1. Consider a standard Solow style economy where the aggregate production function is given by $Y = \sqrt{KN}$, where Y, K and N are output, capital stock, and size of population/worker, respectively. Assume that there is no technological progress ($g = 0$) and no population growth ($n = 0$). Let $\bar{K}$ and $\bar{Y}$ be the steady state capital stock and output respectively. Further, the saving rate and periodic depreciation of capital are represented by $s \in [0, 1]$ and $\delta \in [0, 1]$ respectively. The steady state capital per worker and output per worker are, respectively, given by:

   (A) $s\delta$ and $(s\delta)^2$ (B) $\frac{s}{\delta}$ and $\frac{s}{\delta}$

   (C) $\frac{s^2}{\delta^2}$ and $\frac{s^2}{\delta}$ (D) None of the above

2. Continue with the same problem as above. Now assume that $\delta = 0.1$. At the steady state, consumption per worker and the saving rate that maximises consumption per worker are given by, respectively:

   (A) $\frac{s(1-s)}{\delta}$ and $s = 0.5$ (B) $(\frac{s}{\delta})^2$ and $s = 0.4$

   (C) $\frac{s}{\delta^2}$ and $s = 0$ (D) $\frac{\delta}{1-s}$ and $s = 1$

3. Suppose in the economy the labour market wage setting equation is given as follows: $W = P(1 - u)$ where W represents the nominal wage, u is the unemployment rate, and P is the price level. Suppose the production function is given by $Y = N$, where Y is output and N is the total labour force employed. Assume that the markup over marginal cost is 20% and the size of the total labour force $L = 60$. The natural rate of unemployment, u_n, and natural level of output, Y_n, respectively, are given by:

(A) 16.667% and 50 (B) 23.5% and 15.5

(C) 20% and 15.5 (D) 20% and 20

4. Consider an open economy in which the exchange rate is fixed and equal to 1. Let Consumption (C), investment (I), lump-sum taxes (T), Government expenditure (G) imports (IM) and exports (X) satisfy the following: $C = 20 + 0.8(Y - T); I = 10; G = 10; T = 10; IM = 0.3Y; X = 0.3Y^*$ where Y and Y^* denote domestic output and foreign output respectvely. Further, assume that the foreign economy is characterised by the same equations as the domestic economy. The value of the multiplier in the domestic economy is:

(A) 1 (B) 2 (C) 0.4 (D) 0.8

5. Continue with the same problem as above. Assume that the domestic government has a target level of output of 250. Assuming that the foreign government does not have any such target in mind (and does not change its expenditure, G^*). What is the increase in G necessary to achieve the target output in the domestic economy?

(A) 112.4 (B) 96 (C) 38.8 (D) 86

6. Suppose per-capita output in an economy is represented by y where $y = f(k)$ with $f(k)$ an increasing and concave function of the per-capita capital stock k. Let Y, K and L represent total output, aggregate capital, and the population size (assume no unemployment) in an economy, respectively. Further $Y = A\min[K, L]$ where $A > 0$ is a parameter. If the wage (W) in

the economy is determined by $\frac{\partial Y}{\partial L}$ and the rate of interest (R) is determined by $\frac{\partial Y}{\partial K}$, which of the following statement is correct:

(A) R and W are the same for every level of k.

(B) R and W are the same for $k \leq 1$ but not for $k > 1$.

(C) R and W are the same for $k > 1$ but not for $k \leq 1$.

(D) None of the above.

7. Suppose consumption (C) follows the path $\frac{d}{dt}(-e^{-\rho t}U'(C)) = e^{-\rho t}U'(C)r$ where t represents time, $U(C)$ is the utility function that is increasing and strictly concave. Future utility is discounted at a rate $\rho > 0$ and the interest rate on capital is given by $r > 0$. The notation d represents the total differentiation, $U'(C)$ represents the differentiation of U with respect to C and, e represents the standard natural exponential function. Under what condition, is $\frac{dc}{dt}$ positive, that is, consumption is increasing over time?

(A) $r < \rho$

(B) $r > \rho$

(C) $r = \rho$

(D) Consumption can never be increasing over time in this economy.

8. The present value of a household's income is given by $\sum_{t=0}^{\infty} \beta^t y_t$ where y_t represents income in period t and $\beta \in (0, 1)$ is a fixed discount factor. Suppose that the income stream is given by $\{y_t\}_{t=0}^{\infty} = \{y_h, y_l, y_h, y_l, y_h, y_l, ...\}$ where $y_h > y_l > 0$.

Consider a consumption stream $\bar{c}$ that is given in every period so that the stream has the same present value as the present value of the income stream. Then $\bar{c}$ is equal to:

(A) $\frac{\beta(y_h+y_l)}{1-\beta}$ (B) $\frac{\beta^2(y_h+y_l)}{1-\beta}$

(C) $\beta^2(y_h+y_l)(1-\beta)$ (D) $\frac{(y_h+\beta y_l)}{1+\beta}$

9. There are 20 questions on an exam that many thousands of students take. Answers can either be correct or wrong, with no partial credit. The teaching assistant for the course calculates the average number of correct answers as 11.7 and the average number of wrong answers as 5.3. Has the teaching assistant made a mistake?

   (A) Yes (B) No

   (C) May be (D) Insufficient information is given.

10. To examine the effects of smoking, two studies considered pairs of twins. Each study examined 20 pairs.

    In the first study:

    - In 15 out of 20 pairs, the smoking twin died first.
    - In 5 pairs, the non-smoking twin died first.

    In the second study:

    - In 12 out of 20 pairs, the smoking twin died first.
    - In 8 pairs, the non-smoking twin died first.

    Assuming that within a pair, the smoking and non-smoking twin are equally likely to die first, what is the ratio of the probability

of observing the outcome in the first study to that of the second study?

(A) $= 1$ (B) < 1

(C) > 1 (D) Insufficient information is given.

11. A researcher estimates the following regression:

$$\text{marks in economics} = \beta_0 + \beta_1 \text{marks in mathematics}$$

where β_0 was estimated to be 5, but β_1 was lost. The average marks in economics and mathematics were 65 and 90, respectively. If someone scores 75 in mathematics, their predicted score is:

(A) 55 (B) 75 (C) 40 (D) 65

12. Consider the experiment of tossing two fair coins. Let the event **A** be a head on the first coin, the event **C** be a head on the second coin, the event **D** be that both coins match and the event **G** be two heads. Which of the following is false?

(A) **C** and **D** are statistically independent.

(B) **A** and **G** are statistically independent.

(C) **A** and **D** are statistically independent.

(D) **A** and **C** are statistically independent.

13. A bowl contains 5 chips, 3 marked Re.1 and 2 marked Rs.4. A player draws 2 chips at random and is paid the sum of the values of the chips. The player's expected gain (in Rs.) is

(A) less than 2 (B) 3

(C) above 3 and less than 4 (D) above 4 and less than 5

14. A linear regression of Y on X is run on two different samples. The R^2 of the first regression is greater than that of the second. It follows that

    (A) The estimated coefficient on X is greater in the first regression than in the second.

    (B) The absolute value of the estimated coefficient on X is greater in the first regression than in the second.

    (C) The variance of Y is smaller in the first sample.

    (D) None of the above.

15. Suppose the standard deviation of x in a particular sample is 2 while that of y is 4. Then, it follows that the estimated slope coefficient in a linear regression of y on x is

    (A) 8 times the correlation coefficient.

    (B) 2 times the correlation coefficient.

    (C) 1/2 of the correlation coefficient.

    (D) None of the above.

16. The function $f : \Re \to \Re$ is defined as $f(x) := 4x^3 - 6x^2 - 72x$. Then, f is

    (A) increasing everywhere.

(B) decreasing everywhere.

(C) increasing in $(-\infty, -2)$ and decreasing in $(-2, \infty)$.

(D) increasing in $(-\infty, -2)$ and $(3, \infty)$, and decreasing in $(-2, 3)$.

17. The value of the sum $\frac{1}{1\times2} + \frac{1}{2\times3} + \frac{1}{3\times4} + \ldots + \frac{1}{2024\times2025}$ equals to

(A) 1 (B) $\frac{2025}{2026}$ (C) $\frac{2024}{2025}$ (D) $\frac{2025}{2024}$

18. Find two non-negative numbers x and y such that their sum is 16 and their sum of cubes is minimum across all positive numbers summing to 16.

(A) $x = y = 8$ (B) $x = 15, y = 1$

(C) $x = 12, y = 4$ (D) None of the above

19. The value of the integral

$$\int_1^2 \log x dx$$

equals

(A) $\log 4$ (B) $\log 4 - 1$

(C) $\log 2 - 1$ (D) None of the above

20. What is the remainder when 6^{2025} is divided by 25.

(A) 0 (B) 1 (C) 24 (D) 6

21. Suppose a function $f : \mathbf{N}_+ \to \mathbf{N}_+$, where $\mathbf{N}_+$ is the set of all positive integers, satisfies $f(x+y) = f(x)f(y)$ for all positive integers x and y. If $f(1) = 2$, then the value of $2 + \sum_{n=1}^{2025} f(n)$ equals

(A) 2^{2025} (B) 2^{2026}

(C) 3^{2024} (D) None of the above

22. There are two types of consumers of samosas - students and professors. Both students and professors stop consuming samosas when the price of samosas goes above Rs. 5. For every decrease in the price of samosas by a rupee, student demand goes up by 5 samosas while professor demand goes up by 10 samosas. If a monopolist has a constant marginal cost of Re. 1 and can charge different prices to students and professors, which group will be charged a higher price?

(A) Professors

(B) Students

(C) They will be charged the same price

(D) Not enough information

23. Bharat and Chinmayi are the only two consumers for icecream and both have downward-sloping, linear demand curves. Bharat never buys icecreams when the price goes above Rs.5 and Chinmayi never buys icecreams when the price goes above Rs.10. Which of the following statements is true about the market demand curve:

(A) Will have a kink at Rs.5 and will be flatter to the right of the kink than to the left of the kink.

(B) Will have a kink at Rs.5 and will be flatter to the left of the kink than to the right of the kink.

(C) Will have a kink at Rs.15 and will be flatter to the right of the kink than to the left of the kink.

(D) Will have a kink at Rs.15 and will be flatter to the left of the kink than to the right of the kink.

24. Suppose that your total income is Rs.200. Books cost Rs.5 each, while all other goods (Y) cost Re. 1 each. Your utility from books (B) and from all other goods (Y) is given by: $U(B, Y) = 4B + 2Y$. Now, suppose you are given a Rs.50 gift card for the bookstore. The gift card can only be spent on books. What is the optimal combination of books and other goods you will consume?

(A) 10 books and 200 units of other goods.

(B) 0 books and 200 units of other goods.

(C) 20 books and 150 other goods.

(D) 40 books and 0 units of other goods.

25. Suppose the marginal cost of planting a tree is constant and is equal to Rs.25. There are 15 people living in a small town who have different preferences over the trees planted on the streets

(trees are a public good). 5 people have high marginal benefits given by $MBH = 100 - 0.5Q$, and the remaining ten people have low marginal benefits, $MBL = 50 - 0.25Q$, where Q is the number of trees planted on city streets. What is the maximum number of trees that can be potentially provided in this town if people share the cost of planting trees?

(A) 0 (B) 100 (C) 150 (D) 195

26. Imagine a world where there are only two commodities, apples and bananas. A consumer has income $w > 0$ and faces prices p_a and p_b for apples and bananas respectively. Her preferences over apple-banana bundles are as follows: she strictly prefers bundle $x = (x_a, x_b)$ over bundle $y = (y_a, y_b)$ (where x and y are distinct) if either (i) $x_a + x_b > y_a + y_b$ or (ii) $x_a + x_b = y_a + y_b$ and $x_a > y_a$. In other words, she strictly prefers bundle x to bundle y if x has more fruit than y or if the number of fruit in both bundles is the same and x has more apples. Let $d_a(p_a, p_b, w)$ and $d_b(p_a, p_b, w)$ denote the demand for apples and bananas respectively at (p_a, p_b, w). Consider the following statements:

I. $d_a(p_a, p_b, w) = \frac{w}{p_a}$ if $p_a < p_b$.

II. $d_a(p_a, p_b, w) = \frac{w}{p_a}$ if $p_a \leq p_b$.

III. $d_b(p_a, p_b, w) = \frac{w}{p_b}$ if $p_b \leq p_a$.

IV. $d_b(p_a, p_b, w) = \frac{w}{p_b}$ if $p_b < p_a$.

V. $d_b(p_a, p_b, w) = \frac{w}{p_b^2}$ if $p_b < p_a$.

Which of the following statements is true?

(A) I and III (B) II and III (C) II and IV (D) I and V

27. Consider the same situation as in the previous question. Fix the consumer's income at w and consider changes in p_a and p_b. Which of the following is true?

(A) $d_a(p_a, p_b)$ and $d_b(p_a, p_b)$ are continuous in p_a, p_b.

(B) $d_a(p_a, p_b)$ is continuous in p_a, p_b but $d_b(p_a, p_b)$ is not continuous in p_a, p_b.

(C) $d_a(p_a, p_b)$ is not continuous in p_a, p_b but $d_b(p_a, p_b)$ is continuous in p_a, p_b.

(D) Neither $d_a(p_a, p_b)$ nor $d_b(p_a, p_b)$ are continuous in p_a, p_b.

28. Consider a two commodity world where a commodity bundle $x = (x_1, x_2)$. A consumer has a utility function $U(x_1, x_2) = 4x_1^2 + x_2^2$. For prices $p_1, p_2 > 0$ and income $w > 0$, she solves $\max_{x_1,x_2} u(x_1, x_2)$ subject to $p_1x_1 + p_2x_2 = w$. Let $X(p_1, p_2, w)$ be the set of solutions to her maximization problem, i.e it is the set of commodity bundles that are optimal at (p_1, p_2, w). Which of the following statements are true?

(A) $X(2, 1, 10)$ is not convex. (B) $X(6, 3, 30)$ is convex.

(C) $X(1, 1, 10)$ is not convex. (D) $X(4, 2, 20)$ is convex.

29. Suppose that a consumer has a preference relation represented by a utility function $U : \Re^2_+ \to \Re$, defined by

$$U(x, y) = \frac{x}{1 + x} + y.$$

If $p_x = p_y$ then

(A) the demand for good x is positive and the demand for good y is 0.

(B) the demand for good x is 0 and the demand for good y is positive.

(C) the demand for good x is positive and the demand for good y is positive.

(D) the demand for good x is 0 and the demand for good y is 0.

30. Consider an exchange economy with two consumers. Both consumers have the same preferences and endowments. If the preferences are strictly convex then the economy has

(A) no Pareto-efficient allocation.

(B) multiple competitive equilibrium allocations.

(C) exactly two Pareto-efficient allocations.

(D) only one competitive equilibrium allocation.