account must be opened with an investment for a positive integer number of years. No other deposits or withdrawals are permitted, and the account earns 7 percent interest that is compounded annually. If \$400 were invested in the account for x years, what is the smallest possible value of x such that at the end of x years, the amount in the account will be at least 3 times the initial investment?

(A) 14
(B) 15
(C) 16
(D) 17
(E) 18

2. In Figure 1, point P is the endpoint of vector OP and point Q is the endpoint of vector OQ. When the vectors $\overline{OP}$ and $\overline{OQ}$ are added, what is the length of the resultant vector?

(A) 1.41
(B) 2.24
(C) 2.65
(D) 3.00
(E) 8.60

3. What is the area of a triangle whose vertices are $(0,6\sqrt{3})$, $(\sqrt{35},7)$, and $(0,3)$?

(A) 15.37
(B) 17.75
(C) 21.87
(D) 25.61
(E) 39.61

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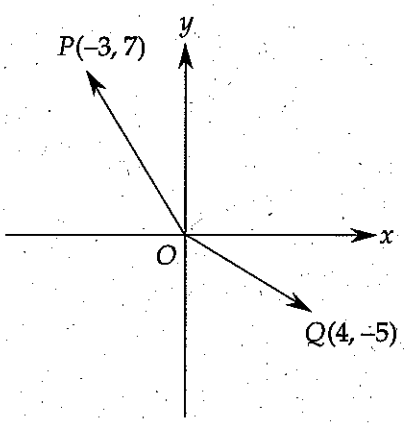

Figure 1

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4. The radius of right circular cone A is $\frac{1}{5}$ of the radius of right circular cone B, and the height of right circular cone A is $\frac{1}{4}$ of the height of right circular cone B. What is the ratio of the volume of right circular cone A to the volume of right circular cone B?

(A) $\frac{1}{16}$

(B) $\frac{1}{25}$

(C) $\frac{1}{64}$

(D) $\frac{1}{80}$

(E) $\frac{1}{100}$

5. The greatest possible distance between any two points on the surface of a right circular cylinder is $\sqrt{193}$ and the area of the circular base of the right circular cylinder is 36π. What is the volume of the right circular cylinder?

(A) 252π
(B) 294π
(C) 343π
(D) 386π
(E) $1{,}008\pi$

6. In Figure 2, the length of XY is 48. What is the length of YZ?

(A) 16.4
(B) 70.8
(C) 95.1
(D) 118.0
(E) 140.3

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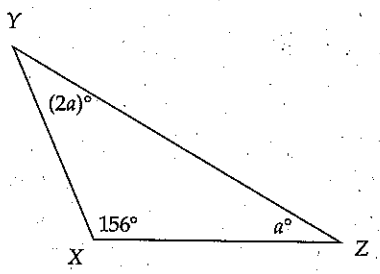

Figure 2
Note: Figure not drawn to scale

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7. In Figure 3, *STUV* is a parallelogram with a perimeter of 14. What is the *y*-coordinate of point *T*?

(A) 1.26
(B) 1.89
(C) 3.26
(D) 3.89
(E) 4.26

8. The mean of a finite set *S* of numbers is 14, the median of this set of numbers is 12, and the standard deviation is 1.8. A new set *T* is formed by multiplying each member of the set *S* by 3. Which of the following statements must be true of the set *T*?

I. The mean of the numbers in set *T* is 42.
II. The median of the numbers in set *T* is 36.
III. The standard deviation of the numbers in set *T* is 5.4.

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

DO YOUR FIGURING HERE.

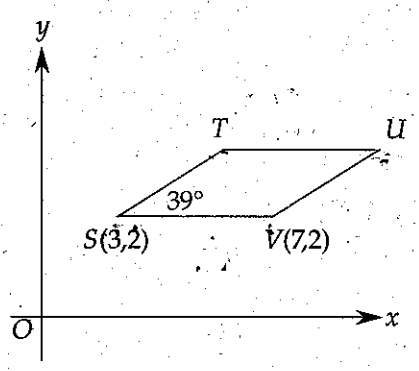

Figure 3

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9. There are 7 orange disks and 5 green disks in bag X and there are 5 orange disks and 15 green disks in bag Y. If one disk is selected at random from each bag, what is the probability that both disks selected are green?

(A) $\frac{5}{48}$

(B) $\frac{7}{48}$

(C) $\frac{5}{16}$

(D) $\frac{7}{16}$

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

10. The terms of a sequence are defined by $a_n = 3a_{n-1} - a_{n-2}$ for $n > 2$. What is the value of a_5 if $a_1 = 4$ and $a_2 = 3$?

(A) 12
(B) 23
(C) 25
(D) 31
(E) 36

11. If $\frac{4}{y} + 4 = \frac{20}{y} + 20$, then what is the value of $\frac{4}{y} + 4$?

(A) –1
(B) 0
(C) 1
(D) 4
(E) 8

DO YOUR FIGURING HERE.

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12. $\dfrac{1}{\dfrac{x}{y}+\dfrac{y}{x}}=$

(A) $\dfrac{xy}{x^2+y^2}$

(B) $\dfrac{x^2+y^2}{xy}$

(C) $\dfrac{x^2+y^2}{2xy}$

(D) $\dfrac{xy}{x+y}$

(E) $\dfrac{(x+y)^2}{x^2+y^2}$

13. One complete cycle of the graph of $y = -\cos x$ is shown in the Figure 4. What are the coordinates of the point at which the maximum possible value of y occurs?

(A) $\left(\dfrac{\pi}{2},0\right)$

(B) $\left(\dfrac{\pi}{2},\pi\right)$

(C) $(\pi,1)$

(D) $\left(\dfrac{3\pi}{2},-1\right)$

(E) $(2\pi,1)$

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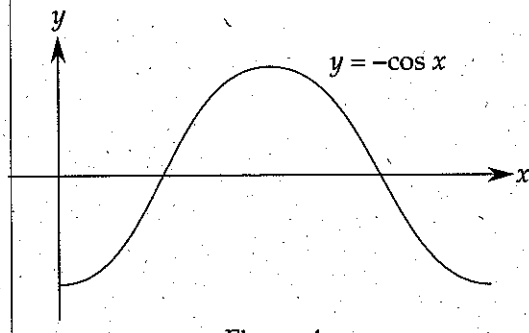

Figure 4

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14. Which of the following CANNOT occur when a line is in the same plane as a triangle?

(A) The points of the line inside the triangle and on the perimeter of the triangle divide the triangle into a triangle and a quadrilateral.
(B) The line has exactly three points in common with the perimeter of the triangle.
(C) The line has exactly one point in common with the perimeter of the triangle.
(D) The triangle and the line have infinitely many points in common.
(E) The points of the line inside the triangle and on the perimeter of the triangle divide the triangle into two isosceles triangles.

15. What is the value of x if $\sqrt{\frac{x}{7}} = 2.74$?

(A) 52.55
(B) 57.54
(C) 94.87
(D) 105.11
(E) 367.87

16. In Figure 5, which of the following is equal to $\csc\theta$?

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

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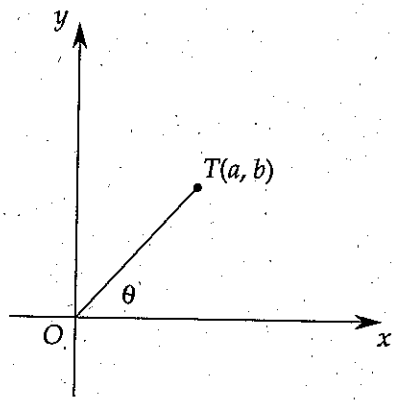

Figure 5

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17. If $f(x) = \sqrt{x^2 - 3x + 6}$ and $g(x) = \frac{156}{x+17}$, then what is the value of $g(f(4))$?

(A) 5.8
(B) 7.4
(C) 7.7
(D) 8.2
(E) 10.3

18. If $xyz \neq 0$ and $30x^{-5}y^{12}z^{-8} = 10x^{-6}y^{5}z^{4}$, then what is the value of x in terms of y and z?

(A) $\frac{z^{12}}{3y^7}$
(B) $\frac{3z^{12}}{y^7}$
(C) $\frac{3y^{12}}{z^7}$
(D) $\frac{3}{y^7z^4}$
(E) $\frac{3y^{17}}{z^4}$

19. In Figure 6, $PQRS$ is a square. What is the slope of segment QR?

(A) $-\frac{10}{3}$
(B) $-\frac{7}{3}$
(C) $-\frac{4}{3}$
(D) $\frac{3}{7}$
(E) $\frac{7}{3}$

DO YOUR FIGURING HERE.

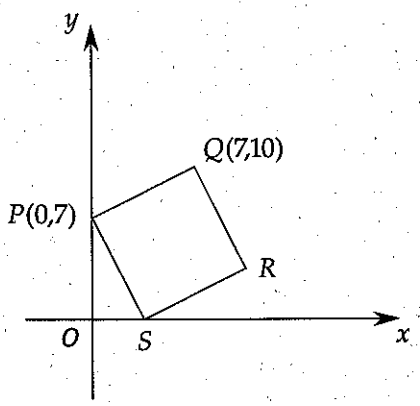

Figure 6

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20. When defined, $\tan(3x)\cot(3x) =$

(A) -1

(B) $\frac{\sqrt{3}}{3}$

(C) 1

(D) $\tan^3 3x$

(E) $\sec^2 3x - 1$

21. If 4 and 0 are both solutions to the equation $q(x) = 0$, where $q(x)$ is a polynomial, then it can be concluded that a factor of $q(x)$ is

(A) x^2

(B) $(x-4)^2$

(C) $x^2 + 4x$

(D) $x^2 - 8x$

(E) $x^2 - 4x$

22. Which of the following could be $g(x)$ if $f(x) = 5x^2 + 4$ and $f(g(3)) = 84$?

(A) $3x - 10$

(B) $4x - 7$

(C) $6x - 17$

(D) $x^2 - 5$

(E) $x^2 - 3$

23. Figure 7 shows line n in a rectangular coordinate system. An equation of line n is

(A) $x = 4$

(B) $y = 4$

(C) $x = 5$

(D) $y = \frac{5}{4}x$

(E) $y = x + 1$

DO YOUR FIGURING HERE.

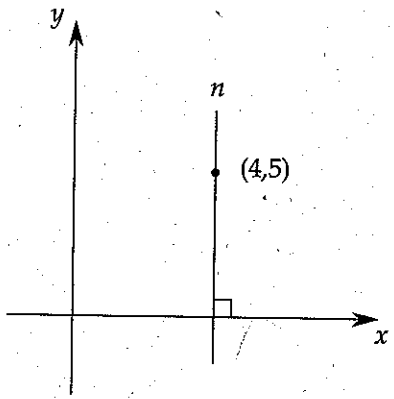

Figure 7

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24. A student's mean score on 5 tests was 84. The student's mean score on the first 4 of these tests was 87. What was the student's score on the fifth of these tests?

(A) 68
(B) 72
(C) 75
(D) 81
(E) 96

25. If $0 < x < \frac{\pi}{2}$ and $\cos x = 0.34$, what is the value of $\sin\left(\frac{x}{2}\right)$?

(A) 0.574
(B) 0.733
(C) 0.819
(D) 0.917
(E) 0.941

26. During a seven-day period, a company produced 49,812 items that it considered acceptable and 21,348 items that it considered unacceptable. If the company produced a total of 10,830 items on the first day and the percent of the items produced on the first day that the company considered acceptable was the same percent of items that the company considered acceptable for the entire seven-day period, how many items produced by the company on the first day did the company consider acceptable?

(A) 3,508
(B) 4,332
(C) 5,415
(D) 7,581
(E) 8,664

DO YOUR FIGURING HERE.

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27. For every pair (x,y) in the rectangular coordinate plane, $f: (x,y) \rightarrow (x, -8x + 3y)$. What is the set of points for which $f: (x,y) \rightarrow (x,y)$?

(A) The point $(-4,0)$
(B) The point $(4,12)$
(C) The set of points (x,y) that satisfy the equation $x = 4y$
(D) The set of points (x,y) that satisfy the equation $y = 4x$
(E) The set of points (x,y) that satisfy the equation $y = 8x$

28. When the number x is subtracted from each of the numbers 8, 16, and 40, the three numbers that result form a geometric progression. What is the value of x?

(A) 3
(B) 4
(C) 6
(D) 12
(E) 18

29. If $f(x) = ax^2 + bx + c$, $f(-1) = -18$, and $f(1) = 10$, what is the value of b?

(A) -12
(B) -4
(C) 14
(D) 21
(E) 28

30. What is the domain of the function $f(x) = \sqrt{x^2 + 3}$?

(A) $-1.73 \leq x \leq 1.73$
(B) $-1.32 \leq x \leq 1.32$
(C) $x > 1.32$
(D) $x > 1.73$
(E) All real numbers

DO YOUR FIGURING HERE.

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31. The function f is defined by $f(x) = \dfrac{180}{x+3}$ for $x \geq 0$, and $f(x) = 60$ for $x < 0$. Figure 8 shows the graph of $y = f(x)$. What is the sum of the areas of the three shaded rectangles?

(A) 111
(B) 135
(C) 141
(D) 180
(E) 195

32. Which of the following are the equations of lines that are asymptotes of the graph of $y = \dfrac{x^2 - 64}{(3x+4)(x-5)}$?

I. $x = -8$
II. $x = 5$
III. $y = \dfrac{1}{3}$

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

33. If $f(x) = 7x + 12$ and $f(g(x)) = 21x^2 + 40$, then which of the following is $g(x)$?

(A) $21x^2 + 28$
(B) $21x^2$
(C) $7x^2 + 4$
(D) $3x^2 + 28$
(E) $3x^2 + 4$

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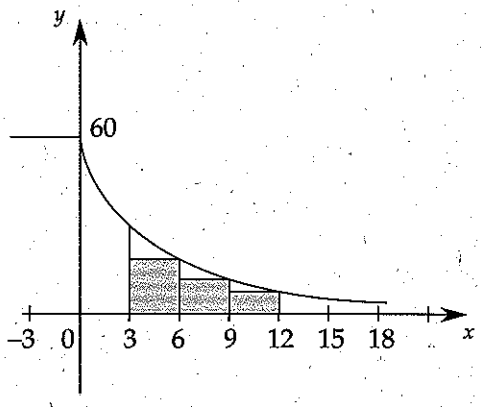

Figure 8
Note: Figure not drawn to scale

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34. A circle is tangent to the lines with the equations $x = 5$ and $y = 7$. Which of the following could be the coordinates of the center of the circle?

(A) (3,7)
(B) (8,4)
(C) (10,8)
(D) (10,14)
(E) (17,21)

35. What is the range of the function f that is defined by

$$f(x) = \begin{cases} 3^{\frac{1}{x^2+1}}, & \text{if } x \geq 0 \\ 5x+3, & \text{if } x < 0 \end{cases}$$?

(A) $y \leq 0$
(B) $0 < y < 3$
(C) $y \leq 3$
(D) $3 \leq y \leq 5$
(E) All real numbers

36. If $x^2 - 7y = 8$, $x - y = 1$, and $y > 0$, what is the value of y?

(A) 1.64
(B) 4.78
(C) 5.64
(D) 6.14
(E) 7.28

DO YOUR FIGURING HERE.

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37. If $f(x) = \log_7 \frac{x}{8}$ for $x \geq 8$, then for the values x of its domain, $f^{-1}(x) =$

(A) $8(7^x)$
(B) $7(8^x)$
(C) $8(7^{x+1})$
(D) $\log_7 \frac{x}{8}$
(E) $\frac{x}{8}$

38. If $x_1 = 2$ and $x_{n+1} = \sqrt{x_n^2 + 8}$, then $x_4 =$

(A) 3.46
(B) 4.47
(C) 5.29
(D) 8.49
(E) 10.39

39. In Figure 9, C is the center of the semicircle, and the area of the semicircle is 8π. What is the area of triangle ABC in terms of θ?

(A) $2 \sin \theta \tan \theta$
(B) $4 \sin \theta$
(C) $8 \cos \theta$
(D) $8 \sin \theta$
(E) $8 \sin \theta \tan \theta$

40. Exactly 70 percent of the people in each of 3 rooms are seniors at university X. If one person is selected at random from each of the 3 rooms, what is the probability that each of the 3 people selected is a senior at university X?

(A) 0.2401
(B) 0.343
(C) 0.49
(D) 0.64
(E) 0.7

DO YOUR FIGURING HERE.

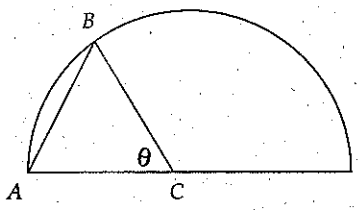

Figure 9

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41. What is the value of x if $4.18^x = 36.54$?

(A) 0.86
(B) 1.43
(C) 1.80
(D) 2.17
(E) 2.52

42. If $\sin(\arcsin x) = \frac{\sqrt{2}}{4}$, then what is the value of x?

(A) $\frac{\sqrt{2}}{4}$
(B) $\frac{\sqrt{7}}{7}$
(C) $\frac{\sqrt{2}}{2}$
(D) $\frac{\sqrt{14}}{4}$
(E) $\frac{2\sqrt{2}}{3}$

43. The sum of the first 25 terms of an arithmetic sequence is 1,400, and the 25th term is 104. If the first term of the sequence is a_1 and the second term is a_2, what is the value of $a_2 - a_1$?

(A) –3
(B) 2
(C) 4
(D) 5
(E) 8

DO YOUR FIGURING HERE.

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44. For all θ, $\sin\theta + \sin(\theta + \pi) + \sin(2\pi + \theta) =$

(A) $-\sin\theta$
(B) $\sin\theta$
(C) $2\sin\theta$
(D) $3\sin\theta$
(E) $2\sin\theta + \cos\theta$

45. If n is a positive integer, then $\frac{(n+4)!}{(n+7)!} =$

(A) $\frac{1}{(n+1)(n+2)(n+3)}$
(B) $\frac{1}{n+5}$
(C) $\frac{1}{(n+5)(n+6)}$
(D) $\frac{1}{(n+6)(n+7)}$
(E) $\frac{1}{(n+5)(n+6)(n+7)}$

46. The graph of $g(x) = x^3 + 1$ was translated 4 units to the right and 2 units up, resulting in a new graph $h(x)$. What is the value of $h(3.7)$?

(A) 0.973
(B) 1.784
(C) 1.973
(D) 2.027
(E) 2.973

DO YOUR FIGURING HERE.

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47. A five-letter code is formed by selecting 5 different letters from the 12 letters A, B, C, D, E, F, G, H, I, J, K, and L and placing these 5 letters in the 5 spaces shown in Figure 10. Which of the following expressions is the number of different five-letter codes that are possible?

(A) $\frac{12!}{4!8!}$

(B) $\frac{12!}{(5!)(7!)}$

(C) $\frac{12!}{7!}$

(D) $\frac{12!}{5!}$

(E) $\frac{12!}{4!}$

DO YOUR FIGURING HERE.

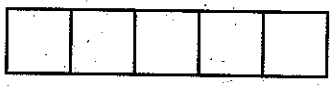

Figure 10

48. Which of the following sets of real numbers is such that if x is an element of the set and y is an element of the set, then the sum of x and y is an element of the set?

I. The set of negative integers
II. The set of rational numbers
III. The set of irrational numbers

(A) None
(B) I only
(C) I and II only
(D) II and III only
(E) I, II, and II

49. If the length of the major axis of an ellipse with the equation $5x^2 + 24y^2 = 40$ is j and the length of the minor axis of the ellipse is n, then what is the value of $j + n$?

(A) 2.58
(B) 5.66
(C) 6.95
(D) 8.24
(E) 9.78

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50. Which of the following describes the values of x for which $\frac{1-5x}{x^2+1}$ is negative?

(A) $x > 0$

(B) $x > \frac{1}{5}$

(C) $x < \frac{1}{5}$

(D) $0 < x < \frac{1}{5}$

(E) None of the above

DO YOUR FIGURING HERE.

STOP!

If you finish before time is up, you may check your work.

Turn the page
for answers and explanations
to Practice Test 3.

Answer Key
Practice Test 3

1. D
2. B
3. C
4. E
5. A
6. E
7. D
8. E
9. C
10. D
11. B
12. A
13. C
14. B
15. A
16. E
17. C
18. A
19. B
20. C
21. E
22. D
23. A
24. B
25. A
26. D
27. D
28. B
29. C
30. E
31. C
32. D
33. E
34. B
35. C
36. D
37. A
38. C
39. D
40. B
41. E
42. A
43. C
44. B
45. E
46. E
47. C
48. C
49. D
50. B