1. If the side of one square is the diagonal of a second square, what is the ratio of the area of the first square to the area of the second?

   (a) $\sqrt{2}$
   (b) $2\sqrt{2}$
   (c) $\frac{1}{2}$
   (d) 2
   (e) 4

2. If $y = x^2$ and $x^y \cdot y^x = x^w$ for $x > 0$, then, in terms of $x$, $w =$

   (a) $x^2 + 2x$
   (b) $x^2 + x + 2$
   (c) $x^2 + 2^x$
   (d) $2x^2$
   (e) $2x^3$

3. How many integers greater than ten and less than one hundred, written in base ten notation, are increased by nine when their digits are reversed?

   (a) 0
   (b) 1
   (c) 8
   (d) 9
   (e) 10

4. If two factors of $2x^3 - hx + k$ are $x + 2$ and $x - 1$, then the value of $|2h - 3k|$ is

   (a) 4  (b) 3  (c) 2  (d) 1  (e) 0

5. Which statement is correct?

   (a) If $x < 0$, then $x^2 > x$
   (b) If $x^2 > 0$, then $x > 0$
   (c) If $x^2 > x$, then $x > 0$
   (d) If $x^2 > x$, then $x < 0$
   (e) If $x < 1$, then $x^2 < x$
6. The sum of the first eighty positive odd integers subtracted from the sum of the first eighty positive even integers is

(a) 0  (b) 20  (c) 40  (d) 60  (e) 80

7. Let $x_1$ and $x_2$ be such that $x_1 \neq x_2$ and $3x_i^2 - hx_i = b$, $i = 1, 2$. Then $x_1 + x_2$ equals

(a) $-h/3$
(b) $h/3$
(c) $b/3$
(d) $2b$
(e) $-b/3$

8. Let $f(t) = \frac{t}{1-t}$, $t \neq 1$. If $y = f(x)$, then $x$ can be expressed as:

(a) $f(\frac{1}{y})$
(b) $-f(y)$
(c) $-f(-y)$
(d) $f(-y)$
(e) $f(y)$

9. If $N$, written in base 2, is 11000, the integer immediately preceding $N$, written in base 2, is:

(a) 10001
(b) 10010
(c) 10011
(d) 10110
(e) 10111

10. In the figure shown to the right, if the degree measures of the angles are shown, then $x + y =$

(a) 190  (b) 170  (c) 80  (d) 50  (e) 30
11. The arithmetic mean of the fifty-two successive positive integers beginning with 2 is:

(a) 27  (b) 27\(\frac{1}{4}\)  (c) 27\(\frac{1}{2}\)  (d) 28  (e) 28\(\frac{1}{2}\)

12. In a class of 15 students, there are 7 girls, 6 honor students, and 11 students who are either boys or honor students. How many girls are honor students?

(a) 1  
(b) 2  
(c) 3  
(d) 4  
(e) 5

13. The unit digit in the number 2\(^{356}\) is

(a) 0  
(b) 2  
(c) 4  
(d) 6  
(e) 8

14. If \(x < -2\), then \(|1 - |1 + x||\) equals

(a) 2 + x  
(b) -2 - x  
(c) x  
(d) -x  
(e) -2

15. A solution to the equation \(2^{2x} - 8 \cdot 2^x + 12 = 0\) is \(x =\)

(note: log = log\(_{10}\)).

(a) log 3  
(b) \(\frac{1}{2}\) log 6  
(c) 1 + log\(\frac{3}{2}\)  
(d) 1 + \(\frac{\log 3}{\log 2}\)  
(e) None of these.
16. If \( s \) varies inversely as the square of \( t \) and if \( s = 9 \) when \( t = 4 \), then when \( t = 3 \), \( s = \)

(a) 12  
(b) 16  
(c) 6  
(d) 25/4  
(e) None of the above.

17. The number of distinct ordered pairs \((x, y)\), where \( x \) and \( y \) have positive integral values satisfying the equation \( x^4y^4 - 10x^2y^2 + 9 = 0 \), is:

(a) 0  
(b) 3  
(c) 4  
(d) 12  
(e) infinite.

18. An urn contains 12 red and 16 blue marbles. Two marbles are drawn in succession, without replacing the first marble. What is the probability that both drawn are red?

(a) \( \frac{33}{196} \)  
(b) \( \frac{16}{49} \)  
(c) \( \frac{9}{16} \)  
(d) \( \frac{11}{63} \)  
(e) None of the above.

19. AB is a diameter of a circle centered at O. Let C be a point on the circle such that angle BOC is 60°. If the diameter of the circle is 5 inches, then the length of the chord AC in inches is:

(a) 3  
(b) \( \frac{5\sqrt{2}}{2} \)  
(c) \( \frac{5\sqrt{3}}{2} \)  
(d) \( \frac{3}{\sqrt{3}} \)  
(e) None of these.
20. A rope 13 feet long is fastened to the top of a pole 12 feet high. If a
cow is tied to the other end of the rope, over how much ground can she
graze?

(a) $25\pi$ sq. ft.
(b) $12\pi$ sq. ft.
(c) $9\pi$ sq. ft.
(d) $\frac{25}{9}\pi$ sq. ft.
(e) None of the above.

21. If $\tan x = \frac{2ab}{a^2-b^2}$, where $a > b > 0$ and $0 < x < 90^\circ$, then $\sin x$ is equal
to

(a) $\frac{a}{b}$
(b) $\frac{b}{a}$
(c) $\frac{\sqrt{a^2-b^2}}{2a}$
(d) $\frac{\sqrt{a^2-b^2}}{2ab}$
(e) $\frac{2ab}{a^2+b^2}$

22. If $x = 1 + 2^p$ and $y = 1 + 2^{-p}$, then $y$ in terms of $x$ is:

(a) $\frac{x+1}{x-1}$
(b) $\frac{x+2}{x-1}$
(c) $\frac{x}{x-1}$
(d) $2 - x$
(e) $\frac{x-1}{x}$
23. If a number $N$, $N \neq 0$, decreased by four times its reciprocal, equals a given real constant $R$, then, for this given $R$, the sum of all such possible values of $N$ is:

(a) $\frac{1}{R}$
(b) $R$
(c) 4
(d) $\frac{1}{4}$
(e) $-R$

24. The bases of an isosceles trapezoid are 7 and 15. Each base angle is $45^\circ$. Find the area of the trapezoid.

(a) 44
(b) 88
(c) 420
(d) 105
(e) None of the above.

25. The shaded region of the xy-plane shown here is the graph of the solution set for:

(a) $|x + y| > 1$
(b) $|x| + 1 > y$
(c) $1 - |x| < y$
(d) $y > |x - 1|$
(e) none of the above