

1. If the n th partial sum of the series $\sum_{n=1}^{\infty} a_n$ is $s_n = \frac{2n^2+2}{3n^2+1}$, then $\sum_{n=1}^{\infty} a_n$ is
- (A) 0
 (B) divergent
 (C) $\frac{2}{3}$
 (D) $\frac{3}{2}$
2. Using data from a sample of size n , the intercept and slope coefficients from an ordinary least squares regression of y on x , are a and b respectively. Which of the following is **false**?
- (A) $\sum_{i=1}^n (y_i - a - bx_i)x_i = 0$
 (B) $\frac{1}{n} \sum_{i=1}^n y_i = a + \frac{b}{n} \sum_{i=1}^n x_i$
 (C) a and b are the solution to $\min_{\alpha, \beta} \sum_{i=1}^n (y_i - \alpha - \beta x_i)^2 = 0$
 (D) a and b are the solution to $\min_{\alpha, \beta} \sum_{i=1}^n |y_i - \alpha - \beta x_i| = 0$
3. Consider a production function $z = 2x + 3y$. For what price ratio $\frac{p_x}{p_y}$, will a corner solution in y , i.e. ($x = 0$) be possible, if the objective is to minimize the cost of producing a given positive quantity z_0 of z ?
- (A) $\frac{p_x}{p_y} = 2/3$ (B) $\frac{p_x}{p_y} \geq 2/3$
 (C) $\frac{p_x}{p_y} < 2/3$ (D) $\frac{p_x}{p_y} \leq -2/3$
4. A number is chosen randomly from the first billion natural numbers. The probability that the product of the number with its two immediate successors is divisible by 24 is closest to
- (A) $\frac{1}{2}$ (B) $\frac{3}{4}$ (C) $\frac{5}{8}$ (D) $\frac{2}{3}$
5. Each of the four entries of a 2×2 matrix is filled by independently choosing either 1 or -1 uniformly at random. What is the probability that the matrix is singular?
- (A) $\frac{1}{16}$ (B) $\frac{1}{4}$
 (C) $\frac{1}{2}$ (D) $\frac{1}{3}$

10. Let V be the vector space of polynomials $p(x)$ of degree less than or equal to 2 that have real coefficients. Then T is a linear transformation from V to V if T is defined by
- (A) $T(p(x)) = x + p(x)$
 (B) $T(p(x)) = xp(x)$
 (C) $T(p(x)) = \frac{dp(x)}{dx}$
 (D) $T(p(x)) = \int p(x)dx$ where the constant of integration is taken to be zero.
11. X is a random variable that can take values only in $[0, 10]$. $P(X > 5) \leq \frac{2}{5}$ and $P(X < 1) \leq \frac{1}{2}$. Then
- (A) $E(X) \geq 1$
 (B) $E(X) \leq 5$
 (C) $E(X) \geq 0.5$ and $E(X) \leq 8.5$
 (D) None of the above is true
12. Given data $(-1, 1), (0, 0), (1, 1)$ on (x, y) , the standard deviations of x and y and the correlation coefficient of x and y are respectively
- (A) $\sigma_x = \sqrt{2}/\sqrt{3}, \quad \sigma_y = \sqrt{2}/3, \quad r = 0$
 (B) $\sigma_x = 2/3, \quad \sigma_y = 2/9, \quad r = 0$
 (C) $\sigma_x = 0, \quad \sigma_y = 0, \quad r$ is undefined
 (D) None of the above
13. An island nation has two potential vaccine firms: denoted as 1 and 2. Both need to invest in R&D to manufacture vaccines. The cost of R&D for firms 1 and 2 are f_1 and f_2 respectively. Once R&D is done, the cost of per unit manufacturing of vaccine is drawn uniformly from

$[0, 1]$. The firms know their (fixed) cost of R&D but only know that the cost of per unit manufacturing is uniformly drawn from $[0, 1]$.

Total demand of vaccine is 1 unit and if firm $i \in \{1, 2\}$ supplies $q_i \in [0, 1]$ units and has a per unit cost of c_i , it incurs a manufacturing cost of $c_i q_i$ (along with f_i).

Suppose both firms invest in R&D but only the lowest per unit cost firm is chosen to supply the entire one unit of vaccine. What is the total expected cost of vaccination (expected cost is the fixed cost of R&D and expected cost of manufacturing)?

- (A) $f_1 + f_2 + \frac{1}{2}$ (B) $f_1 + f_2 + \frac{1}{3}$
(C) $f_1 + f_2 + \frac{2}{3}$ (D) $f_1 + f_2 + \frac{3}{4}$

14. India and China produce only shirts and phones using only 2 factors of production: either higher skilled labour H or low skilled labour L . Shirts are high skill labour intensive while phones are low skill labour intensive. The production function for each good is identical in both countries. India and China have equal amounts of lower skilled labour, but India has a greater amount of higher skilled labour. Which good will India import?

- (A) Shirts
(B) Phones
(C) Both Shirts and Phones
(D) Neither Shirts nor Phones

15. Consider a duopoly with market demand $p = 10 - q$. The cost function of firm 1 is $7q_1$, and that of firm 2 is $2q_2$, where q_i is the quantity produced by firm i , $i = 1, 2$. In equilibrium, firm 2 charges a price of:

- (A) 7 (B) 6
(C) 10 (D) 0

16. Virat and Mithali eat rice and drink milk in exactly the same quantities. The price of rice falls. In response, Virat increases the amount of milk but decreases the amount of rice he consumes. Mithali, on the other hand, increases both rice and milk consumption. Both Virat and Mithali spend all their income on eating rice or drinking milk. For Virat's behaviour to be consistent with standard, well-behaved indifference curves, his preferences over rice consumption imply that for him, rice must be a:
- (A) Inferior good (B) Giffen good
(C) Luxury good (D) Normal good
17. If the short-run IS-LM equilibrium occurs at a level of income above the natural rate of output, in the long run output will return to the natural rate via
- (A) an increase in the price level
(B) a decrease in the interest rate
(C) an increase in the money supply
(D) a downward shift of the consumption function
18. If the short-run aggregate supply curve is steep, the Phillips curve will be:
- (A) flat
(B) steep
(C) backward-bending
(D) unrelated to the slope of the short-run aggregate supply curve
19. There are no capital controls between the US and the UK. If the interest rate is higher in the US than in the UK, then we can conclude that
- (A) The US dollar is expected to appreciate with respect to the pound (the UK's currency)
(B) The pound is expected to appreciate with respect to the US dollar

40 dosas and 10 filter coffees in a week. Like in Delhi, each dosa and filter coffee cost the same. In Bangalore, he can just afford to have 10 dosas and 20 filter coffees in a week. Here, 2 filter coffees costs the same as 1 dosa. Where will Rohit prefer to stay?

- (A) Delhi
- (B) Chennai
- (C) Bangalore
- (D) Indifferent between Delhi and Chennai

24. Consider the IS-LM model with the real interest rate, R , on the vertical axis and output, Y , on the horizontal axis. Now suppose that the central bank chooses R for the economy, based on its own assessment, at $R = \bar{R}$. In this case the LM curve will

- (A) not exist
- (B) will be horizontal at $R = \bar{R}$
- (C) upward sloping like the usual LM curve
- (D) None of the other options

25. Consider a supply-demand diagram for the labor market with an upward sloping labor supply curve (L^s) and a downward sloping labor demand curve (L^d). Let the wage be on the vertical axis, and the level of employment (L) be on the horizontal axis. Suppose the wage is rigid above the equilibrium wage at \bar{w} , i.e., it fails to adjust to clear the labor market. Then a reduction in labor demand leads to

- (A) A larger reduction in employment compared to the case if wages were flexible
- (B) A smaller reduction in employment compared to the case if wages were flexible
- (C) The same reduction in employment compared to the case if wages were flexible
- (D) None of the other options.