

IIT JAM

Economics

(FMTP)

Attempt ALL the 60 questions.

There are a total of 60 questions carrying 100 marks.

Section-A contains a total of 30 **Multiple Choice Questions (MCQ)**.

Q.1 - Q.10 carry 1 mark each and Questions Q.11 - Q.30 carry 2 marks each.

Section-B contains a total of 10 **Multiple Select Questions (MSQ)**. Questions

Q.31 - Q.40 belong to this section and carry 2 marks each with a total of 20 marks.

Section-C contains a total of 20 **Numerical Answer Type (NAT)** questions.

Questions Q.41 - Q.60 belong to this section and carry a total of 30 marks.

Q.41 - Q.50 carry 1 mark each and Questions Q.51 - Q.60 carry 2 marks each.

In **Section-A** for all 1 mark questions, $\frac{1}{3}$ marks will be deducted for each wrong answer. For all 2 marks questions, $\frac{2}{3}$ marks will be deducted for each wrong answer. In **Section-B** (MSQ), there is **NO NEGATIVE** and **NO PARTIAL** marking provisions. There is **NO NEGATIVE** marking in **Section-C** (NAT) as well.

Time : 3 Hours

MAX.MARKS : 100

MARKS SCORED :

MULTIPLE CHOICE QUESTIONS (MCQ) :

1. A firm practising price discrimination will be—
 - (A) Charging different prices for different qualities of a product
 - (B) Buying in the cheapest and selling in the dearest markets
 - (C) Charging different prices in different markets for a product
 - (D) Buying only from firms selling in bulk at a distance
2. The law of diminishing returns begins at the level of output where
 - (A) marginal cost is at a minimum.
 - (B) average variable cost is at a minimum.
 - (C) average fixed cost is at a maximum.
 - (D) None of the above is correct.

3. When an information asymmetry is observed after an agreement is obtained between individuals, it is called :
- (A) Signalling (B) Moral hazard
(C) None of the above (D) Both (A) and (B) above
4. What is the probability of getting a 2 or a 5 when a die is rolled?
- (A) $1/6$ (B) $1/4$ (C) $3/4$ (D) $1/3$
5. Permanent income hypothesis assumes positive correlation between which of the following pairs of variables ?
- (A) Permanent income and transitory income
(B) Permanent income and transitory consumption
(C) Permanent income and permanent consumption
(D) Transitory income and transitory consumption
6. The Keynesian theory of the business cycle regards _____ as the main source of economic fluctuations.
- (A) fluctuations in the quantity of money
(B) volatile expectations
(C) random fluctuations in productivity
(D) unanticipated fluctuations in aggregate demand
7. Inclusive growth objective was given for the first time in which five year plan of India?
- (A) 9th Five Year Plan (B) 10th Five Year Plan
(C) 11th Five Year Plan (D) 12th Five Year Plan
8. In the Union budget of 2020-21, Fiscal deficit is targeted at
- (A) 3.5% of GDP (B) 3.8% of GDP
(C) 2.7% of GDP (D) 2.4% of GDP
9. Which model of growth outlines how a steady economic growth rate results from a combination of three driving forces—labor, capital, and technology ?
- (A) Harrod-Domar model (B) Rostow's Model
(C) Neo classical (D) Solow model

10. As per new definition of poverty line as per the recommendation of Rangarajan committee, the percentage of persons below the Poverty Line in India is
 (A) 21.9% (B) 20.5% (C) 20.75% (D) 29.6%
11. Which of the following is not an assumption of indifference curve analysis of consumer's equilibrium ?
 (A) The consumer's indifference map for the two goods X and Y is based on his scale of preferences for them which does not change at all in this analysis
 (B) His money income is given and constant.
 (C) Prices of the two goods X and Y are also given and constant.
 (D) The goods X and Y are not homogeneous
12. For the function $Q = A \cdot K^\alpha \cdot L^\beta$ which of the following is correct ?
 (A) The degree of homogeneity is 1
 (B) Elasticity of substitution is equal to $\alpha + \beta$
 (C) Output elasticity with respect to capital is α
 (D) Marginal product of a factor = Average product of the factor
13. A perfectly competitive industry is at the point of equilibrium when
 (A) $MC = MR$
 (B) $MC = MR = AR$
 (C) the slope of MR curve should be less than the slope of the MC curve
 (D) $MR = P$
14. Which one of the following statement is not correct ?
 (A) Marginal cost is the increase in total cost resulting from a unit increase in output.
 (B) Average total cost is total cost per unit of output.
 (C) Average fixed cost plus average variable cost equals average total cost.
 (D) Total cost equals total fixed cost plus total average cost.
15. Which economic growth model stresses the importance of savings and investment as key determinants of growth ?
 (A) Harrod-Domar model (B) Rostow's Model
 (C) Lewis Model (D) Solow model

16. Match the following: List I contains types of unemployment and List II contains their meaning

List-I

List-II

- | | |
|-----------------------------|--|
| (a) Hidden unemployment | (i) the unemployment of potential workers that is not taken into account in official unemployment statistics |
| (b) Frictional unemployment | (ii) the time period in between jobs when a worker is searching for work |
| (c) Cyclical unemployment | (iii) occurs when there is not enough aggregate demand in the economy to provide jobs for everyone who wants to work |
| (d) Structural unemployment | (iv) occurs when the labor market is not able to provide jobs for everyone who wants to work |
- (A) a-(i), b-(iii), c-(ii) and d-(iv) (B) a-(i), b-(iii), c-(iv) and d-(ii)
(C) a-(iv), b-(i), c-(iii), d-(ii) (D) a-(i), b-(ii), c-(iii), d-(iv)

17. GDP is calculated by the following formula

- (A) $GDP = C + I + G + (X - M)$
(B) $GDP = C + I + G + (X - M) + NFIA$
(C) $GDP = C + I + G + (X - M) + NFIA - IT - Depreciation$
(D) $GDP = C + I + G + (X + M)$

18. The national income of a country for a given period is equal to the

- (A) total value of goods and services produced by the nationals
(B) sum of total consumption and investment expenditure
(C) sum of personal income of all individuals
(D) money value of final goods and services produced

19. Match the items of the List - I with those of List - II and suggest the correct code from the following :

List-I

List - II

- | | |
|------------------------|--|
| (a) GDP | (i) National income |
| (b) GDP at factor cost | (ii) NDP plus Net flow of income from abroad |

- | | |
|------------------------------------|--|
| (c) NNP at factor cost | (iii) Money value of final goods and services produced |
| (d) NNP | (iv) Total gross value added by all enterprises in the economy |
| (A) a-(i), b-(iii), c-(ii), d-(iv) | (B) a-(iii), b-(iv), c-(i), d-(ii) |
| (C) a-(iv), b-(iii), c-(ii), d-(i) | (D) a-(ii), b-(i), c-(iv), d-(iii) |

- 20.** Which one of the following is not covered in the approach adopted by "Niti Aayog" ?
- (A) Five year planning approach (B) Three year action agenda
(C) Seven year strategy (D) Fifteen year vision
- 21.** Slutsky equation explains the
- (A) Demand for durable goods.
(B) Supply of durable goods.
(C) Split between price, income and substitution effects.
(D) Demand for rare or non-reproducible goods
- 22.** Which of the following statements is not correct ?
- (A) Foreign Investment Promotion Board (FIPB) was abolished in May 2017
(B) FDI policy has further been liberalized in key sectors in Jan 2018
(C) 100% FDI under automatic route for Single Brand Retail Trading and has been allowed in Jan 2018
(D) Foreign airlines allowed to invest up to 100 % under approval route in Air India in Jan 2018
- 23.** A decrease in Cash Reserve Ratio (CRR) can lead to which among the following?
- (A) increase in cash availability of the banks (B) increase in repo rate
(C) decrease in SLR (D) increase in SLR
- 24.** The first fundamental Theorem of Welfare Economics requires
- (A) that there be an efficient market for every commodity.
(B) that the economy operates at some point on the utility possibility curve.
(C) producers and consumers to be price takers.
(D) All of the above

25. Difference equation is concerned with
 (A) Continuous changes (B) Discrete changes
 (C) Both of the above (D) None of the above
26. The focus of the economic policies pursued by the colonial government in India was
 (A) to reduce the country to being a raw material supplier for Great Britain's industries.
 (B) development of the Indian economy
 (C) transforming the country into supplier of finished industrial products
 (D) to estimate India's national and per capita income
27. The correct relationship among Arithmetic Mean (AM), Geometric Mean (GM) and Harmonic Mean (HM) is
 (A) $GM = AM + HM$ (B) $AM < HM$
 (C) $[GM]^2 = HM$ (D) $AM \times HM = GM^2$
28. Consider the following production function forms with a technical progress term $A(t)$.
 (a) $Q = f(Kt, A(t) \cdot Lt)$ (b) $Q = f(A(t) \cdot Kt, Lt)$ (c) $Q = A(t)f(Kt, Lt)$
 Of the above which production function, with labour augmenting technology will keep the distribution of output between labour and capital as constant? Answer from the code below :
 (A) Only (a) (B) Both (a) and (b) (C) Only (c) (D) Both (a) and (c)
29. Which amongst the following is a correct description of inverse demand function? Where p = price, D = demand and y = income
 (A) $p = f(D)$ (B) $D = f(p)$ (C) $D = f(1/p)$ (D) $p = f(D/Y)$
30. Fundamental equation for Solow model of growth that governs its dynamic is
 (A) $\Delta N/N = \Delta K/K$ (B) $sf(k^*) = (n + \delta)k$ (C) $Gw.Cr = s$ (D) $\Delta I/I = \alpha\sigma$

MULTIPLE SELECT QUESTIONS (MSQ) :

31. With reference to consumer theory , consider the following statements :
- (A) Consumer theory is the study of how people decide to spend their money.
 - (B) Through consumer theory, we are better able to understand how individuals' tastes and incomes influence the demand curve.
 - (C) Consumers choose those goods and services that bring the greatest benefit to them
 - (D) None of these
32. Which of the following features belong to Cournots' model of duopoly ?
- (a) It yields determinate and stable equilibrium for the duopolists
 - (b) It is an adequate representation of Nash equilibrium
 - (c) If the duopolists combine to form a monopoly, the price changed by them will be less than the equilibrium price without their combining together.
- Of the above which statements are true ? Choose from the code below :
- (1) All the above are correct
 - (2) (a) and (c) are correct
 - (3) (a) and (b) are correct
 - (4) (b) and (c) are correct
33. Which of the following are assumptions of Mundell-Fleming economic model?
- (I) Spot and forward exchange rates are not identical
 - (II) Taxes and saving increase with income
 - (III) Fixed money wage rate, unemployed resources and constant returns to scale are assumed
 - (IV) The balance of trade depends only on income and the exchange rate
- (1) I, II
 - (2) I, II, III
 - (3) II, III, IV
 - (4) I, II, III
34. Which among the following can result in 'demand pull inflation' ?
- (I) increase in subsidy on LPG
 - (II) increase in fuel prices
 - (III) decrease in income tax rates
- (1) I, III
 - (2) I, II
 - (3) II, III
 - (4) I, II, III

- 35.** Consider the following statements regarding the relative effectiveness of monetary and fiscal policies :
- (I) The relative effectiveness of monetary and fiscal policy depends upon the shape of the IS and LM curves and the economy's initial position
 - (II) If the economy is in the Keynesian range, monetary policy is ineffective and fiscal policy is highly effective
 - (III) In the classical range, monetary policy is ineffective and fiscal policy is effective.
 - (IV) In the intermediate range both monetary and fiscal policies are effective
- Which of the above statements is/ are correct ?
- (1) I, II, III (2) I, II and IV (3) II, III , IV (4) I, II, III, IV
- 36.** Which one of the following statements are correct regarding FEMA?
- (I) The Foreign Exchange Management Act, 1999 (FEMA) deals with cross border investments
 - (II) The Foreign Exchange Management Act, 1999 (FEMA) deals with foreign exchange transactions
 - (III) The Foreign Exchange Management Act, 1999 (FEMA) deals with transactions between residents and non-residents
 - (IV) The Foreign Exchange Management Act, 1999 (FEMA) controls capital account transactions also.
- (1) I and II (2) I, II and III (3) I, II and IV (4) I, II, III and IV
- 37.** Foreign Trade Policy 2015-20 contains specific measures to give boost to 'make in India'. These measures include :
- (I) Reduced Export Obligation (EO) for domestic procurement under EPCG scheme
 - (II) Specific Export Obligation under EPCG scheme, in case capital goods are procured from indigenous manufacturers has been reduced to 75%
 - (III) Specific Export Obligation under MEIS scheme, has been reduced to 75%
 - (IV) Higher level of rewards under MEIS for export items with high domestic content and value addition
- (1) I and II (2) I, II and III (3) I, II and IV (4) I, II, III and IV

38. With reference to Pradhan Mantri Jan Arogya Yojana (PM-JAY), consider the following statements

(I) It was launched in feb 2019 under the ambit of Aushman Bharat.

(II) Government provides health insurance cover of up to Rs. 1,00,000 per family per year

(III) Priority to girl child, women and and senior citizens

(IV) More than 10.74 crore poor and vulnerable families will be covered across the country

Which of the above statements are correct ?

Code :

(1) I and II (2) I, II and III (3) I, III and IV (4) I, II, III and IV

39. The Indian economy is becoming more formalised. This is indicated by which of the following shifts ? Select the correct answer from the codes given below :

(I) Introduction of GST.

(II) Demonetization.

(III) An increase in savings in the Non formal financial sector.

(IV) An increase in savings in the formal financial sector

(1) I and II (2) I, II and III (3) I, II and IV (4) I, II, III and IV

40. Which of the following measures formed part of the new economic policy, 1991?

(i) Devaluation

(ii) Disinvestment

(iii) Foreign Direct Investment

(iv) Extension of facilities available to foreign investors to the Non-Resident Indians.

Select the correct answer from the codes given below :

Codes :

(1) (i), (ii), (iii) and (iv)

(2) (i), (ii) and (iii)

(3) (i), (ii) and (iv)

(4) (ii), (iii) and (iv)

NUMERICAL ANSWER TYPE (NAT) :

41. Total cost function of a producer is $C = 10 + 5Q + 2Q^2$. If price is 15, what is marginal cost of the producer in equilibrium?
 42. The CPI value in 1975 was 54.6 and in 2018 it was 252.439. What was percentage rise in inflation during above period?
 43. According to Harrod Domar Growth model, If the savings rate is 10% and the capital output ratio is 2, then what will be the annual percentage growth of a country?
 44. In a class of 100 students, 35 like science and 45 like math. 10 like both. How many like either of them and how many like neither?
 45. In a moderately skewed distribution the values of mean and median are 5 and 6 respectively. What will be the value of mode in such a situation?
 46. If $AR = 15$ and $MR = 5$, What is the price elasticity of demand?
 47. According to neo-classical theory of distribution, constancy in the wage share in national income would come about when the elasticity of factor substitution will be equal to
 48. For the function $Q = A \cdot K^\alpha \cdot L^\beta$, What will be the output elasticity with respect to capital (k)?
 49. The number 102 has the positive divisors 1, 2, 3, 6, 17, 34, 51, 102, and the number -170 has the positive divisors 1, 2, 5, 10, 17, 34, 85, and 170. What is the greatest common divisor of two numbers ?
 50. A bag contains 5 red, 7 white and 3 green balls. One ball is randomly drawn from the bag. What is the probability that it is green?
- Q. 51 – Q. 60 carry two marks each.**
51. If dangerous fires are rare (1%) but smoke is fairly common (10%) due to barbecues, and 90% of dangerous fires make smoke then what is the probability of dangerous Fire when there is Smoke?
 52. Check whether the function $4x^2 - 1/2x - 1$ is continuous or not?

53. Evaluate the determinant $\Delta = \begin{bmatrix} 6 & 1 & 1 \\ 4 & -2 & 5 \\ 2 & 8 & 7 \end{bmatrix}$.
54. How do you find d^2y/dx^2 given $2x^2 - 3y^2 = 4$?
55. Find the output of the function $g(t) = 6t^2 + 5$ at $t = 2$.
56. Find the indefinite integral of the function $f(y) = 5$.
57. Maximise $Z = 3x + 4y$ subject to the constraints :
 $x + y \leq 4, x \geq 0, y \geq 0$
58. Find the values of x , at which the cubic function $f(x) = x^3 + ax^2 + bx + c$ is convex downward.
59. Determine order and degree(if defined) of differential equation
 $Y' + 5y = 0$
60. Let V be the set of n by 1 column matrices of real numbers, let the field of scalars be R , and define vector addition and scalar multiplication by
 $(x_1 \ x_2 \ \dots \ x_n) + (y_1 \ y_2 \ \dots \ y_n) = (x_1 + y_1, x_2 + y_2 \ \dots \ x_n + y_n)$
 $c(x_1 \ x_2 \ \dots \ x_n) = (cx_1 \ cx_2 \ \dots \ cx_n)$
 Verify existence of Associativity of vector addition, Distributivity and Existence of a zero in this case.

SECTION-(A) MCQ		SECTION-(B) MSQ		SECTION-(C) NAT	
Question	Answer	Question	Answer	Question	Answer
1	C	31	A, B, C	41	15
2	A	32	A, B	42	462.34%
3	B	33	B, C, D	43	5% per year
4	D	34	A, C	44	70 and 30 respectively
5	C	35	A, B, D	45	8
6	B	36	A, B, C	46	1.5
7	C	37	A, B, D	47	1
8	A	38	A, C, D	48	Output elasticity with respect to capital is Alpha
9	C	39	A, B, D	49	34
10	D	40	A, B, C, D	50	1/5
11	D			51	9%
12	C			52	1/2
13	B			53	-306
14	D			54	$d^2y/dx^2 = -8/9y^3$
15	A			55	29
16	D			56	$\int 5dy = 5y + C$
17	A			57	16
18	D			58	maximum value = 4.5, minimum value = 2.83
19	B			59	Sub.
20	A			60	Sub.
21	C				
22	D				
23	A				
24	D				
25	B				
26	A				
27	D				
28	A				
29	A				
30	B				

Hint and Solution

1. **(C)** Price discrimination is a strategy that consists of a business or seller charging a different price to various customers for the same product or service.

It is one of the competitive practices used by larger, established businesses in an attempt to profit from differences in supply and demand from consumers.

2. **(A)** The law of diminishing returns begins at the level of output where marginal cost is at a minimum.

Marginal cost is the increase in cost that accompanies a unit increase in output.

The law of diminishing returns, also referred to as the law of diminishing marginal returns, states that in a production process, as one input variable is increased, there will be a point at which the marginal per unit output will start to decrease, holding all other factors constant.

3. **(B)** When an information asymmetry is observed after an agreement is obtained between individuals, it is called moral hazard.

Asymmetric Information is defined as a market situation in which one party in a transaction has insufficient information about other party which leads to market failure.

Moral hazard and adverse selection are two terms used in economics, risk management and insurance to describe situations where one party is at a disadvantage.

Adverse selection occurs when there's a lack of symmetric information prior to a deal between a buyer and a seller, whereas moral hazard occurs when there is asymmetric information between two parties and change in behavior of one party after a deal is struck.

4. **(D)** Taking the individual probabilities of each number, getting a 2 is $1/6$ and so is getting a 5.

Applying the formula of compound probability,

Probability of getting a 2 or a 5,

$$P(2 \text{ or } 5) = P(2) + P(5) - P(2 \text{ and } 5)$$

$$\Rightarrow 1/6 + 1/6 - 0$$

$$\Rightarrow 2/6 = 1/3.$$

5. (C) Permanent income hypothesis assumes positive correlation between permanent income and permanent consumption.

A permanent income hypothesis is a theory of consumer spending which states that people will spend money at a level consistent with their expected long term average income.

The level of expected long term income then becomes thought of as the level of "permanent" income that can be safely spent.

6. (B) According to Keynes, business cycle is caused by variations in the rate of investment caused by fluctuations in the Marginal Efficiency of Capital.

The term 'marginal efficiency of capital' means the expected profits from new investments.

Entrepreneurial activity depends upon profit expectations. In his business cycle theory, Keynes assigns the major role to expectations.

Business cycles are periodic fluctuations of employment, income and output.

According to Keynes, income and output depend upon the volume of employment. The volume of employment is determined by three variables: the marginal efficiency of capital, the rate of interest and the propensity to consume.

In the short period the rate of interest and the propensity to consume are more or less stable. Therefore, fluctuations in the volume of employment are caused by fluctuations in the marginal efficiency of capital.

7. (C) Inclusive growth objective was given for the first time in 11th Five Year Plan.

Eleventh Plan aimed "Towards Faster & More Inclusive Growth.

The target of the 11th plan was not just faster growth but also inclusive growth, that is, a growth process which yields broad-based benefits and ensures equality of opportunity for all.

This broad vision of the Eleventh Plan includes several inter-related components: rapid growth that reduces poverty and creates employment opportunities, access to essential services in health and education especially for the poor, equality of opportunity, empowerment through education and skill development etc.

- 8. (A)** Fiscal Deficit is a term used to refer to the difference between the government's total revenue and total expenditure in a financial year.
Fiscal deficit is targeted at 3.5% of GDP, lower than the revised estimate of 3.8% in 2019-20.
Revenue deficit is targeted at 2.7% of GDP, which is higher than the revised estimate of 2.4% in 2019-20.
- 9. (C)** Robert Solow and Trevor Swan first introduced the neoclassical growth theory in 1956.
The theory states that economic growth is the result of three factors—labor, capital, and technology.
While an economy has limited resources in terms of capital and labor, the contribution from technology to growth is boundless.
- 10. (D)** The Rangarajan committee, which has retained consumption expenditure as the basis for determining poverty, has pegged the total number of poor in the country at 363 million or 29.6 per cent of the population against 269.8 million (21.9 per cent) by the Suresh Tendulkar committee.
The Rangarajan committee raised the daily per capita expenditure to Rs 32 from Rs 27 for the rural poor and to Rs 47 from Rs 33 for the urban poor, thus raising the poverty line based on the average monthly per capita expenditure to Rs 972 in rural India and Rs 1,407 in urban India.
- 11. (D)** A consumer is in equilibrium when given his tastes, and price of the two goods, he spends a given money income on the purchase of two goods in such a way as to get the maximum satisfaction.
The indifference curve analysis of consumer's equilibrium is based on the following assumptions :
- (1) The consumer's indifference map for the two goods X and Y is based on his scale of preferences for them which does not change at all in this analysis.
 - (2) His money income is given and constant.
 - (3) Prices of the two goods X and Y are also given and constant.
 - (4) The goods X and Y are homogeneous and divisible.
 - (5) There is no change in the tastes and habits of the consumer throughout the

analysis

(6) There is perfect competition in the market from where he makes his purchases of the two goods.

(7) The consumer is rational and thus maximises his satisfaction from the purchase of the two goods.

12. (C) The production function is the relationship that exists between the obtained output and the combination of factors used to obtain it.

The Cobb-Douglas Production Function is a particular form of the Production Function.

It takes the following form:

$$Q(L, K) = A L^{\beta} K^{\alpha}$$

" L: labor

" K: capital

" Q: output

If the Cobb-Douglas production function is $Q(L, K) = A L^{\beta} K^{\alpha}$, the output elasticity with respect to labor (L) is β and the output elasticity with respect to capital (K) is α .

13. (B) A firm is in equilibrium when it has no tendency to change its level of output. It needs neither expansion nor contraction.

Under a perfectly competitive industry these two conditions must be satisfied at the point of equilibrium, i.e.

$$MC = MR \dots (A)$$

$$AC = AR \dots (B)$$

$$AR = MR$$

$$MC = AC = AR$$

Such a situation represents full equilibrium of the industry.

14. (D) Total cost (TC) in the simplest terms is all the costs incurred in producing something or engaging in an activity.

Total cost (TC) describes the total economic cost of production and is made up of variable costs, which vary according to the quantity of a good produced and include inputs such as labor and raw materials, plus fixed costs, which are

independent of the quantity of a good produced and include inputs (capital) that cannot be varied in the short term, such as buildings and machinery.

15. (A) The Harrod-Domar economic growth model stresses the importance of savings and investment as key determinants of growth.

To maintain full employment equilibrium level of income, aggregate demand should be equal to aggregate supply. Thus we arrive at the fundamental equation of the model:

$\Delta I * 1/\alpha = I\sigma$, Solving this equation by dividing both sides by 'I' and multiplying by α we get:

$$\Delta I/I = \alpha\sigma,$$

where I is investment, ΔI is change in investment, α is propensity to save.

16. (D) Types of Unemployment

- **Classical** : occurs when real wages for jobs are set above the market-clearing level. It causes the number of job seekers to be higher than the number of vacancies.
- **Cyclical** : occurs when there is not enough aggregate demand in the economy to provide jobs for everyone who wants to work. Demand for goods and services decreases, less production is needed, and fewer workers are needed.
- **Structural** : occurs when the labor market is not able to provide jobs for everyone who wants to work. There is a mismatch between the skills of the unemployed workers and the skills needed for available jobs. It differs from frictional unemployment because it lasts longer.
- **Frictional** : the time period in between jobs when a worker is searching for work or transitioning from one job to another.
- **Hidden** : the unemployment of potential workers that is not taken into account in official unemployment statistics because of how the data is collected. For example, workers are only considered unemployed if they are looking for work so those without jobs who have stopped looking are no longer considered unemployed.
- **Long-term** : usually defined as unemployment lasting longer than one year.

17. (A) GDP at market price: is money value of all goods and services produced within the domestic domain with the available resources during a year.

GDP is made up of 4 Components

- consumption
- investment
- government expenditure
- net foreign exports of a country

$$\text{GDP} = C + I + G + (X - M)$$

Where,

C = Consumption

I = Investment

G = Government expenditure

(X – M) = Export minus import

18. (D) National income is the total value a country's final output of all new goods and services produced in one year

There are various concepts of National Income. The main concepts of NI are: GDP, GNP and NNP.

These different concepts explain about the phenomenon of economic activities of the various sectors of the various sectors of the economy.

National income = NNP (Net National Product) @Market price minus indirect tax plus subsidies.

Net National Product is the market value of all final goods and services after allowing for depreciation.

It is also called National Income at market price.

Gross National Product, GNP, is the total market value of all final goods and services produced annually in a country plus net factor income from abroad.

Thus, GNP is the total measure of the flow of goods and services at market value resulting from current production during a year in a country including net factor income from abroad.

19. (B) Gross domestic product (GDP) : GDP is the money value of all final goods and services produced in the domestic territory of a country in an accounting

year.

GDP at factor cost and at market price : The contribution of each producing unit to the current flow of goods and services is known as the net value added. GDP at factor cost is estimated as the sum of net value added by the different producing units.

Net national product (NNP) refers to gross national product (GNP), i.e. the total market value of all final goods and services produced by the factors of production of a country or other polity during a given time period, minus depreciation.

It can also be found out by adding the NFIA(net factor income from abroad) to the NDP.

Net domestic product (NDP) : While calculating GDP, no provision is made for depreciation. However, capital goods such as machines, equipment, tools, buildings, tractors, and so on, get depreciated during the process of production. When depreciation allowance is subtracted from GDP, NDP is got.

NNP at factor cost or national income : NNP at factor cost is the volume of commodities and services produced during an accounting year, counted without duplication.

In terms of income earned by the factors of production, NNP at factor cost or national income is defined as the sum of domestic factor incomes and NFIA.

20. (A) Abandoning the ancient concept of five-year plans that India has been following since 1951, the National Institution for Transforming India (NITI) Aayog has decided to come up with a 15-year vision document in tandem with global trends and economic growth.

Niti Aayog will prepare three inter-connected documents, with differing time frame.

These interconnected documents would include a vision document keeping in view the social goals set or proposed and sustainable development goals (SDGs) for about 15 years i.e. up to 2030, a seven-year strategy from 2017-18 to 2023-24 to convert the long-term vision into implementable policy and action as a part of "National Development Agenda" with a mid-term review after 3 years i.e. the year ending March 2020.

21. (C) The Slutsky equation named after Eugen Slutsky (1880–1948), relates changes in Marshallian (uncompensated) demand to changes in Hicksian (compensated) demand, which is known as such since it compensates to maintain a fixed level of utility.

There are two parts of the Slutsky equation, namely the substitution effect, and income effect.

He designed this formula to explore a consumer's response as the price changes.

The equation demonstrates that the change in the demand for a good, caused by a price change, is the result of two effects :

- **a substitution effect** : the good becomes relatively cheaper, so the consumer purchases other goods as substitutes
- **an income effect** : the purchasing power of a consumer increases as a result of a price decrease, so the consumer can now afford better products or more of the same products, depending on whether the product itself is a normal good or an inferior good.

22. (D) Foreign Investment Promotion Board (FIPB) which was the responsible agency to oversee the government route was abolished on May 24, 2017.

Henceforth, the work relating to processing of applications for FDI and approval of the Government thereon under the extant FDI Policy and FEMA, shall now be handled by the concerned Ministries/Departments in consultation with the Department for Promotion of Industry and Internal Trade(DPIIT) , Ministry of Commerce.

FDI policy further liberalized in key sectors in Jan 2018 :

- 100% FDI under automatic route for Single Brand Retail Trading
- 100% FDI under automatic route in Construction Development
- Foreign airlines allowed to invest up to 49% under approval route in Air India
- FIIs/FPIs allowed to invest in Power Exchanges through primary market.

23. (A) Under CRR(Cash Reserve Ratio) a certain percentage of the total bank deposits has to be kept in the current account with RBI which means banks do not have access to that much amount for any economic activity or commercial

activity.

Banks can't lend the money to corporates or individual borrowers, banks can't use that money for investment purposes.

In short, CRR is the amount in cash which banks have to keep with RBI. Any decrease in CRR will therefore increase cash availability with the banks.

Repo rate and SLR would not be affected by changes in CRR. They are separate mechanisms, the rate of which is decided by RBI.

- 24. (D)** The first theorem of welfare economics is based on the two assumptions:
1. In the economy, all commodities are competitive. The equilibrium in the economy is Pareto efficient.
 2. There is market for all commodities. Each commodity is produced in the economy and consumption of commodity adds to utility function.
- As long as producers and consumers act as price takers and there is a market for every commodity, the equilibrium allocation of resources is Pareto efficient. That is, the economy operates at some point on the utility possibilities frontier. An important implication of the First Welfare Theorem is that the price system allows Pareto efficiency to be achieved in a totally decentralized setting. Relative prices convey to people all of the information they need to know.

- 25. (B)** Difference equation, mathematical equality involving the differences between successive values of a function of a discrete variable.

A discrete variable is one that is defined or of interest only for values that differ by some finite amount, usually a constant and often 1; for example, the discrete variable x may have the values $x_0 = a$, $x_1 = a + 1$, $x_2 = a + 2$, . . . , $x_n = a + n$.

The function y has the corresponding values y_0 , y_1 , y_2 , . . . , y_n , from which the differences can be found:

$$\begin{aligned}\Delta y_0 &= y_1 - y_0 \\ \Delta y_1 &= y_2 - y_1 \\ &\dots \\ \Delta y_n &= y_{n+1} - y_n\end{aligned}$$

Differential equation are great for modeling situations where there is a continually changing population or value. If the change happens incrementally rather than continuously then we will use difference equations which are recursively defined sequences.

26. (A) The sole purpose of the British colonial rule in India was to reduce the country to being a raw material supplier for Great Britain' own rapidly expanding modern industrial base.

The economic policies pursued by the colonial government in India were concerned more with the protection and promotion of the economic interests of their home country than with the development of the Indian economy.

Such policies brought about a fundamental change in the structure of the Indian economy — transforming the country into supplier of raw materials and consumer of finished industrial products from Britain.

Obviously, the colonial government never made any sincere attempt to estimate India's national and per capita income.

27. (D) For two numbers x and y , let x, a, y be a sequence of three numbers.

If x, a, y is an arithmetic progression then 'a' is called arithmetic mean.

If x, a, y is a geometric progression then 'a' is called geometric mean.

If x, a, y form a harmonic progression then 'a' is called harmonic mean.

Let AM = arithmetic mean, GM = geometric mean, and HM = harmonic mean.

The relationship between the three is given by the formula

$$AM \times HM = GM^2$$

28. (A) According to Harrod, neutral technical progress is one which leaves capital output ratio unchanged, provided that rate of profit remains constant.

Thus, Harrod's neutrality of technical progress requires the constancy of both the rate of profit r and capital output ratio K/Y .

If the rate of profit remains unchanged and the capital output ratio increases, the technical progress would be labour-saving.

The assumption of constant capital output ratio implies that the capital stock and labour force must grow at same rate.

Harrod's neutrality can be shown in the form of production function as:

$$Q = [F K, A(t) L]$$

Here Q is a function of F and K and $A(t) L$ means that the given constant return to scale on equal proportionate rise in capital (K) and labour units [$A(t) L$] must lead to proportionate rise in national output Q .

The constant rate of interest increases the efficiency of labour in whole economy.

- 29. (A)** In economics, an 'inverse demand function', $P = f^{-1}(Q)$, is a function that maps the quantity of output demanded to the market price (dependent variable) for that output.

Quantity demanded, Q , is a function of price; the inverse demand function treats price as a function of quantity demanded, and is also called the price function. Note that the inverse demand function is not the reciprocal of the demand — the word "inverse" refers to the mathematical concept of an inverse function.

- 30. (B)** The central idea of the Solow growth model is an economy which is reaching steady state.

The steady state as a situation when the capital stock rises at a constant rate, though capital per capita does not rise.

Fundamental equation for the model that governs its dynamic:

$$\Delta k = sf(k) - (\delta + n)k$$

The term $sf(k)$ denotes gross investment, the term $(\delta + n)k$ denotes investment that goes to replacement of depreciated capital δk and to equipment of new workers with capital nk .

The steady state level of capital per worker k^* is determined by :

$sf(k^*) = (n + \delta)k^*$ which gives constant level of production per capita.

- 31. (A, B, C)** Consumer theory is the study of how people decide to spend their money, given their preferences and budget constraints.

A branch of microeconomics, consumer theory shows how individuals make choices, given restraints, such as their income and the prices of goods and services.

Through consumer theory, we are better able to understand how individuals' tastes and incomes influence the demand curve.

These choices are among the most critical factors, shaping the overall economy. Consumers are able to choose different bundles of goods and services; logically, they choose those that bring the greatest benefit (or maximizes utility, in economic terms).

Consumer theory is based on the premise that we can infer what people like

from the choices they make.

32. (A, B) Cournot duopoly, also called Cournot competition, is a model of imperfect competition in which two firms with identical cost functions compete with homogeneous products in a static setting.

Cournot's duopoly represented the creation of the study of oligopolies, more particularly duopolies, and expanded the analysis of market structures which, until then, had concentrated on the extremes: perfect competition and monopolies.

What Cournot's approach does is maximise both market share and profitability by defining optimum prices.

This price will be the same for both companies, as otherwise the one with the lower price will obtain full market share, which makes this a Nash equilibrium, also known for this model the Cournot-Nash equilibrium.

(Nash equilibrium is a stable state of a system involving the interaction of different participants, in which no participant can gain by a unilateral change of strategy if the strategies of the others remain unchanged.)

33. (B, C, D) The Mundell–Fleming model is an economic model first set forth (independently) by Robert Mundell and Marcus Fleming.

The model is an extension of the IS–LM model. Whereas the traditional IS-LM model deals with economy under autarky (or a closed economy), the Mundell–Fleming model describes a small open economy.

Basic assumptions of the model are as follows:

Spot and forward exchange rates are identical, and the existing exchange rates are expected to persist indefinitely.

Fixed money wage rate, unemployed resources and constant returns to scale are assumed. Thus domestic price level is kept constant, and the supply of domestic output is elastic.

Taxes and saving increase with income.

The balance of trade depends only on income and the exchange rate.

Capital mobility is less than perfect and all securities are perfect substitutes.

Only risk neutral investors are in the system.

The country under consideration is so small that the country cannot affect foreign incomes or the world level of interest rates.

34. (A, C) Demand-pull inflation occurs when the overall demand for goods and services in an economy increases more rapidly than the economy's production capacity. It creates a demand-supply gap with higher demand and lower supply, which results in higher prices.

Increase in subsidy of LPG will reduce the pocket expenditure of people on LPG, making more money available with them, thereby increasing demand and pulling inflation.

Similar will be the effect of decrease of income tax rates – more money availability.

Increase in fuel prices will lead to cost-push inflation.

35. (A, B, D) The relative effectiveness of monetary and fiscal policy has been the subject of controversy among economists. The monetarists regard monetary policy more effective than fiscal policy for economic stabilization.

On the other hand, the keynesians hold the opposite view.

In between these two extreme views, there are the synthesists who advocate the middle path.

Modern economists explain these three views in terms of the elasticities of the IS-LM curves.

The IS curve represents fiscal policy and the LM curve represents monetary policy.

The relative effectiveness of monetary and fiscal policy depends upon the shape of the IS and Lm curves and the economy's initial position.

If the economy is in the Keynesian range, monetary policy is in effective and fiscal policy is highly effective.

On the other hand, in the classical range, monetary policy is effective and fiscal policy is ineffective.

But in the intermediate range both monetary and fiscal policies are effective.

In fact, in the intermediate range, the effectiveness of monetary and fiscal policies depends largely on the elasticities of the IS curve. If the IS curve is

inelastic, fiscal policy is more effective than monetary policy.

On the other hand, if the IS curve is elastic, monetary policy is more effective than fiscal policy.

36. (A, B, C) The Foreign Exchange Management Act, 1999 (FEMA) deals with cross border investments, foreign exchange transactions and transactions between residents and non-residents. It has come into force from June 1, 2000.

Capital account transactions though liberalised to a great extent, continue to be regulated – by RBI in respect of transactions involving debt instruments and by the Government of India in respect of other transactions.

Section 6 of FEMA . Capital account transactions.—

(1) Subject to the provisions of sub-section (2), any person may sell or draw foreign exchange to or from an authorised person for a capital account transaction.

—(1) Subject to the provisions of sub-section (2), any person may sell or draw foreign exchange to or from an authorised person for a capital account transaction."

(2) The Reserve Bank may, in consultation with the Central Government, specify—

(a) any class or classes of capital account transactions which are permissible;

(b) the limit up to which foreign exchange shall be admissible for such transactions: Provided that the Reserve Bank shall not impose any restriction on the drawal of foreign exchange for payments due on account of amortization of loans or for depreciation of direct investments in the ordinary course of business.

37. (A, B, D) BOOST TO "MAKE IN INDIA"

Reduced Export Obligation (EO) for domestic procurement under EPCG scheme: Specific Export Obligation under EPCG scheme, in case capital goods are procured from indigenous manufacturers, which is currently 90% of the normal export obligation (6 times at the duty saved amount) has been reduced to 75%, in order to promote domestic capital goods manufacturing industry.

Higher level of rewards under MEIS for export items with high domestic content and value addition.

It is proposed to give higher level of rewards to products with high domestic

content and value addition, as compared to products with high import content and less value addition.

38. (A, C, D) Under the ambit of Ayushman Bharat, a Pradhan Mantri Jan Arogya Yojana (PM-JAY) to reduce the financial burden on poor and vulnerable groups arising out of catastrophic hospital episodes and ensure their access to quality health services was conceived.

Benefits of PM-JAY include

- Government provides health insurance cover of up to Rs. 5,00,000 per family per year.
- More than 10.74 crore poor and vulnerable families (approximately 50 crore beneficiaries) covered across the country.
- All families listed in the SECC database as per defined criteria will be covered. No cap on family size and age of members.
- Priority to girl child, women and and senior citizens.
- Free treatment available at all public and empaneled private hospitals in times of need.
- Cashless and paperless access to quality health care services.
- Hospitals will not be allowed to charge any additional money from beneficiaries for the treatment.

39. (A, B, D) The Indian economy is becoming more formalized.

This is indicated by four key shifts .

First, the introduction of the goods and services tax (GST) has brought more firms into the tax net. The number of enterprises paying indirect taxes has gone up by 3.4 million, an increase of 50%.

Second, only around a quarter of the 240 million Indian working outside farms file their income tax returns. The demonetization decision taken in November 2016 seems to have led to a statistically significant increase in the number of new income tax filers, after controlling for obvious problems such as the previous trend as well as seasonal patterns of change.

Third, the Indian workforce is more formalized than most people believed till recently. Nearly a third of the non-farm Indian workforce of 240 million has some

social security coverage. And more than half of the non-farm workforce is employed in firms that now pay taxes.

Fourth, the demonetization shock is one reason—and perhaps not the only reason—why Indians are putting a greater proportion of their savings in the formal financial sector.

These four shifts—more firms paying indirect taxes, more individual filing income tax returns, a big increase in the proportion of formal jobs and the increase in savings in the formal financial sector—can have profound effects on the Indian economy if they are sustained.

40. (A, B, C, D) New economic policy, 1991 refers to ongoing economic liberalisation or relaxation started in 1991 of the countries economic policies.

It was introduced with the goal of making the economy more market-oriented and expanding the role of the private and foreign investment.

Specific changes include the reduction in import tariffs, deregulation of markets, reduction of taxes, and greater foreign investment.

The first aspect of new economic policy was liberalization.

Liberalisation of an economy means removing or relaxing government controls and restrictions on economic activities.

Relief for foreign investors, Revaluation of Indian Currency, New Industrial Policy, New Trade Policy, Import Technology, Encouraging foreign tie-ups, Privatisation in Public Sector.

41. 15

A firm (producer) is said to be in equilibrium when it has no inclination to expand or to contract its output. This state either reflects maximum profits or minimum losses.

According to MR-MC approach, producer's equilibrium refers to stage of that output level at which: $MC = MR$

As long as MC is less than MR, it is profitable for the producer to go on producing more because it adds to its profits. He stops producing more only when MC becomes equal to MR

To find the profit maximizing quantity, set $MR = MC$ (MR : Marginal Revenue,

MC : Marginal cost)

When Price is = 15

Total revenue R for a firm is the selling price(P_x) times the quantity sold(Q)

$R = P_x Q$ or $15Q$ (in our case) and

$MR = dR/dQ = 15$

Total cost function of a producer is $C = 10 + 5Q + 2Q^2$

Therefore, $MC = dC/dQ = 5 + 4Q$

Setting $MR = MC$ yields

$$15 = 5 + 4Q \quad \text{therefore } Q = 2.5$$

Marginal cost or price of the producer in equilibrium will be

$$P = MC \text{ or } P = 5 + 4Q$$

$$P = 5 + 4 \times 2.5 = 15$$

42. 462.34%

The Formula for Measuring Inflation is

Change in Inflation = (Final CPI Index Value/Initial CPI Value)

So, if we put the values we get

$$\text{Rise in Inflation} = (252.439/54.6) = 4.6234 = 462.34\%$$

43. 5% per year

Basically, the Harrod Domar Growth model suggests that the economy's rate of growth depends on:

The level of national saving (S) and the productivity of capital investment (this is known as the capital-output ratio)

Rate of growth of GDP = Savings ratio / capital output ratio.

Therefore, If the savings rate is 10% and the capital output ratio is 2, then a country would grow at $10\%/2 = 5\%$ per year.

44. 70 and 30 respectively

Total number of students, $n(\mu) = 100$

Number of science students, $n(S) = 35$

Number of math students, $n(M) = 45$

Number of students who like both, $n(M \cap S) = 10$

Number of students who like either of them,

$$n(M \cup S) = n(M) + n(S) - n(M \cap S)$$

$$\rightarrow 45 + 35 - 10 = 70$$

$$\text{Number of students who like neither} = n(\mu) - n(M \cup S) = 100 - 70 = 30$$

45. 8

In statistics, skewness is a measure of the asymmetry of the probability distribution of a random variable about its mean.

In case of a moderately skewed distribution, the difference between mean and mode is almost equal to three times the difference between the mean and median.

$$\text{Mean} - \text{Mode} = 3 (\text{Mean} - \text{Median})$$

$$\text{Therefore, Mode} = 3 \times \text{median} - 2 \times \text{mean}$$

$$\text{Given that, mean} = 5, \text{ median} = 6$$

If we put the given values, we get

$$\text{Mode} = 3(6) - 2(5) = 8.$$

46. 1.5

$$E = AR / AR - MR$$

Where, AR stands for Average Revenue

MR stands for Marginal Revenue

E stands for Elasticity of Demand.

$$\text{In our case, AR} = 15, \text{ MR} = 5$$

$$\text{Therefore, } E = 15 / (15 - 5) = 15 / 10 = 1.5$$

$$\text{Elasticity of demand, } E = 1.5$$

47. 1

According to neo-classical theory of distribution, constancy in the wage share in national income would come about only when the elasticity of factor substitution is equal to 1.

Elasticity of factor substitution is defined as the proportionate change in the factor- proportions to the proportionate change in the marginal rate of technical substitution, so that the output remains the same.

The Neo-Classical theory of distribution shows the division of National income among the factors of production.

The output produced will depend on the contribution of factor to production. The national income generated will depend on the total output produced. An elasticity of 1 (= 100%) means that the two variables change in the same proportion. Therefore the proportional response to one of the variables is equal to the change in the other variable.

48. Output elasticity with respect to capital is α

The production function is the relationship that exists between the obtained output and the combination of factors used to obtain it.

The Cobb-Douglas Production Function is a particular form of the Production Function.

It takes the following form :

$$Q(L, K) = A L^\beta K^\alpha$$

L : labor

K : capital

Q : output

If the Cobb-Douglas production function is $Q(L, K) = A L^\beta K^\alpha$, the output elasticity with respect to labor (L) is β and the output elasticity with respect to capital (K) is α .

49. 34

The number 102 has the positive divisors 1, 2, 3, 6, 17, 34, 51, 102, and the number -170 has the positive divisors 1, 2, 5, 10, 17, 34, 85, and 170.

The common positive divisors are 1, 2, 17, and 34. Hence $(102, -170) = 34$

50. 1/5

Total number of balls = $5 + 7 + 3 = 15$

Out of this number of green balls = 3

Probability of getting a green ball = $3 / 15 = 1 / 5$

51. 9%

Bayes' Theorem is a way of finding a probability when we know certain other probabilities.

The formula is :

$$P(A|B) = P(A) P(B|A) / P(B)$$

Which tells us : how often A happens given that B happens, written $P(A|B)$,
 When we know : how often B happens given that A happens, written $P(B|A)$
 and how likely A is on its own, written $P(A)$
 and how likely B is on its own, written $P(B)$

Using Bay's theorem formula, We see

$$P(\text{Fire}|\text{Smoke}) = P(\text{Fire}) P(\text{Smoke}|\text{Fire}) / P(\text{Smoke}) = 1\% \times 90\% / 10\% = 9\%$$

So the "Probability of dangerous Fire when there is Smoke" is 9%

52. 1/2

Mathematically, A function is said to be continuous at a point $x = a$, if

$\lim_{x \rightarrow a} f(x)$ Exists, and

$$\lim_{x \rightarrow a} f(x) = f(a)$$

It implies that if the left hand limit (L.H.L), right hand limit (R.H.L) and the value of the function at $x=a$ exists and these parameters are equal to each other, then the function f is said to be continuous at $x=a$.

If the function is undefined or does not exist, then we say that the function is discontinuous.

At $x = 1/2$, the value of denominator is 0. So the function is discontinuous at $x = 1/2$

53. -306

For a 2×2 matrix : $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$

The determinant is defined as

$$|A| = ad - bc$$

For a 3×3 matrix (3 rows and 3 columns)

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$

- Multiply a by the determinant of the 2×2 matrix that is not in a's row or column.
- Likewise for b, and for c
- Sum them up, but remember the minus in front of the b

$$|C| = 6 \times (-2 \times 7 - 5 \times 8) - 1 \times (4 \times 7 - 5 \times 2) + 1 \times (4 \times 8 - (-2 \times 2))$$

$$= 6 \times (-54) - 1 \times (18) + 1 \times (36) = -306$$

54. $d^2y/dx^2 = -8/9y^3$

$$2x^2 - 3y^2 = 4$$

Differentiating implicitly we get;

$$4x - 6y/dydx = 0$$

$$\therefore dy/dx = 4x/6y$$

$$\therefore dy/dx = 2x/3y$$

So, using the quotient rule

$$d/dx(u/v) = vdu/dx - u dv/dx/v^2$$

the second derivative is given by:

$$d^2y/dx^2 = (3y)(d/dx^2x) - (2x)(d/dx^3y)(3y)^2$$

$$\therefore d^2y/dx^2 = 6y - (2x)(dy/dxd/dy^3y)9y^2$$

$$\therefore d^2y/dx^2 = 6y - 6xdy/dx/9y^2$$

$$\therefore d^2y/dx^2 = 6y - 6x(2x/3y)/9y^2$$

$$\therefore d^2y/dx^2 = 6y - 4x^2/y/9y^2$$

$$\therefore d^2y/dx^2 = 6y^2 - 4x^2/9y^3$$

$$\therefore d^2y/dx^2 = 2 \cdot 3y^2 - 2x^2/9y^3$$

$$\text{But } 2x^2 - 3y^2 = 4 \Rightarrow 3y^2 - 2x^2 = -4$$

$$\therefore d^2y/dx^2 = 2 - 4/9y^3$$

$$\therefore d^2y/dx^2 = -8/9y^3$$

55. 29

A function is a relation between a set of inputs and a set of permissible outputs with the property that each input is related to exactly one output.

Functions are generally represented as $f(x)$

$$\text{Let , } f(x) = x^{\{3\}}$$

It is said as f of x is equal to x cube.

$$\text{The given function is } g(t) = 6t^2 + 5$$

$$\text{At } t = 2, g(2) = 6(2)^2 + 5 = 29$$

56. $\int 5dy = 5y + C$

The indefinite integral of a function $f(x)$ with respect to x is denoted by :

$$\int f(x)dx.$$

The function appearing inside the integral, $f(x)$, is known as the integrand.

We can find the indefinite integral of a function using the rules for finding the indefinite integral.

It is important to note that the indefinite integral of a function is a function itself.

We denote this function by $F(x)$, so we can write

$$\int f(x)dx = F(x) + C$$

where C is called the constant of integration and arises from the constant rule of differentiation.

the constant rule of differentiation is

$$\int adx = ax + C,$$

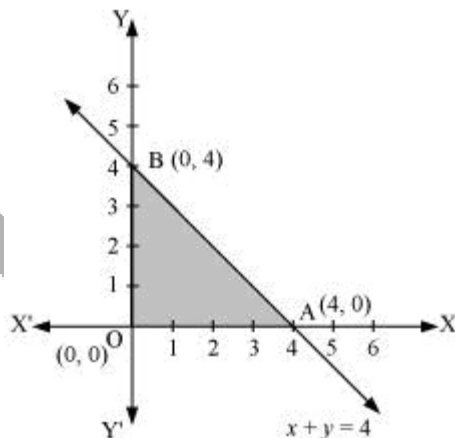
Therefore

indefinite integral of the function $f(y) = 5$ will be

$$\int 5dy = 5y + C$$

57. 16

The feasible region determined by the constraints, $x + y \leq 4$, $x \geq 0$, $y \geq 0$, is as follows.



The corner points of the feasible region are $O(0, 0)$, $A(4, 0)$ and $B(0, 4)$. The values of Z at these points are as follows.

Corner Point	$Z = 3x + 4y$	
$O(0,0)$	0	
$A(4,0)$	12	
$B(0,4)$	16	→ Maximum

Therefore, the maximum value of Z is 16 at the point $B(0, 4)$.

58. maximum value = 4.5, minimum value = 2.83

We compute the second derivative of the given function :

$$f'(x) = (x^3 + ax^2 + bx + c)' = 3x^2 + 2ax + b;$$

$$f''(x) = (3x^2 + 2ax + b)' = 6x + 2a.$$

The function is convex upward if $f''(x) \leq 0$. Find the corresponding values of x .

$$f''(x) \leq 0, \Rightarrow 6x + 2a \leq 0, \Rightarrow 6x \leq -2a, \Rightarrow x \leq -a/3$$

As it can be seen, only the point $x = \sqrt{2}$ falls in the interval $[0.5, 2]$.

Calculate the values of the function at the extremum point $x = \sqrt{2}$ and at the boundary points of the interval :

$$f(\sqrt{2}) = \sqrt{2} + 2/\sqrt{2} = 2\sqrt{2} \approx 2.83; f(0.5) = 0.5 + 2/0.5 = 4.5; f(2) = 2 + 2/2 = 3.$$

So the maximum value of the function in this interval is equal to 4.5 at the point $x = 0.5$ and the minimum value is 2.83 at $x = \sqrt{2}$.

59. The given differential equation is

$$Y' + 5y = 0$$

The highest order derivative present in the differential equation is y' . Therefore, its order is one.

It is a polynomial equation in y' . The highest power raised to y' is 1. Hence, its degree is one.

60. Associativity of vector addition : $(u + v) + w = u + (v + w)$ for all $u, v, w \in V$

$$((x_1, x_2, \dots, x_n) + (y_1, y_2, \dots, y_n)) + (z_1, z_2, \dots, z_n) = (x_1 + y_1, x_2 + y_2, \dots, x_n + y_n) + (z_1, z_2, \dots, z_n)$$

$$= ((x_1 + y_1) + z_1, (x_2 + y_2) + z_2, \dots, (x_n + y_n) + z_n)$$

$$= (x_1 + (y_1 + z_1), x_2 + (y_2 + z_2), \dots, x_n + (y_n + z_n))$$

$$= (x_1, x_2, \dots, x_n) + ((y_1, y_2, \dots, y_n) + (z_1, z_2, \dots, z_n))$$

Thus Associativity of vector addition is proved.

Existence of a zero vector: There is a vector in V , written 0 and called the zero vector, which has the property that $u + 0 = u$ for all $u \in V$

Existence of a zero vector is proven by showing that the all-zero column matrix satisfies the conditions for being a zero vector:

$$(x_1 x_2 \dots x_n) + (0 0 \dots 0) = (x_1 x_2 \dots x_n)$$

Distributivity :

Distributivity : $(a + b)u = au + bu$ and $a(u + v) = au + av$ for all $a, b \in F$ and $u, v \in V$.

$$A((x_1 x_2 \dots x_n) + (y_1 y_2 \dots y_n)) = (a(x_1 + y_1)a(x_2 + y_2) \dots a(x_n + y_n))$$

$$= (ax_1 + ay_1 ax_2 + ay_2 \dots ax_n + ay_n) = a(x_1 x_2 \dots x_n) + a(y_1 y_2 \dots y_n)$$

$$\text{and } (a + b)(x_1 x_2 \dots x_n) = ((a + b)x_1 (a + b)x_2 \dots (a + b)x_n)$$

$$= (ax_1 + bx_1 ax_2 + bx_2 \dots ax_n + bx_n) = a(x_1 x_2 \dots x_n) + b(x_1 x_2 \dots x_n)$$

VPM CLASSES