

1. The formula for the time a traffic light remains yellow is  $t = \frac{1}{8}s + 1$  where  $t$  is the time in seconds and  $s$  is the speed limit in miles/hour (mph). What is the speed limit if the traffic light remains yellow for 4 seconds?

(A) 24 mph    (B) 31 mph    (C) 32 mph    (D) 40 mph

2. Let  $a, b, c, d$  and  $e$  be integers such that  $a = 6b = 12c$  and  $2b = 9d = 12e$ , then which of the following pairs contains a number that is not an integer ?

(A)  $\left(\frac{a}{27}, \frac{b}{e}\right)$                       (B)  $\left(\frac{a}{36}, \frac{c}{e}\right)$

(C)  $\left(\frac{a}{12}, \frac{bd}{18}\right)$                       (D)  $\left(\frac{a}{6}, \frac{c}{d}\right)$

3. Find the value of  $z$  from the following equations

$$(x + y)(x + y + z) = 21$$

$$(y + z)(x + y + z) = 42$$

$$(z + x)(x + y + z) = 35$$

(A) 4                      (B) -4                      (C)  $\pm 4$                       (D) None of these

4. A two-wheeler manufacturer has to select a subcontractor for the aluminium plating of the wheel rims. Five aluminium plating subcontractors have been short-listed and given 50 wheel rims to each subcontractor for aluminium plating. After aluminium plating, the wheel rims are thoroughly checked and the ones with plating not satisfactory are rejected. The number of wheel rims rejected due to defective plating is less than 10 for each subcontractor. If the median rejection is 5 and mode is 4, what is the minimum rejection?

(A) 0                      (B) 2                      (C) 3                      (D) None of these

5. The number of four-digit numbers that can be formed using the digits 0, 2, 3, 4, 5, 6, 7 that are divisible by 5 and repetition is not allowed are:

(A) 240      (B) 230      (C) 220      (D) 200

6. If  $p$  is a real number and if the middle term in the expansion of  $\left(\frac{p}{2} + 2\right)^8$  is 1120, then the value of  $p$  is

(A)  $\pm 3$       (B)  $\pm 2$       (C)  $\pm 1$       (D) None of these

7. The value of

$$\lim_{(x,y) \rightarrow (0,0)} xy \frac{x^2 - y^2}{x^2 + y^2}$$

is

(A) 0      (B) 1      (C)  $\frac{1}{2}$       (D) 2

8. The length of six line segments are 2, 3, 4, 5, 6, & 7 units. The number of triangles that can be formed by these lines is

(A)  ${}^6C_3 - 7$       (B)  ${}^6C_3 - 6$       (C)  ${}^6C_3 - 5$       (D)  ${}^6C_3 - 8$

9. Let  $S = \{1, 2, 3, 4\}$ . The total number of unordered pairs of disjoint subsets of  $S$  is equal to

(A) 25      (B) 34      (C) 42      (D) 41

10. Given  $(y) = \frac{y+4}{2y-5}$ , find  $z^{-1}(y)$ .

(A)  $\frac{4+5y}{2y-1}$       (B)  $\frac{5+4y}{2y-1}$       (C)  $\frac{2+3y}{5y-3}$       (D)  $\frac{2+4y}{3y-6}$

11. A balloon takes off from a location that is 24 feet above sea level. It rises 45 feet/minute. Choose the correct equation to model the balloon's elevation  $h$  as a function of time  $t$ .
- (A)  $h = 24t + 45$                       (B)  $t = 24h + 45$   
 (C)  $h = 45t + 24$                       (D)  $t = 45h + 24$

12. If the product of two matrices

$$A = \begin{bmatrix} \cos^2 \theta & \cos \theta \sin \theta \\ \cos \theta \sin \theta & \sin^2 \theta \end{bmatrix}$$

and

$$B = \begin{bmatrix} \cos^2 \varphi & \cos \varphi \sin \varphi \\ \cos \varphi \sin \varphi & \sin^2 \varphi \end{bmatrix}$$

is a null matrix, then  $\theta$  and  $\varphi$  differ by

- (A) Odd multiple of  $\pi$                       (B) Even multiple of  $\pi$   
 (C) Odd multiple of  $\frac{\pi}{2}$                       (D) Even multiple of  $\frac{\pi}{2}$

13. If  $f(x) = \frac{9^x}{9^{x+3}}$  then the sum of the terms

$$f\left(\frac{1}{1996}\right) + f\left(\frac{2}{1996}\right) + \cdots + f\left(\frac{1995}{1996}\right)$$

is

- (A)  $996\frac{1}{2}$                       (B)  $997\frac{1}{2}$                       (C)  $998\frac{1}{2}$                       (D)  $999\frac{1}{2}$
14. If  $a_1, a_2, \dots, a_{21}$  are in arithmetic progression and  $\sum_{i=1}^{21} a_i = 693$ , then  $\sum_{i=0}^{10} a_{2i+1}$  is
- (A) 361                      (B) 396                      (C) 363                      (D) 292

15. The area bounded by the curves  $y = |x| - 1$  and  $y = -|x| + 1$  is
- (A) 1 square unit                      (B) 2 square units  
 (C)  $2\sqrt{2}$  square units              (D) 4 square units
16. A day's production of 850 manufactured parts contains 50 parts that do not meet customer requirements. Two parts are selected randomly without replacement from the batch. The probability that the second part is defective given that the first part is defective is
- (A) 0.0032              (B)  $\frac{49}{849}$               (C)  $\frac{50}{850} \times \frac{49}{850}$               (D)  $\frac{50}{849}$
17. If  $ab = 2a + 3b, a > 0, b > 0$ , then the minimum value of  $ab$  is
- (A) 18                      (B) 36                      (C) 24                      (D)  $\frac{1}{4}$
18. A seven-digit number is formed using the digit 3, 3, 4, 4, 4, 5, 5. The probability, that number so formed is divisible by 2, is
- (A)  $\frac{6}{7}$                       (B)  $\frac{4}{7}$                       (C)  $\frac{3}{7}$                       (D)  $\frac{1}{7}$
19. Solve:  $y - ye^{5y+2} = 0$
- (A) 1 and  $-\frac{1}{5}$                       (B) 0 and  $-\frac{5}{2}$   
 (C) 0 and  $-\frac{2}{5}$                       (D) 1 and  $-\frac{5}{2}$
20. Find the opposite and reciprocal of the number 0.38.
- (A)  $\frac{50}{19}, \frac{19}{50}$                       (B)  $-0.38, \frac{50}{19}$   
 (C)  $-0.38, \frac{19}{50}$                       (D)  $\frac{50}{19}, 0.38$

21. The sum of eigenvalues of the matrix  $\begin{bmatrix} 3 & 4 \\ x & 1 \end{bmatrix}$  for real and negative values of  $x$  is
- (A) greater than 0                      (B) less than 0  
(C) 0    (D) dependent on the value of  $x$

22. From a group of 3 members of party  $A$ , 2 members of party  $B$ , and 1 member of party  $C$ , a committee of two people is to be selected randomly. What is the probability that the committee has 1 member of party  $A$  and a member of party  $B$ ?
- (A) 0.3                      (B) 0.4                      (C) 0.5                      (D) 0.6

23. An experiment succeeds twice as often it fails. Then, the probability that in the next four trials there will be at least 2 successes is
- (A)  $\frac{1}{9}$                       (B)  $\frac{8}{9}$                       (C)  $\frac{5}{9}$                       (D)  $\frac{2}{9}$

24. The value of

$$\lim_{x \rightarrow 0} \frac{xe^x - \log(1+x)}{x^2}$$

is

- (A)  $\frac{e}{2}$                       (B)  $\frac{1}{2}$                       (C)  $-\frac{e}{2}$                       (D)  $\frac{3}{2}$
25. Three distinct numbers are selected from the first 100 natural numbers. The probability that all the three numbers are divisible by 2 and 3 is
- (A)  $\frac{4}{25}$                       (B)  $\frac{4}{35}$                       (C)  $\frac{4}{55}$                       (D)  $\frac{4}{1155}$

26. Given  $x = cy + bz, y = az + cx, z = bx + ay$  where  $x, y, z$  are not all zero. The value of  $a^2 + b^2 + c^2 + 2abc$  is

- (A) 1                      (B) 0                      (C) 2                      (D) 3

27. The value of

$$\lim_{h \rightarrow 0} \frac{2(-3 + h)^2 - 18}{h}$$

is

- (A) 12                      (B) -18                      (C) -10                      (D) -12

28. If  $f(\pi) = 2$  and  $\int_0^\pi (f(x) + f''(x)) \sin x \, dx = 5$  then  $f(0)$  is equal to (assume  $f(x)$  is continuous in  $[0, \pi]$ )

- (A) 0                      (B) 1                      (C) 2                      (D) 3

29. If

$$P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$$

is the adjoint of a  $3 \times 3$  matrix  $A$  and  $|A| = 4$ , then the value of  $\alpha$  is

- (A) 4                      (B) 11                      (C) 5                      (D) 0

30. The coefficient of  $x^7$  in the expression

$$(1 + x)^{10} + x(1 + x)^9 + x^2(1 + x)^8 + \dots + x^{10}$$

is

- (A) 420                      (B) 330                      (C) 210                      (D) 120