

1. Since the area of the surface of a sphere varies as the square of its radius, what effect does halving the radius have on the area of the surface?
- (1) divides it by 4  
 (2) divides it by 2  
 (3) doubles it  
 (4) multiplies it by 4  
 (5) none of these
2. If  $x+3$  divides  $x^3+3kx^2-8$  with a remainder of 73, then  $k$  equals
- (1) 9 (2) -27 (3) 5 (4) 4 (5) none of these
3. The sum of three numbers in arithmetic progression is 60. If the numbers are increased by 3, 10, and 25 respectively, the new numbers will be in geometric progression. The first member of the arithmetic progression may be
- (1) 14 (2) 15 (3) 16 (4) 17 (5) none of these
4. A tank can be filled by an inlet pipe in 4 hours and emptied in 6 hours by a drain pipe. How long will it take to fill the tank if both pipes are open?
- (1) 2 hrs. (2) 8 hrs. (3) 10 hrs. (4) 12 hrs. (5) none of these
5. The equation  $\frac{x}{x-2} + \frac{2}{x+2} = \frac{x^2+4}{x^2-4}$
- (1) has the root 2 only  
 (2) has the root 0 only  
 (3) has the root -2 only  
 (4) has both 2 and -2 as roots  
 (5) has no root
6. The set of all numbers for  $x$  for which  $3 \geq |x - 2|$  is:
- (1)  $5 \geq x \geq -1$   
 (2)  $2 \leq x \leq 5$   
 (3)  $0 \leq x \leq 1$   
 (4)  $x \leq 0$   
 (5)  $x \geq 0$
7. Evaluate the determinant  $\begin{vmatrix} 4 & 2 & 4 \\ 4 & 2 & 6 \\ 3 & 1 & 5 \end{vmatrix}$
- (1) 2 (2) 4 (3) 6 (4) 8 (5) none of these
8. The number for  $x$  in the solution set  $\{x, y, z\}$  of the set of linear equations
- $$\begin{cases} 3x - 2y - 4z = 15 \\ 4x + 2y - 5z = 18 \\ x - 3y - 6z = 5 \end{cases} \text{ is}$$
- (1) 5 (2) 7 (3) 9 (4) 12 (5) none of these

9. Determine  $k$  so that the roots of  $3x^2 - kx + 3 = 0$  will be equal.  
 (1) 36 (2) -36 (3) -6 (4) 0 (5) none of these
10. If  $|a| > 0$ ,  $|b| > 0$ ,  $|c| > 0$ , then simplify  $\frac{625a^5 b^2}{5a^2 b^3 c^6}$ .  
 (1)  $125a^3$   
 (2)  $\sqrt{125} a^3$   
 (3)  $125 a^5$   
 (4)  $125 |a|^{7/2}$   
 (5)  $125 |a|^3$
11. If the function  $3x^2 + kx + 8$  has one of its zeros equal to 2, the value of  $k$  is:  
 (1) -20 (2) 20 (3) 4 (4) 10 (5) -10
12. If  $x^{1/2} - x = 25$ , there are how many real numbers for  $x$  for which the statement is true:  
 (1) 1 (2) 2 (3) 4 (4) none (5) infinitely many
13. Which of the following is tangent to the parabola  $y = x^2 + 3x - 5$  at  $x = 2$ ,  $y = 5$ :  
 (1)  $-y = x - 7$   
 (2)  $y = 3x - 1$   
 (3)  $y = -x - 9$   
 (4)  $y + 2x = 9$   
 (5) none of these
14. If 1 is a root of a quadratic equation whose coefficients are all real numbers the following is also a root:  
 (1)  $1 + i$  (2)  $1 - i$  (3)  $i^2$  (4)  $1/i$  (5) none of these
15. The graphs of  $2y = -3x - 3$  and  $3x + 2y = 2$   
 (1) have the same  $x$ -intercept  
 (2) have the same  $y$ -intercept  
 (3) intersect each other at right angles  
 (4) have the same slope  
 (5) all of the above
16. If three coins are tossed in the air simultaneously, what is the probability that all three will turn up heads?  
 (1)  $1/4$  (2)  $1/8$  (3)  $1/16$  (4)  $1/2$  (5) none of these

17. In the expansion of  $\left(\frac{x}{y^2} - \frac{y^3}{x^2}\right)^8$  the term involving  $y^9$  is:

- (1) 6th term
- (2) 7th term
- (3) 5th term
- (4) 8th term
- (5) 4th term

18. Of two numbers, if  $1/2$  of the larger is added to  $1/3$  of the smaller the sum is 13; if  $1/2$  of the smaller is subtracted from  $1/3$  of the larger the remainder is zero. The smaller number is

- (1) 12 (2) 15 (3) 18 (4) 20 (5) 24

19. When expanded  $(x^n - y^n)^3$  is equal to:

- (1)  $x^{3n} - 3x^{2n}y^n + 3x^n y^{2n} - y^{3n}$
- (2)  $x^{2n} - 2x^n y^n + y^{2n}$
- (3)  $x^{3n} - y^{3n}$
- (4)  $(x^n)^3 - x^{2n}y^n + x^n y^{2n} - (y^n)^3$
- (5)  $x^{3n} + 3x^{2n}y^n + 3x^n y^{2n} + y^{3n}$

20. The fact that  $ax + ay = a(x + y)$ , where  $a, x, y$  represent real numbers, is true due to which of the following laws:

- (1) associative law for addition
- (2) distributive law
- (3) commutative law for multiplication
- (4) closure of the set of real numbers under addition
- (5) none of these

21. For what real numbers for  $k$  are the roots of  $kx^2 + 2x - 3 = 0$  imaginary

- (1)  $k < 1/3$  (2)  $k < -1/3$  (3)  $k < 0$  (4)  $k > 3$  (5) none of these

22. For what real numbers for  $x$  will  $\frac{x+2}{x-3} \leq 0$ .

- (1)  $-2 > x > 3$
- (2)  $3 > x > -2$
- (3)  $3 < x < -2$
- (4)  $3 > x > 2$
- (5) none of these

23. If  $x > -3/4$ , then

- (1)  $4x < 3$
- (2)  $x > -3$
- (3)  $4x \leq 3$
- (4)  $4x > -3$
- (5) none of these

24. The 100th term of the arithmetic progression  $\frac{1}{3} + \frac{5}{3} + \frac{9}{3} + \frac{13}{3} \dots$  is

- (1) 132
- (2)  $6633 \frac{1}{3}$
- (3)  $40 \frac{1}{3}$
- (4) 43
- (5) none of these

25. Four persons enter a bus with nine vacant seats. In how many ways can they be seated?

- (1)  $24$
- (2) 120
- (3) 3096
- (4)  $3024$
- (5) none of these

26. The solution set for x and y of the simultaneous equations

$$\begin{cases} x + y = 12 \\ x - y = 6 \end{cases}$$

- (1)  $x = 6, y = 6$
- (2)  $x = 9, y = 3$
- (3)  $x = 3, y = 9$
- (4)  $x = 4, y = 3$
- (5) none of these

27. In the expansion of  $(x+y)^{15}$  the coefficient of the term containing  $x^7$  is

- (1) 5005
- (2) 3003
- (3) 9
- (4) 10
- (5) none of these

28.  $\log_2 16$  equals

- (1) 4
- (2) 8
- (3)  $\frac{1}{4}$
- (4) 32
- (5) none of these

29. If it takes 8 days for a man to dig a hole 8 feet square and 8 feet deep, how long will it take him to dig a hole 4 feet square and 4 feet deep? Assume that the time required is proportional to the volume of the hole.

- (1) 1 day (2) 2 days (3) 3 days (4) 4 days (5) none of these

30. The reciprocal of  $2 - 5i$  in the form of  $a + bi$  is

- (1)  $2 + 5i$
- (2)  $\frac{1}{2 - 5i}$
- (3)  $2/29 + 5/29i$
- (4)  $1/2 - 1/5 i$
- (5) none of these

31. If  $\text{Log}_m(x+6) - \text{Log}_{10}(x-3) = 1$  then  $x$  equals

- (1) 10 (2) 2 (3) 4 (4) 3 (5) none of these

32. The set of all numbers for  $x$  that satisfies  $|2x - 5| < 7$  is

- (1)  $\{x/x > 6 \text{ or } x < -1\}$
- (2)  $\{x/-1 < x < 6\}$
- (3)  $\{x/x > 6\}$
- (4)  $\{x/x < 0\}$
- (5) none of these

33. If  $A = \{a, b, c, d, e, f\}$ ,  $B = \{b, c, d\}$ ,  $C = \{b, d, e\}$ , which of the following is false?

- (1)  $B \subset A$
- (2)  $C \subset A$
- (3)  $\emptyset \subset B$
- (4)  $\emptyset \subset C$
- (5)  $B \subset C$

34. The expression  $(x^n y^2)^m$  is equal to

- (1)  $x^{nm} y^{2m}$
- (2)  $(xy)^{2nm}$
- (3)  $x^{nm} y^2$
- (4)  $x^n y^{2m}$
- (5)  $x^{nm} y^{2m}$

35. When one rationalizes the denominator of  $\frac{4}{\sqrt[3]{16}}$  one gets as a correct answer:

- (1)  $\frac{1}{\sqrt[3]{4}}$  (2)  $\frac{2}{\sqrt[3]{4}}$  (3)  $\frac{1}{\sqrt[3]{2}}$  (4)  $\sqrt[3]{16}$  (5)  $\sqrt[3]{4}$

36. To rationalize the denominator of the fraction  $\frac{1}{3 - \sqrt[3]{3}}$  one may multiply numerator and denominator by:

- (1)  $3 + \sqrt[3]{2}$  (2)  $3^2 - \sqrt[3]{4}$  (3)  $3^2 + \sqrt[3]{4}$   
 (4)  $9 - 3\sqrt[3]{3} + \sqrt[3]{4}$  (5)  $9 + 3\sqrt[3]{2} + \sqrt[3]{4}$

37. At what time between the hours of two and three o'clock will the hour and minute hands of a clock make right angles with each other?

- (1) 2:29  $\frac{5}{16}$  (2) 2:15 (3) 2:23  $\frac{3}{13}$  (4) 2:27  $\frac{3}{11}$  (5) 2:28  $\frac{1}{3}$

38. If the graph of  $2y = mx + 5$  contains the point (1,2), m is equal to which of the following:

- (1) 2 (2) 1 (3) 0 (4) -1 (5) -2

39. Which of the following is equivalent to:  $\frac{\frac{1}{a} + \frac{1}{b}}{\frac{1}{a^2} - \frac{1}{b^2}}$

- (1)  $\frac{1}{b-a}$  (2)  $\frac{1}{\frac{1}{a} + \frac{1}{b}}$  (3)  $\frac{ab}{b-a}$   
 (4)  $a(b-a)$  (5)  $\frac{a^2b + b^2a}{a^2b^2}$

40. All possible numbers for x for which  $|x| = \sqrt{6}$  are:

- (1)  $-\sqrt{6} < x < \sqrt{6}$   
 (2)  $0 < x < \sqrt{6}$   
 (3)  $x = \pm\sqrt{6}$   
 (4)  $x = \pm 36$   
 (5)  $x \pm \sqrt{6}$