# 1. MATRICES & DETERMINANTS

**I. ONE mark questions:**

1) If $A = \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}, find\ 2A'$ **[Apr 2019]**
2) If $A = \begin{bmatrix} 1 & -3 & 5 \\ 6 & 2 & 4 \end{bmatrix}, find\ 5A'$ **[Apr 2015, 2017]**
3) If $A = \begin{bmatrix} 1 & -5 & 4 \\ 2 & 3 & 6 \end{bmatrix}, find\ 4A'$ **[July 2018]**
4) Find x such that $\begin{bmatrix} 3 & x \\ 4 & 7 \end{bmatrix}$ *is symmetric.* **[July 2015]**
5) Find x if $\begin{vmatrix} 4 & x \\ x & 16 \end{vmatrix} = 0$ **[Apr 2016]**
6) Evaluate: $\begin{vmatrix} 400 & 404 \\ 408 & 412 \end{vmatrix}$ **[July 2016]**
7) Evaluate: $\begin{vmatrix} 3200 & 3201 \\ 3202 & 3203 \end{vmatrix}$ **[July 2016]**
8) Evaluate: $\begin{vmatrix} 5431 & 5433 \\ 5435 & 5437 \end{vmatrix}$ **[June 2019]**
9) Evaluate: $\begin{vmatrix} 500 & 503 \\ 506 & 509 \end{vmatrix}$
10) Evaluate: $\begin{vmatrix} 4000 & 4001 \\ 4002 & 4003 \end{vmatrix}$
11) If $A = \begin{bmatrix} 2 & 4 \\ 3 & -1 \\ 4 & 0 \end{bmatrix}$ *show that* $(A')' = A$ **[Apr 2018]**
12) If $A = [5 \quad -6 \quad 3],\ B = \begin{bmatrix} -3 \\ 1 \\ 0 \end{bmatrix}$ *find AB*
13) If $A = \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ *and* $B = \begin{bmatrix} -1 \\ 3 \end{bmatrix}, find\ AB$ **[Apr 2018]**
14) If $\begin{bmatrix} 2a-1 & 5 \\ b+3 & 0 \end{bmatrix}$ *is a skew symmetric matrix find* $a, b.$
15) If $\begin{bmatrix} 5x & 2 \\ -10 & 1 \end{bmatrix}$ *is a singular matrix, find* $x.$
16) If $\begin{bmatrix} 2x & -9 \\ -4 & 5x \end{bmatrix}$ *is a singular matrix, find* $x.$
17) If $\begin{bmatrix} 3 & 2 & x \\ 4 & 1 & -1 \\ 0 & 3 & 4 \end{bmatrix}$ *is a singular matrix, find* $x.$

**II. TWO mark questions:**

1) Solve using Crammer's rule: $3x + 4y = 7, \quad 7x - y = 6$ **[Apr 2015, 2018]**
2) Solve using Crammer's rule: $5x + 7y = 3, \quad 7x + 5y = 9$ **[July 2015]**
3) Solve using Crammer's rule: $2x + 5y = 1, \quad 3x + 2y = 7$ **[July 2016]**
4) Solve using Crammer's rule: $3x + 2y = 8, \quad 4x - 3y = 5$ **[Apr 2018]**
5) Solve using Crammer's rule: $2x + 3y = 11, \quad x - y - 3 = 0$
6) Solve using Crammer's rule: $2x + y = 1, \quad x - 3y = 4$

7) If $\begin{bmatrix}2 & -1\\3 & 1\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix}=\begin{bmatrix}10\\2\end{bmatrix}$, find x and y **[Apr 2016]**

8) If $A=\begin{bmatrix}-4 & -3\\-2 & -1\end{bmatrix}, find\ A^{-1}$ **[Apr 2017]**

9) If $A=\begin{bmatrix}2\\-1\\3\end{bmatrix}, B=[1 \quad 4 \quad 2]\ find\ AB\ and\ BA$ **[July 2017]**

10) If $A=\begin{bmatrix}2 & 3 & 1\\1 & -2 & 0\end{bmatrix}\ and\ B=\begin{bmatrix}1 & -2 & 4\\1 & 3 & 2\end{bmatrix}\ find\ 2A-3B$ **[July 2018]**

11) If $A=\begin{bmatrix}1 & 3 & -1\\-1 & 0 & 2\end{bmatrix}\ and\ B=\begin{bmatrix}4 & -1 & 2\\1 & 3 & -2\end{bmatrix}\ find\ A-3B$ **[Apr 2019]**

12) If $A=\begin{bmatrix}2 & -1\\-1 & 2\end{bmatrix}$ then show that: $A^2-4A+3I=0$

13) If $A=\begin{bmatrix}2 & 3\\4 & 5\end{bmatrix}\ show\ that: A^2-7A-2I=0$ **[Apr 2018]**

14) If $\begin{bmatrix}x+y & 3\\-1 & x-y\end{bmatrix}=\begin{bmatrix}4 & 3\\-1 & 8\end{bmatrix} find\ x\ and\ y$ **[June 2019]**

**III. THREE mark questions:**

1) If $A=\begin{bmatrix}1 & 2 & 2\\2 & 1 & 2\\2 & 2 & 1\end{bmatrix}, then\ prove\ that: A^2-4A-5I=0$ **[Apr 2015, July 2018]**

2) If $A=\begin{bmatrix}2 & 3\\-4 & 1\end{bmatrix}\ and\ B=\begin{bmatrix}-1 & 5\\6 & 2\end{bmatrix}\ then\ show\ that: (AB)'=B'A'$ **[Apr 2019]**

3) If $A=\begin{bmatrix}2 & -1\\1 & 4\end{bmatrix}\ and\ B=\begin{bmatrix}-3 & 2\\-1 & 4\end{bmatrix}\ then\ show\ that: (AB)'=B'A'$ **[July 2015, Apr 17]**

4) If $A=\begin{bmatrix}2 & 3\\-4 & 1\end{bmatrix}\ and\ B=\begin{bmatrix}-1 & 5\\6 & 2\end{bmatrix}\ then\ show\ that: (AB)'=B'A'$ **[July 2016]**

5) If $A=\begin{bmatrix}1 & 2\\1 & 4\end{bmatrix}, B=\begin{bmatrix}4 & -3\\2 & 1\end{bmatrix}\ and\ C=\begin{bmatrix}1 & 0\\-2 & 4\end{bmatrix}$, show that: $A(B+c)=AB+AC$ **[Apr 2016]**

6) If $2A+B=\begin{bmatrix}3 & -1\\-2 & 5\end{bmatrix} and\ A-2B=\begin{bmatrix}4 & 2\\-1 & 5\end{bmatrix}\ then\ find\ A\ and\ B$ **[July 2017]**

7) If $A=\begin{bmatrix}2 & -1\\-3 & 1\\4 & 0\end{bmatrix}\ find\ AA^T$ **[June 2019]**

8) Solve for x: $\begin{vmatrix}x+2 & 3 & 4\\2 & x+3 & 4\\2 & 3 & x+4\end{vmatrix}=0$ **[July 2015]**

9) Solve for x: $\begin{vmatrix}2+x & 3 & -4\\2 & 3+x & -4\\2 & 3 & -4+x\end{vmatrix}=0$ **[July 2017]**

10) Prove that: $\begin{vmatrix}1 & a & bc\\1 & b & ca\\1 & c & ab\end{vmatrix}=(a-b)(b-c)(c-a)$ **[Apr 2015]**

11) Prove that: $\begin{vmatrix}1 & 1 & 1\\a & b & c\\bc & ca & ab\end{vmatrix}=(a-b)(b-c)(c-a)$ **[July 2018]**

12) Prove that: $\begin{vmatrix}1 & a+b & a^2+b^2\\1 & b+c & b^2+c^2\\1 & c+a & c^2+a^2\end{vmatrix}=(a-b)(b-c)(c-a)$ **[Apr 2016]**

13) Prove that: $\begin{vmatrix} a-2b-2c & 3b & 3c \\ 3a & b-2c-2a & 3c \\ 3a & 3b & c-2a-2b \end{vmatrix} = 4(a+b+c)^3$ **[July 2016]**

14) If $A = \begin{bmatrix} -1 & 2 \\ 3 & 4 \end{bmatrix}$ Show that $A(adj\ A) = (adj\ A)A = |A|I$ **[Apr 2018]**

15) Show that $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix} = 4a^2b^2c^2$ **[Apr 2018]**

16) Prove that: $\begin{vmatrix} x & p & q \\ p & x & q \\ p & q & x \end{vmatrix} = (x-p)(x-q)(x+p+q)$

17) Prove that: $\begin{vmatrix} x & y & y \\ y & x & y \\ y & y & x \end{vmatrix} = (x+2y)(x-y)^2$ **[Apr 2018][June 2019]**

18) Prove that: $\begin{vmatrix} a-3b-3c & 4b & 4c \\ 4a & b-3c-3a & 4c \\ 4a & 4b & c-3a-3b \end{vmatrix} = 9(a+b+c)^3$

19) Using properties of determinants, prove: $\begin{vmatrix} 1+a & b & c \\ a & 1+b & c \\ a & b & 1+c \end{vmatrix} = 1+a+b+c$ **[Apr 2019]**

20) Using properties of determinants, prove: $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ca & cb & c^2+1 \end{vmatrix} = 1+a^2+b^2+c^2$

21) Find the inverse of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

22) Find the adjoint of the matrix $A = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$

23) Prove that if any two rows (or columns) of a determinant are interchanged then the value of the determinant changes only in sign.

24) Prove that in a determinant scalar multiple of the elements of any row or column is added to any other row or column. The value of the determinant remains unchanged.

25) Prove that "If each element of any row (or column) of a determinant is the sum of two terms, then the determinant can be expressed as sum of two determinants" **[Apr 2017]**

## IV. FIVE mark questions:

1) Solve by matrix method: $x+y+z=5,\quad 2x+y-z=2,\quad 2x-y+z=2$ **[Apr 2015]**
2) Solve by matrix method: $3x+y+2z=3,\quad 2x-3y-z=-3,\quad x+2y+z=4$ **[July 2016]**
3) Solve by matrix method: $x+y-z=3,\quad 3x+y-2z=3,\quad x-y-z=-1$
4) Solve by matrix method: $3x-y+2z=13,\quad 2x+y-z=3,\quad x+3y-5z=-8$
5) Solve by matrix method: $x-y+2z=3,\quad 2x+z=1,\quad 3x+2y+z=4$ **[June 2019]**

6) If $A = \begin{bmatrix} 1 & 2 & -3 \\ 5 & 0 & 2 \\ 1 & -1 & 1 \end{bmatrix}$ $verify$: $A(adj\ A) = (adj\ A)A = |A|I$

7) If $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = 0$ *then show that*: $\mathbf{1 + \sum \frac{1}{x} = 0}$ **(OR)** $\mathbf{1 + \frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 0}$

8) If x, y and z are all different and $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$ *then show that*: $1 + xyz = 0$

9) Show that: $\begin{vmatrix} 1 & 1 & 1 \\ x^2 & y^2 & z^2 \\ x^3 & y^3 & z^3 \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx)$

10) Show that: $\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2$

**V. SIX mark questions:**

1) A school wants to award its students for the values of leadership **(Punctuality)**, good behavior and hard work with a total cash award of ₹6000 . Three times the award money for hard work added to that given for leadership amounts to ₹11000. The award money for leadership and hard work together is double the one given for good behavior. Calculate the award money given for each value, using matrix method. **[July 2015, 2017] [Apr 2018]**

2) Transport Corporation operates bus service between two villages. Data regarding the passenger traffic during the first three days of the week is given below along with the total revenue: **[Apr 2016, July 2018]**

| Day | Number of passengers travelled | | | Total Revenue(in ₹) |
|---|---|---|---|---|
| | Children | Senior citizen | Adult | |
| 1 | 10 | 10 | 20 | 90 |
| 2 | 30 | 20 | 10 | 100 |
| 3 | 10 | 20 | 30 | 140 |

Find the bus fare charged per children, senior citizen and per adult, by using matrix method.

3) A sales person's sales details are given below.

| Months | Sales (in units) | | | Profit(in ₹) |
|---|---|---|---|---|
| | Pen | Book | Bag | |
| January | 9 | 10 | 2 | 800 |
| February | 15 | 5 | 4 | 900 |
| March | 6 | 10 | 3 | 850 |

Find profit for each Pen, Book and Bag using matrix method. **[Apr 2017,2018]**

4) Salesman Venki has the following record of sale during 3 months of July, August and September for three products A, B, C which have different rates of commission.

| Months | Sales (in units) | | | Total commission(in ₹) |
|---|---|---|---|---|
| | A | B | C | |
| July | 100 | 100 | 100 | 700 |
| August | 200 | 300 | 200 | 1700 |
| September | 400 | 900 | 100 | 3700 |

Find the rate of commission on items A, B and C received by Venki using matrix method.

# 2. PERMUTATION & COMBINATION

## I. ONE mark questions:

1) In how many ways can 10 people be seated around a table? **[Apr 2015,19, July 2017]**
2) In how many ways can 9 people be seated around a table? **[Apr 2018]**
3) Find n if $nc_8 = nc_7$ **[July 2015]**
4) Find n if $nc_8 = nc_5$ **[July 2018]**
5) How many different arrangements can be made with the letters of the word MONDAY? **[Apr 2016]**
6) How many straight lines can be formed from 10 points if no three of them are collinear? **[July 2016]**
7) How many different 4 digit number can be formed using the digits 1,2,4,5,7,8,9. No digit being repeated **[Apr 2018]**
8) If $nP_4 = 360,\ find\ n$ **[Apr 2017]**
9) If $nP_3 = 210,\ find\ n$ **[Apr 2018]**
10) If $nP_r = 24\, nc_4,\ find\ n$
11) If $5P_r = 60,\ find\ the\ value\ of\ r$ **[June 2019]**
12) Find r if $25c_{r+3} = 25c_{2r-3}$
13) Find $x\ if\ 99c_{40} + 99c_x = 100c_{59}$
14) Find $x\ if\ 9c_x + 9c_7 = 10c_7$
15) In how many ways can 9 flowers of different colours be strung together to form a garland
16) A person has 9 friends. In how many ways can he invite one or more of them to a dinner.

## II. TWO mark questions:

1) In how many ways 3 boys and 4 girls can be arranged in a row so that all the 3 boys sit together? **[Apr 2015]**
2) Find the number of parallelograms that can be formed from a set of 6 parallel lines intersecting another set 4 of parallel lines **[July 2015]**
3) Find the number of parallelograms that can be formed from a set of 7 parallel lines intersecting another set 3 of parallel lines **[Apr 2018]**
4) If $nc_8 = nc_{12,}\ find\ the\ value\ of\ nc_5$ **[Apr 2016]**
5) In how many ways can 6 gentlemen and 4 ladies be seated around a table so that no 2 ladies are together? **[July 2016]**
6) In how many ways can 6 people be selected out of 12 people so that
   a) Two particular members must be included.
   b) Two particular members must be excluded. **[Apr 2017]**
7) In a party each person shakes hands with everyone else. If there are 25 members in the party, calculate the number of handshakes. **[July 2017]**
8) In how many ways can the letters of the word 'HOPPER' be arranged? **[July 2018]**
9) In how many ways the word 'CARROM' be arranged such that 2R's are always together? **[Apr 2019]**
10) There are 15 points in a plane of which 5 are collinear. Find the number of straight lines can be formed.
11) Find the number of straight lines and triangles that can be formed out of 20 points of which 8 are collinear.
12) Find the number of words formed by the letters of the word '**DELHI**'. How many of them start with D and end with I
13) If a convex polygon has 170 diagonals, find the number of sides of the polygon. **(3m) [July 2018]**
14) How many 6 digit number can be formed from the digits 1, 2, 3, 4, 5, 6 (no digit being repeated) which are divisible by 5? **[June 2019]**
15) If $nP_r = 240,\ nc_r = 120\ find\ n\ and\ r$

**III. THREE mark questions:**

1) A man has 10 relatives, 4 of them are ladies, 3 gentlemen and 3 children. In how many ways can he invite 7 relatives to a dinner party so that there are exactly 2 gentlemen and atleast 3 ladies. **[Apr 2015]**
2) From a class of 9 boys and 7 girls, 12 students are to be chosen for a competition which includes atleast 6 boys and atleast 4 girls. In how many ways can this be done if a particular boy is always chosen? **[Apr 2019]**
3) Find the number of permutations of the letters of the word '**ENGINEERING**'. How many of these
   a) Begin with GRIN
   b) Begin with E and end with E
   c) Have all 3E's together **[Apr 2018][July 2015, 2017]**
4) Find the number of permutations of the letters of the word '**COMMITTEE**'. How many of these
   a) have all the vowels together
   b) begin with T and end with T **[Apr 2016]**
5) An examination paper consists of 12 questions divided into part A and B. Part A has 7 questions and Part B has 5 questions. A candidate is required to answer 8 questions, selecting atleast 3 from each part. In how many ways can the candidate select the questions? **[July 2016]**
6) Find the number of permutations of the letters of the word '**UNIQUE**'.
   a) How many of them end with 'QUE'
   b) How many begin with 'U' and end with 'E'
   c) How many of them begin with a consonant **[Apr 2017]**
7) Find the number of permutations of the letters of the word **'COMMISSION'**. If the word
   a) start with M and end with M
   b) 2S's are together
   c) 2O's are not together
8) A box contains 5 red, 4 black and 3 white balls. How many ways the selection of 8 balls can be made if the selection contains team
   a) exactly 4 red, 2 black and 2 white balls
   b) atleast 3 red, atleast 3 black and atleast 1 white ball. **[June 2019]**
9) A team of 11 is to be chosen from 18 cricketers of whom 6 are bowlers and 3 wicket keepers. In how many ways can a team be chosen so that
   a) There are exactly 4 bowlers and one wicket keeper
   b) There are atleast 4 bowlers and atleast 2 wicket keepers. **[Apr 2018]**
10) A team of 8 players has to be selected from 14 players. In how many ways the selections can be made if
   a) 2 particular players are always included
   b) 2 particular players are always excluded
11) In how many ways 3 boys and 5 girls can be arranged in a row so that no two boys are together?

# 3. PROBABILITY

## I. TWO mark questions:

1) A box contains 8 red marbles, 6 green marbles and 10 pink marbles .One marble is drawn at random from the box. What is the probability that the marble drawn is either red or green? **[Apr 2019]**
2) The probability of the occurrence of 2 events A and B are ¼ and ½ respectively. The probability of their simultaneous occurrence is 7/50. What is the probability that neither A nor B occurs? **[Apr 2015]**
3) What is the probability that there will be 53 Mondays in a randomly selected leap year? [**July 2015]**
4) One ticket is drawn at random from a bag containing 20 tickets numbered 1 to 20. Find the probability that it is a multiple of 2 or 5 **[Apr 2016]**
5) A bag contains 5 red, 7 yellow and 8 green marbles. 3 marbles are drawn randomly from the bag. What is the probability that all the 3 are red? **[July 2016]**
6) A bag contains 6 white beads and 4 red beads. A bead is drawn at random, what is the probability that the bead drawn is white. **[July 2017]**
7) A bag contains 5 red and 7 yellow and 8 green marbles.3 marbles are drawn at randomly from the bag. What is the probability that all the 3 are red? **[Apr 2018]**
8) Two dice are thrown at once. What is the probability of getting face upwards with "sum equal to 4 or 5" **[Apr 2018]**
9) A boy drawn 3 balls randomly from a bag containing 9 red and 5 white balls. What is the probability of getting
    a) All red balls
    b) 2 red and 1 white
10) Find the probability that a card drawn from a pack playing cards is a diamond or a heart? **[June 2019]**
11) Find the probability of getting a black jack from a pack of 52 cards?
12) If $P(A) = \frac{1}{2},\ P(B) = \frac{1}{3},\ P(A \cup B) = \frac{7}{12}, find\ P(B|A)$ **[Apr 2017]**
13) If $P(A) = \frac{5}{8},\ P(B) = \frac{3}{8},\ P(A \cup B) = \frac{3}{4}, find\ P(B|A)\ and\ P(A|B)$ **(3 Mark) [Apr 2018]**
14) If $P(A) = \frac{1}{4},\ P(B) = \frac{2}{5},\ P(A \cup B) = \frac{1}{2}, find\ P(A|B)$ **[July 2018]**

## II. THREE mark questions:

1) A couple appears in an interview for two vacancies in the same post. The probability of husband getting selected is 1/7 and the probability of wife getting selected is 1/5. What is the probability that
    a) Both of them will be selected?
    b) Only one of them will be selected?
    c) None of them will be selected? **[Apr 2019]**
2) 3 fair coins are tossed simultaneously. Find the probability of
    a) Getting one head
    b) Getting atmost one head
    c) Getting atleast two heads **[June 2019][Apr 2015, 2018]**
3) One card is randomly drawn from a pack of 52 cards. Find the probability that
    a) card is black jack
    b) card is red
    c) card is diamond [**July 2015]**

4) A box contains 8 white balls and 9 red balls. Two balls are taken at random from the box. Find the probability that both of them are red if
   a) The two balls are taken together
   b) The balls are taken one after the other without replacement
   c) The balls are taken one after the other with replacement **[Apr 2016]**
5) The probability that India win a cricket test against Australia is 1/3. If India and Australia play 3 tests, what is the probability that
   a) India loses all 3 tests
   b) India wins all 3 tests and
   c) India wins atleast one test [**July 2016]**
6) Two cards are drawn from a pack of playing cards, one after the other. Find the probability of getting a queen in first and second draw, if the cards are drawn
   a) With replacement
   b) Without replacement **[Apr 2017]**
7) A die is thrown. If E is the event "the number appearing is a multiple of 3" and F be the event "the number appearing is even". Then find whether E and F are independent. [**July 2017]**
8) A bag contains 10 gold and 8 silver coins. Two successive drawings of 4 coins are made. Find the probability that the first drawing will get 4 gold and second 4 silver coins if coins are replaced before the second trial. [**July 2018]**
9) A bag contains 7 white, 3 red and 4 black balls, one ball is picked up at random. What is the probability that
   a) None is black
   b) Ball is red
   c) Ball is white
10) The probability that a MBA aspirant will join IIM is 2/5 and that he will join XLRI is 1/3. Find the probability that
   a) He will join IIM or XLRI
   b) He will join neither IIM nor XLRI
11) A box contains 4 defective and 6 non defective bulbs. Find the probability that at least 3 bulbs are defective when 4 bulbs are selected at random.
12) Three of the six vertices of a regular hexagon are chosen at random. What is the probability that the triangle formed with these 3 vertices is equilateral.

# 4. BINOMIAL THEOREM

## I. FIVE mark questions:

1) Find the co-efficient of $x^5$ in the expansion of $\left(x+\frac{1}{x^2}\right)^{17}$ **[Apr 2015][July 2018]**
2) Find the co-efficient of $x^{-11}$ in the expansion of $\left(\sqrt{x}-\frac{2}{x}\right)^{17}$
3) Find the term independent of x in $\left(x^3-\frac{3}{x^2}\right)^{15}$ **[July 2015]**
4) Find the term independent of x in $\left(\frac{3x^2}{2}-\frac{1}{3x}\right)^{9}$ **[June 2019]**
5) Find the term independent of x in $\left(\sqrt{x}-\frac{2}{x}\right)^{21}$ **[July 2016]**
6) Find the term independent of x in $\left(\sqrt{x}+\frac{1}{3x^2}\right)^{10}$
7) Evaluate $\left(\sqrt{3}+1\right)^5-\left(\sqrt{3}-1\right)^5$ using Binomial theorem **[Apr 2016]**
8) Evaluate $\left(\sqrt{2}+1\right)^6-\left(\sqrt{2}-1\right)^6$ using Binomial theorem **[July 2017]**
9) Evaluate $\left(2+\sqrt{3}\right)^5+\left(2-\sqrt{3}\right)^5$ using Binomial theorem **[Apr 2018]**
10) Evaluate $\left(1+\sqrt{5}\right)^4-\left(1-\sqrt{5}\right)^4$ using Binomial theorem
11) Evaluate $\left(3+\sqrt{5}\right)^6+\left(3-\sqrt{5}\right)^6$ using Binomial theorem
12) Find the middle terms in the expansion of $\left(\frac{2x^2}{3}-\frac{3}{2x}\right)^{10}$ **[Apr 2019]**
13) Find the middle terms in the expansion of $\left(3x-\frac{2}{x^2}\right)^{15}$ **[Apr 2017, 2018]**
14) Find the middle terms in the expansion of $\left(\sqrt{x}-\frac{4}{x^2}\right)^{11}$
15) The second, third and fourth terms in the binomial expansion $(x+a)^n$ are 240, 720 and 1080 respectively. Find x, a and n

## II. FOUR mark questions:

1) Find the value of $(1.2)^5$ using Binomial theorem, upto 4 decimal places. **[Apr 2015,2019]**
2) Find the value of $(1.1)^5$ using Binomial theorem, upto 4 decimal places. **[July 2015]**
3) Find the value of $(0.99)^4$ using Binomial theorem, upto 4 decimal places. **[Apr/July 2016]**
4) Find the value of $(1.01)^5$ using Binomial theorem, upto 4 decimal places. **[Apr 2017, 2018][July 2018]**
5) Find the value of $(1.02)^6$ using Binomial theorem, upto 4 decimal places.
6) Find the value of $(1.05)^5$ using Binomial theorem, upto 4 decimal places.
7) Find the value of $(1.0005)^4$ using Binomial theorem, upto 4 decimal places.
8) Find the value of $(0.99)^5$ using Binomial theorem, upto 4 decimal places. **[Apr 2018]**
9) Find the value of $(0.98)^4$ using Binomial theorem, upto 4 decimal places.

# 5. PARTIAL FRACTION

**I. FIVE mark questions:**

1) Resolve into partial fraction: $\frac{x-1}{x(x+2)(x+4)}$ **[Apr 2019]**
2) Resolve into partial fraction: $\frac{x^2}{(x+1)(x+2)(x+3)}$ **[Apr 2015, 2018]**
3) Resolve into partial fraction: $\frac{3x+2}{(x-2)(x+3)^2}$ **[July 2015, 2018] [Apr 2017]**
4) Resolve into partial fraction: $\frac{3x+5}{(x+2)(x-1)^2}$ **[Apr 2016, 2018]**
5) Resolve into partial fraction: $\frac{1+2x}{(x+2)^2(x-1)}$ **[July 2016]**
6) Resolve into partial fraction: $\frac{2x^2-4x+1}{(x-2)(x-3)^2}$ **[July 2017]**
7) Resolve into partial fraction: $\frac{x^2-10x+13}{(x+1)(x^2-5x+6)}$ **[June 2019]**
8) Resolve into partial fraction: $\frac{2x+1}{(x-1)(x+2)(3x-1)}$
9) Resolve into partial fraction: $\frac{2x+1}{(x-1)(x-2)(x-3)}$
10) Resolve into partial fraction: $\frac{2x^2+16x+29}{(x+3)^2(x+4)}$
11) Resolve into partial fraction: $\frac{2x^2-7x+1}{x^2-3x-4}$
12) Resolve into partial fraction: $\frac{x^3+7x^2+17x+11}{x^2+5x+6}$
13) Resolve into partial fraction: $\frac{2x^3+x^2-x-3}{x(x-1)(2x+3)}$

# 6. MATHEMATICAL LOGIC

## I. ONE mark questions:

1) Negate: $\sim p \rightarrow q$ **[Apr 2015]**
2) Negate the proposition "4 is an even integer or 7 is a prime number" **[July 2015]**
3) Negate the proposition "6 is an even number and 7 is a prime number" **[Apr 2018]**
4) Negate "If he is rich then he is happy" **[June 2019]**
5) If p and q are propositions with truth values F and T respectively, find the truth value of $\sim q \rightarrow p$ **[Apr 2016]**
6) Write the inverse of the proposition "If $x(x-2)=0$ then $x=2$" **[July 2016]**
7) Symbolize the propositions "$3x = 9\ and\ x < 7$" **[Apr 2017]**
8) Symbolize the propositions "$2+5=6\ or\ all\ integers\ are\ rationals$ " **[Apr 2018]**
9) Symbolize the propositions "$If\ oxygen\ is\ a\ gas\ then\ gold\ is\ a\ compound$ " **[Apr 2019]**
10) Write the verbal form of the compound proposition $p \vee q$ where
$p$: $x\ is\ an\ integer$
$q$: $5\ is\ an\ odd\ number$ **[July 2017]**
11) Write the truth value of the proposition "If 2 is not a prime number then $\sqrt{2}$ is an irrational number"
12) Write symbolically "If gold is element then water is a compound".
13) Write symbolically "If two numbers are equal then their squares are equal" **[July 2018]**
14) Negate: "If Ramya study hard then she will get the rank"

## II. TWO mark questions:

1) Write the converse and contrapositive of the proposition: "$If\ x^2 = y^2\ then\ x = y$" **[Apr 2015]**
2) Write the converse and inverse of the statement: "If maths is easy then child is brave" **[July 2015]**
3) Write the converse and contrapositive of "If the questions are easy then students score better marks. **[Apr 2016, 2018]**
4) If the compound proposition $p \rightarrow (\sim q \vee r)$ is false, then find the truth values of $p, q\ and\ r$ **[July 2016]**
5) If $p \rightarrow (q \vee r)$ is false proposition, then find the truth values of $p, q\ and\ r$ **[June 2019]**
6) If $(\sim p \vee q) \vee \sim r$ is false, then find the truth values of $p, q\ and\ r$ **[July 2018]**
7) Write the converse and contrapositive of "If $x < 1$ then it is a prime number" **[Apr 2017]**
8) If p, q and r are the propositions with truth values F, T and F respectively, find the truth value of $p \rightarrow (q \rightarrow r)$ **[July 2017]**
9) If the truth values of propositions p, q, r are T, T, F respectively, find the truth value of $(p \vee r) \wedge q$ **[Apr 2018]**
10) If the truth values of propositions p, q, r are T, T, F respectively, find the truth value of $p \rightarrow (q \wedge r)$ **[Apr 2019]**
11) If p, q and r are three propositions with truth values T, T and F respectively, find the truth value of $p \rightarrow (\sim q \wedge r)$
12) Write the converse and contrapositive of the compound proposition "If Prashanth got first class in mathematics then prof. John will gift him a watch"
13) If the truth value of p is true, q is false. Find the truth value of $\sim(p \rightarrow \sim q) \vee \sim p$
14) Write the converse and contrapositive of "If two straight lines are parallel then they do not intersect".

**III. FIVE mark questions:**

1) Examine whether the propositions $[(p \wedge \sim q) \vee q]$ and$p \vee q$ are logically equivalent. **[Apr 2015]**
2) Verify whether the proposition $(\sim p \wedge q) \wedge \sim r$ is a Tautology, contradiction or neither. **[Apr 2019]**
3) Show that the proposition $\sim(p \vee q) \rightarrow (\sim p \wedge \sim q)$is a Tautology. **[Apr 2018][June 2015, 2019]**
4) Verify whether the proposition $[\sim(p \rightarrow \sim q)] \vee (\sim p \leftrightarrow q)$ is a Tautology, contradiction or neither. **[Apr 2016]**
5) Prove that: $(p \vee q) \wedge (\sim p \wedge \sim q)$ is a contradiction. **[July 2016, 2017]**
6) Verify whether the proposition $[p \rightarrow (\sim p \vee q)]$ is a Tautology, contradiction or neither. **[Apr 2018]**
7) Prove that : $\sim(p \rightarrow q) \equiv (p \wedge \sim q)$ **[July 2018]**
8) Verify whether the proposition $\sim(p \rightarrow q) \vee [(\sim p \wedge q) \leftrightarrow \sim q]$ is a Tautology, contradiction or neither.
9) Verify whether the proposition $\sim(p \rightarrow q) \vee [(\sim p \wedge q) \leftrightarrow \sim q]$ is a Tautology, contradiction or neither.
10) Define Tautology and Verify for Tautology: $\sim(p \wedge q) \rightarrow (\sim p \vee \sim q)$
11) Examine whether the propositions $p \leftrightarrow q$ and $[(p \rightarrow q) \wedge (q \rightarrow p)]$ are logically equivalent.
12) Prove that : $\sim(p \leftrightarrow q) \equiv (p \wedge \sim q) \vee (q \wedge \sim p)$

# 7. RATIO & PROPORTION

## I. ONE mark questions:

1) Find the compound ratio of $3 : 5$ *and* $4 : 7$ **[Apr 2015]**
2) Find the value of x if $32 : x = 75 : 50$ **[July 2015]**
3) Find the third proportional of 4 and 6. **[Apr 2016]**
4) Find the third proportional of 7 and 28. **[July 2018]**
5) Find the third proportional of 6 and 24.
6) Find the fourth proportional to $6, 12, 15$ **[July 2016]**
7) Find the fourth proportional to $4, 5, 24$ **[Apr 2018]**
8) If $5 : 20 = 3 : x, find\ the\ value\ of\ x.$ **[Apr 2017]**
9) Find the triplicate ratio of $3 : 5$ **[Apr 2019]**
10) Find the triplicate ratio of $5 : 4$ **[July 2017]**
11) Find the duplicate ratio of $5 : 3$ **[Apr 2018]**
12) Find the mean proportion of 9 *and* 16 **[June 2019]**
13) Find the mean proportion of 36 *and* 4
14) If $a : b = 2 : 5\ and\ b : c = 3 : 5\ find\ a : c$
15) If $a : b = 3 : 5\ and\ b : c = 15 : 23\ find\ a : c$

## II. TWO mark questions:

1) Two numbers are in the ratio 3: 5. If 5 is added to each term, the ratio becomes 2: 3.Find the numbers **[Apr 2015,17,18]**
2) Divide ₹6000 in the ratio 3: 4: 5 **[July 2015, 2018]**
3) Monthly incomes of A and B are in the ratio 2: 3 and their monthly expenditures are in the ratio 3: 5. If each saves ₹100 per month, find the monthly incomes of A and B **[Apr 2016, 2018]**
4) If 10 persons can do a job in 60 days, then in how many days can 20 persons do the same job? **[July 2016]**
5) If $a : b = 4 : 5. Find\ \frac{3a+2b}{3a-2b}$ **[July 2017]**
6) What must be added to each term in the ratio 5: 6 so that it becomes 8: 9 **[Apr 2019]**
7) A mixture contains milk and water in the ratio 5:1, on adding 5 litres of water, the ratio of milk and water becomes 5:2. Find the quantity of milk in the original mixture **[June 2019]**
8) A certain number is subtracted from each of the two term of the ratio 21: 35 to give a new ratio 3: 10. Find the number which is subtracted?
9) Two numbers are in the ratio 3: 5. If 9 is subtracted from each, then new numbers are in the ratio becomes 12: 23. Find the smaller number
10) The ages of a father and his son in the ratio $6 : 1$. After 14 years their age will be in the ratio $8 : 3$. What are their present ages?
11) An article is sold at 40% gain on the cost price. Find the ratio of the selling price and cost price
12) If $a + b : a - b = 4 : 3\ find\ the\ value\ of\ a\ and\ b$
13) If $a : 3 : 15 = 5 : b : 5,\ find\ the\ values\ of\ a\ and$
14) If $\frac{a}{b} = \frac{c}{d}\ then\ prove\ that: \frac{3a+5b}{3c+5d} = \frac{3a-5b}{3c-5d}$

## III. THREE mark questions:

1) In a fort, there was ration for 560 soldiers that would last the soldiers for 70 days. After 20 days, 60 soldiers left the fort. For how many days the remaining ration can support the remaining soldiers? **[Apr 2015, 2019]**
2) Walking 4kmph a student reaches his college 5 minutes late and he walks at 5kmph, he reaches $2\frac{1}{2}$ minutes early. What is the distance from his house to the college? **[Apr 2018][July 2015]**
3) 5 carpenters can earn ₹540 in 6 days working 9 hours a day. How much will 8 carpenters earn in 12 days working 6 hours a day? **[Apr 2016]**
4) If ₹120 maintain a family of 4 people for 30 days, how long ₹300 maintain a family of 6 people? **[July 2016]**
5) 3 carpenters can earn ₹360 in 6 days working 9 hours a day. How much will 8 carpenters earn in 12 days working 6 hours a day? **[Apr 2017]**
6) 5 men each working 9 hours a day can finish a work in 30 days. How many men are required to finish eight times the work in 25 days, each working 8 hours a day? **[July 2018]**
7) A sum of ₹2415 has to be divided among three persons A, B and C in such proportion that A's share to B's as 4: 5 and B's share to C's share as 9: 16. How much does each get?
8) Two quantities are in the ratio3: 4. If 10 is subtracted from each of them, the remainder are in the ratio 1: 3. Find the quantities.
9) The driver of a car is travelling at a speed of 36kmph and spots a bus 80metres ahead of him. After 1 hour the bus is 120 metres behind the car. What is the speed of the bus?
10) X, Y and Z play cricket. The run scored by X and Y are in the ratio 3:2 The runs scored by Y and Z are in the ratio 3:2. They all together scores 342 runs. How many runs did each score? **[June 2019]**
**11)** Evaluate: $\frac{x+a}{x-a}+\frac{x+b}{x-b}$, $\quad where \quad x=\frac{2ab}{a+b}$.

## IV. FIVE mark questions:

1) 4 men or 12 boys can do a job in 5 days by working 8 hours per day. In how many days 2 men and 4 boys can do the same job working12 hours a day? **[Apr 2015]**
2) Two taps can separately fill a tank in 12 minutes and 15 minutes respectively. The tank when full can be emptied by a drain tap in 20 minutes. When the tank was empty, all the three taps were opened simultaneously. In what time will the tank be filled up? **[July 2015, 2017(3 Mark)] [Apr 2018]**
3) Two taps fill a cistern separately in 20 minutes and 40 minutes respectively. Another pipe can drain off 30 litres per minute from the cistern. If all 3 pipes are opened together, the cistern fills in 72 minutes. What is the capacity of the cistern? **[June 2019]**
4) Distribute ₹632 amongst A, B and C in such a way that B will get 20% more than A and C gets 20% less than B **[Apr 2016]**
5) The monthly incomes of A and B are in the ratio 9:7 and that of B and C are in the ratio 3:2. If 10% of A's income and 15% of C's income differ by ₹18, then find the income of A,B and C. **[July 2016]**
6) ₹5625 is divided among A, B and C so that A receives one half as much as B and C together receive and B receives one fourth of what A and C together receive. Find the share of A, B and C. **[Apr 2017, 2018]**
7) Divide **₹1647** into three parts such that $\left(\frac{3}{7}\right)^{th}$ of the first, $\left(\frac{2}{3}\right)^{rd}$ of second and $\left(\frac{4}{5}\right)^{th}$ of the third are equal. **[July 2017]**
8) If two men or four women can do a work in 33 days and 3 men and 5 women can do the same work in 24 days. How long shall 5 men and 2 women take to do the same work ? **[Apr 2018]**

9) If 15 men working 12 hours per day perform job in 16 days. How long will it take for 21 men working 10 hours daily to do the same job

10) Walking 4kmph a student reaches his college 5 minutes late and if he walks at 5kmph he reaches $2\frac{1}{2}$ $minutes$ early. What is the distance from his house to the college? **[Apr 2019]**

11) A jar contains two liquids A and B in the ratio$7:5$. When 9 litres of the mixture is drawn and the jar is filled with the same quantity of B, the ratio of A and B becomes $7:9$. Find the quantity of A in the jar initially. **[July 2018]**

12) A jar contains two liquids X and Y in the ratio$7:5$. When 6 litres of the mixture is drawn and the jar is filled with the same quantity of Y, the ratio of X and Y becomes $7:9$. Find the quantity of X in the jar initially.

13) If $\frac{\sqrt{1+x}+\sqrt{1-x}}{\sqrt{1+x}-\sqrt{1-x}} = \frac{a}{b}$ $find\ x$

14) If $\frac{2a+2b-3c-3d}{2a-2b-3c+3d} = \frac{a+b-4c-4d}{a-b-4c+4d}$ $then\ prove\ that\ a:b :: c:d$

# 8. BILL DISCOUNTING

## I. ONE mark questions:

1) A bill was drawn for 3 months was legally due on 18-08-2012. Find the date of drawing the bill. **[July 2017]**
2) A bill was drawn for 3 months was legally due on 06-07-2018. Find the date of drawing the bill. **[Apr 2018]**
3) Find the legally due date for a bill date 22-4-2014 due 6 months hence.

## II. TWO mark questions:

1) BD and BG on a certain bill due after sometime are ₹1250 and ₹50 respectively. Find the face value of the bill. **[Apr 2015, 2017, 2018]**
2) A banker pays ₹2380 on a bill of ₹2500, 73 days before the legal due date. Find the rate of discount charged by the banker. **[June 2015, 2019]**
3) Find the Banker's discount on a bill of ₹415 due 9 months at 15% p.a. **[Apr 2016]**
4) True discount on a bill was ₹100 and Banker's gain was ₹10. What is the face value of the bill? **[July 2016, 2018]**
5) True discount on a bill was ₹900 and Banker's gain was ₹27. What is the face value of the bill? **[Apr 2019]**
6) Banker's gain on a bill due after 6 months at 4% p.a. is **₹24**. Find TD,BD and bill amount **[July 2017, 2018]**
7) The Banker's gain on a certain bill due six months hence is ₹10, the rate of interest being 10% p.a. Find the face value of the bill.

## III. THREE mark questions:

1) A bill for ₹3500 due for 3 months was drawn on 27 March 2012 and discounted on 18 April 2012, at the rate of 7% p.a. Find the Bankers Discount and discounted value of the bill. **[Apr 2015][July 2016]**
2) A bill for ₹12900 was drawn on 3 Feb 2014 at 6 months and discounted on 13 March 2014 at 8% p.a. For what sum was the bill discounted? **[July 2015]**
3) A banker pays ₹2340 on a bill of ₹2500, 146 days before the legal due date. What is the rate of interest charged by the banker. **[Apr 2016, 2018]**
4) A banker pays **₹4520** on a bill of ₹5000, 146 days before the legal due date. Find the rate of discount charged by the banker. **[July 2017]**
5) For **₹512.50** due 6 months at 15% p.a. Find the true present value and discounted value **[Apr 2019]**
6) Banker's gain on a bill due 6 months at 4% p.a.is **₹20.** Find the true discount, banker's discount and bill amount. **[Apr 2017]**
7) Banker's gain on a bill due after 6 months at 4% p.a.is **₹24.** Find the true discount and face value of the bill.**[Jun 2019]**
8) The Banker's gain on a bill is $1/5^{Th}$ of the banker's discount and the rate of interest is 20% p.a. Find the unexpired period of the bill. **[Apr 2018]**
9) A bill for ₹5000 was drawn on 10 April 2013 at 3 months and was discounted on 1 May 2013, at 12% p.a. For what sum was the bill discounted and also find the Banker's Gain?
10) Find the bankers discount on face value ₹1000 of the period is 73 days at 5% p.a. banker's commission
11) A bill for ₹2920 was drawn on September 11 for 3 months after date and was discounted at 16% p.a. for ₹2875.20. On what date was the bill discounted?

# 9. STOCKS & SHARES

## I. ONE mark questions:

1) Define yield **[Apr 2015, 2018]**
2) Find the income obtained by investing ₹3600 in 5% stock at 90 **[Apr 2019][July2015]**
3) What income can be obtained from ₹8000 of 4% stock **[Apr 2016] [July2015]**
4) How much stock at 75 can be bought for ₹3375? **[July 2016]**
5) What rate of interest is obtained by investing in 9% stock at 180? **[Apr 2017, 2018]**
6) What rate of interest is obtained by investing in 14.5% stock at 81?

## II. THREE mark questions:

1) Sanjana invests ₹3240 in a stock at 108 and sells when the price falls to 104. How much stock at 130 can Sanjana buy now? **[Apr 2015, 2019]**
2) Prathik sells out₹6000 of 7.5% stock at 108 and reinvests the proceeds in 9% stock. If Prathik's income increases by ₹270, at what price did Prathik buy 9% stock? **[June 2015, 2019]**
3) Mr.Sandeep invests ₹15000 cash partly in 3% stock at 75 and partly in 6% debentures at 125 in such a way as to get a return of 4.5% for his money. How much does he invest in each? **[Apr 2016]**
4) A person has invested ₹4300 partly in 4.5% stock at ₹72 and partly in 5% stock at ₹95. If the total income from both is ₹250, find the investment in both the types of stocks. **[July 2016]**
5) A man invests equal sums of money in 4%, 5% and 6% stock, each stock being at par. If the total income of the man is ₹3600, find his total investment. **[Apr 2017]**
6) Rakshith decides to invest in TCS shares which are selling at ₹2020 per share. How much money is required to purchase 10 shares if the brokerage is 0.5%? **[July 2017] [Apr 2018]**
7) Prashanth sold 25 Biocon shares when the market price was ₹400 per share. He then bought 10 reliance shares which were selling at ₹800 per share. Brokerage for each transaction was 0.25%. The balance amount he gave to his daughter Sonu for shopping. How much did Sonu receive. **[July 2018]**
8) Find the interest earned on ₹4897.50 cash invested in 15% stock at ₹81.50, given that brokerage is 0.125%
9) What is the market value of 9.5 stock when an investment of ₹12400 produce income ₹1472.5
10) What is the market value of 6% stock if it earns an interest of 4.5% after deducting the income tax of 4%
11) Ritu purchased 200HDFC shares when the price was 625 and then sold all the shares when the price went upto 715. If the brokerage for each transactions was 1%. How much did Ritu gain.
12) Mr. Ravi sold **₹2250** stock at 75 and bought stock at 88.5 with the proceeds. How much stock does he buy if the brokerage is 2% for selling and 1.5% for buying.
13) If a client buys shares worth **₹1,25,000** and sells shares worth **₹75,000** through a broker, assuming that the buying side brokerage is 0.5% and the selling side brokerage is 0.25%, find the total brokerage paid to the broker. **[Apr 2017]**

# 10. LEARNING CURVE

## I. ONE mark questions:

1) Define Learning curve.
2) Write the formula for Learning Index. **[June 2018, 2019]**
3) Write the Learning equation.
4) Find the index of learning for 70% learning effect.
5) Find the index of learning for 80% learning effect.

## II. FIVE mark questions:

1) An engineering company has 80% learning effect and spends 1000 hours to produce 1 lot of the product. Estimate the labour cost of producing 8 lots of the product if the labour cost is ₹40 per hour. **[Apr 2015]**
2) ABC Company required 1000 hours to produce first 30 engines. If the learning effect is 90%, find the total labour cost at ₹20 per hour to produce total of 120 engines. **[July 2015]**
3) XYZ Company supplies water tankers to the Government. The first water tanker takes ₹20,000 labour hours. The government auditors suggest that there should be a 90% learning effect rate. The management expects an order of 8 water tankers in the next year. What will be the labour cost if the company will incur at the rate of ₹20 per hour. **[Apr 2016] [July 2018]**
4) A company requires 200 hours to produce the first 10 units at ₹10 per hour. If the learning effect is 90%, find the total labour hours to produce 160 units and also the total labour cost. **[July 2016]**
5) A company requires 100 hours to produce the first 10 units at ₹15/hour. The learning effect is 80%, find the total labour cost to produce a total of 160 units. **[July 2017]**
6) A company requires 100 hours to produce the first 10 units at ₹25/hour. The learning effect is 80%, find the total labour cost to produce a total of 160 units. **[June 2019]**
7) A company has 80% learning effect and spends 500 hours for the prototype. Estimate the labour cost of producing 7 engines of new order if the labour cost is ₹40 per hour. **[Apr 2017, 2018]**
8) Samsung company which manufacture LCD TV. The 1st lot of 10 unit was completed in 1400 labour hours. Find each subsequent lot, the commutative production was doubled. And it has observed that 90% learning effect applies to all labour related cost. The anticipated production is 320 unit of LCD TV. Find total labour cost required to manufacture 320 units and also find the total labour cost at ₹20 per hour. **[Apr 2018]**
9) A motor company Ltd. has observed that a 90% learning effect applies to all labour related costs whenever a new product is taken up for production the anticipated production to 320 units for the coming year. The production is done in lots of 10 units each. Each lot requires 1000 hours at ₹15/hour. Calculate the total labour hours and labour cost to manufacture 320 units. **[Apr 2019]**
10) The time required to produce the first unit of a product is 1000 hours. If the manufacturer experience 80% learning effect. Calculate the cumulative average time per unit and the total time taken to produce altogether 8 units. Also find the labour charges for the production of 8 units at the rate of ₹10 per hour.
11) The production manager of a company obtained the following equation for the learning effect $y = 1400x^{-0.3}$ This function is based on the company's experience for assembling the first 50 units of the product. The company was asked to bid a new order of 100 additional units and the labour cost for producing an additional 100 units at the rate of ₹20 per hour.

12) The production manager of a company obtained the following equation for the learning effect. $y = 1356x^{-0.3219}$ This function is based on the company's experience for assembling the first 50 units of the product. Find the labour hours required to assemble 100 units.

# 11. LINEAR PROGRAMMING PROBLEM(LPP)

**I. FIVE mark questions:**

1) Maximize: $Z = 5x + 3y$ *subject to the constraints* $3x + 5y \leq 15, 5x + 2y \leq 10, x \geq 0, y \geq 0$ **[Apr 2015, 17, 18]**
2) Maximize: $Z = 10500x + 9000y$ *subject to the constrints* $x + y \leq 50, 2x + y \leq 80$ *and* $x \geq 0, y \geq 0$ **[June 2019]**
3) A Company produces two products P and Q. Each P requires 4 hours of grinding and 2 hours of polishing and each Q requires 2 hours of grinding and 5 hours of polishing. The total available hours for grinding is 20 hours and for polishing is 24 hours. Profit per unit of P is ₹6 and that of Q is ₹8. Formulate the L.P.P to maximize the profit. **[July 2015, 2019]**
4) A furniture maker has 6 units of wood and 28 hours of free time in which he will make decorative screens. He estimates that each of model 1 requires 2 units of wood and 7 hours of free time. Each of model 2 needs 1 unit of wood and 8 hours of free time. The prices of the models are ₹120 and ₹80 respectively. Formulate the LPP to determine how many screens of each type should be assembled so as to maximize his sales revenue. **[July 2016]**
5) Maximize: $Z = 6x + 8y$ *subject to the constrints* $4x + 2y \leq 20,\ 2x + 5y \leq 24,\ x, y \geq 0.$ **[Apr/July 2016]**
6) Maximize: $Z = 60x + 15y$ *subject to the constrints* $x + y \leq 50,\ 3x + y \leq 90$ *and* $x, y \geq 0.$ **[Apr 19][July 17,18]**
7) Minimize: $Z = 3x + 5y$ *subject to the constrints* $x + 3y \leq 3,\ x + y \leq 2,$ *and* $x \geq 0, y \geq 0.$ **[Apr 2018]**
8) Minimize: $Z = 1.5x + 2.5y$ *subject to the constrints* $x + 3y \geq 20,\ x + y \geq 2,$ *and* $x \geq 0, y \geq 0.$
9) Maximize: $Z = 400x + 150y$ *subject to the constrints* $3x + y \leq 600,\ x \leq 150, y \leq 400$ *and* $x \geq 0, y \geq 0.$
10) Maximize: $Z = 4x + 3y$ *subject to the constrints* $x + 2y \leq 5,\ x + y \leq 3,\ 3x + y \leq 7$ *and* $x, y \geq 0.$
11) Maximize: $Z = x + y$ *subject to the constrints* $2x - y + 1 \geq 0,\ x + y \leq 3,\ x \leq 2$ *and* $x,\ y \geq 0.$

# 12. SALES TAX & VALUE ADDED TAX

**I. THREE mark questions:**

1) A shopkeeper bought a TV at a discount of 30% of the listed price of ₹24,000. The shopkeeper offers a discount of 10% of the listed price to the customer. If the VAT is 10%, find:
   i. The amount paid by the customer
   ii. The VAT to be paid by the shopkeeper **[Apr 2015]**
2) A furniture dealer sold furniture for ₹21,000 and added 5% sales tax to the quoted price. The customer agrees to buy it for ₹21,000 including sales tax. Find the discount he received. **[July 2015]**
3) Sanju goes to a shop to buy a bicycle at ₹2,000. The rate of sales tax is 12% on it. He asks the shopkeeper for a rebate on the price of the bicycle to such an extent that he has to pay ₹2016 inclusive of sales tax. Find the rebate percentage on the price of the bicycle he received. **[Apr 2019]**
4) A shopkeeper bought a Washing machine at a discount of 20% from a wholesaler, the printed price of the Washing machine being ₹18,000. The shopkeeper sells it to a consumer at a discount of 10%on the printed price. If the rate of sales tax is 8%, find:
   i. The VAT paid by the shopkeeper
   ii. Total amount that the consumer pays for the washing machine. **[Apr 2016]**
5) An owner of a departmental store purchased an article of ₹1500 at 4% VAT and sells it at ₹1700 to the customer at 4% VAT. How much amount did the shopkeeper deposit to the Government as VAT? What is the total amount paid by the customer? **[July 2016]**
6) A shopkeeper announces a discount of 10% on a washing machine set. The marked price of washing machine is ₹12000. How much will a customer have to pay for buying the washing machine set if the rate of sales tax is 8% **[Apr 2017]**
7) Bharath bought a shirt for ₹336 including 12% sales tax and a neck tie for ₹110 including 10% sales tax. Find the printed price of shirt and neck tie together. **[July 2017]**
8) The price of washing machine, inclusive of sales tax is ₹13,530. If the sales tax is10%, find its basic price? **[Apr 2018]**
9) Gopal purchased a scooter costing ₹32,450. If the rate of sales tax is 9%, calculate the total amount payable by him **[Apr 2018]**
10) Ananya went to the grocery shop to purchase biscuits for ₹40, Rice for ₹50 and wheat for ₹50, sales tax on each item is 10%. How much should she pay to the shopkeepers?
11) Raju goes to purchase a motorcycle which is priced ₹35,640 including at 10% sales tax however the actual rate of sales tax at the time of purchase is at 7%. Find the extra profit made by the shopkeeper if he still charges the original listed price.
12) A colour TV is marked for sale for ₹17600 which includes sales tax at 10%. Calculate the sales tax in ₹ **[July 2018]**
13) A shopkeeper purchases an audio system for ₹3000 and sell it off at a gain of 15%. He also charges a sales tax of 10% on the selling price. Calculate the amount that the buyer will pay to the shopkeeper **[June 2019]**

# 13. HEIGHTS & DISTANCES

**I. FOUR mark questions:**

1) The angle of elevation of the top of a tower from the base and top of a building are $60^0$ and $45^0$ respectively. If the building is 20m tall. Find the height of the tower. **[Apr 2015, 2018][July 2016]**
2) The angle of elevation of the top of a tower from the base and top of a building are $60^0$ and $30^0$ respectively. If the building is 20m high. Find the height of the tower. **[July 2015]**
3) Two towers of heights 14m and 25m stand on level ground. The angles of elevation of their tops from a point on the line joining their feet are $45^0$ and$60^0$respectively. Find the distance between the towers. **[Apr 2016]**
4) The angle of elevation of the summit of a hill from the top and the bottom of a building are $30^0$ and $60^0$ respectively. If the height of the building is 'h'm, Show that the height of the hill is 3h/2 **[Apr 2017]**
5) A person is at the top of a tower 75feet high. From there, he observes a vertical pole and finds the angles of depressions of top and bottom of the pole which are $30^0$ and $60^0$ respectively. Find the height of the pole. **[June 2017, 2019]**
6) The angle of depression of two boats as observed from the mast head of a ship 50m high are $45^0$ and $30^0$. What is the distance between the boats if they are on same side of the mast head in line with it? **[Apr 2018]**
7) A person standing on the bank of a river observes, that the angle subtended by a tree on the opposite bank is $60^0$. When he returns 40meters from the bank he finds the angle to be $30^0$. Find the height of the tree and the breadth of the river. **[July 2018]**
8) A person standing on the bank of a river observes, that the angle subtended by a tree on the opposite bank is $60^0$. When he returns 80meters from the bank he finds the angle to be $30^0$. Find the height of the tree and the width of the river. **[Apr 2019]**
9) The angle of elevations of the top of an unfinished tower at a point distance 120mt from its base is $45^0$. How much higher must the tower be raised so that the angle of elevation at the same point be $60^0$
10) From the top of a house 32m high, the angle of elevation of the top of a tower is $45^0$ and the angle of depression of the foot of the tower is $30^0$. Find the height of the tower.
11) The angles of elevation of the top of a tower from two points distant $a\ and\ b\ (a < b)$ from its foot and the same straight line from it are $30^0$ and $60^0$. Show that the height of the tower is $\sqrt{ab}$
12) The angle of elevation of an object from a point 100m above a lake is $30^0$ and angle of depression of its image in the lake is $45^0$. Find the height of the object above the lake.

# 14. COMPOUND ANGLES, MULTIPLE ANGLES, SUB-MULTIPLE ANGLES & TRANSFORMATION FORMULAE

## I. ONE mark questions:

1) If $\sin A = \frac{3}{5}, find\ \sin 2A$ **[Apr 2015, 2017, 2018]**
2) Find the value of : $3\sin 10^0 - 4\sin^3 10^0$ **[July 2015]**
3) Find the value of : $4\cos^3 10^0 - 3\cos 10^0$ **[Apr 2018]**
4) Find the value of : $4\cos^3 20^0 - 3\cos 20^0$ **[July 2017]**
5) If $\tan A = \frac{3}{4},\ A\ is\ acute. Find\ \tan 2A$ **[Apr 2016]**
6) If $\tan A = \frac{1}{2},\ \tan B = \frac{1}{3}\ then\ find\ \tan(A+B)$ **[July 2016]**
7) Find the value for $\sin 15^0$ **[Apr 2018]**
8) Write the value for $\sin 75^0$
9) Find $\cos 2A\ \ if\ \sin A = \frac{1}{2}$ **[July 2018]**
10) If $\sin A = \frac{1}{2}, find\ \sin 2A$
11) Find the value of: $\sin 80^0 \cos 10^0 + \cos 80^0 \sin 10^0$ **[June 2019]**
12) Find the value of: $\sin 70^0 \cos 20^0 + \cos 70^0 \sin 20^0$
13) Express $\sin 5A \cos 3A$ as sum or difference of two trigonometric function **[Apr 2019]**

## II. TWO mark questions:

1) If $\tan A = \frac{1}{3},\ \tan(A+B) = \frac{1}{7}\ then\ find\ \tan B$ **[Apr 2015]**
2) If $\tan A = \frac{1}{2},\ \tan(A-B) = \frac{2}{7}\ then\ find\ \tan B$ **[Apr 2018]**
3) Prove that: $\frac{\cos 2A}{\sec A} + \frac{\sin 2A}{\operatorname{cosec} A} = \cos A$ **[Apr 2015, 2018]**
4) If $A+B+C = 180^0\ and\ \tan A = 1,\ \tan B = 2,\ show\ that\ \tan C = 3$ **[July 2015]**
5) Prove that: $\frac{\cos 75^0 + \cos 15^0}{\sin 75^0 - \sin 15^0} = \sqrt{3}$ **[July 2015]**
6) Prove that: $\frac{\cos 2y - \cos 2x}{\sin 2y + \sin 2x} = \tan(x-y)$ **[June 2019]**
7) Prove that: $\frac{\cos 2A - \cos 12A}{\sin 12A - \sin 2A} = \tan 7A$
8) Prove that: $\cos 3A = 4\cos^3 A - 3\cos A$ **[Apr 2016]**
9) Prove that: $\sin 3A = 3\sin A - 4\sin^3 A$
10) Find the value of $\tan 15^0$ **[Apr 2016]**
11) Find the value of $\tan 105^0$ **[June 2019]**
12) Find the value of $\cos 15^0$ **[Apr 2019]**
13) Prove that: $\frac{\cos 2A}{1+\sin 2A} = \frac{\cos A - \sin A}{\cos A + \sin A}$ **[July 2016]**
14) Prove that: $\frac{\sin 3A}{1+2\cos 2A} = \sin A$ **[July 2017]**
15) Prove that: $\sin 2A = \frac{2\tan A}{1+\tan^2 A}$ **[Apr 2017]**

16) If $\sin A = \frac{3}{5}, \cos B = -\frac{8}{17}, \frac{\pi}{2} < A < \pi \text{ and } \frac{\pi}{2} < B < \pi, \text{find the value of } \sin(A-B)$ **[July 2016]**

17) Show that: $\cos\left(\frac{\pi}{4}-\alpha\right)\cos\left(\frac{\pi}{4}+\alpha\right) = \sqrt{2}\sin\alpha$ **[Apr 2017]**

18) Show that: $\tan(45^\circ + A)\tan(45^\circ - A) = 1$ **[Apr 2018]**

19) If $\tan A = \frac{5}{6}, \ \tan B = \frac{1}{11}$ *then prove that* $A + B = \frac{\pi}{4}$ **[July 2017]**

20) If $\tan A = \frac{1}{2}, \ \tan B = \frac{1}{3}$ *find* $\tan(A+B)$ **[Apr 2019]**

21) If $\tan A = \frac{1}{2}, \ \tan B = \frac{1}{3}$ *then prove that* $A + B = \frac{\pi}{4}$

22) Prove that: $(\sin A + \cos A)^2 = 1 + \sin 2A$ **[July 2018]**

23) Prove that: $\frac{\sin x - \sin y}{\sin x + \sin y} = \tan\left(\frac{x-y}{2}\right)\cot\left(\frac{x+y}{2}\right)$ **[July 2018]**

24) Derive the value for $\cos 105^0$

25) Transform $2\sin 40^0 \cos 20^0$ *into sum.*

26) If $\sin\theta = \frac{3}{5}$ *and* $\theta$ *is acute, find* $\sin 3\theta$

27) Show that: $\sin(A+B)\sin(A-B) = \sin^2 A - \sin^2 B$

28) Prove that: $\cot(A+B) = \frac{\cot A \cot B - 1}{\cot A + \cot B}$

29) Prove that: $\tan 4A \tan 3A \tan A = \tan 4A - \tan 3A - \tan A$

30) If $A + B + C = 180^\circ$, *Prove that*: $\cot A \cot B + \cot B \cot C + \cot C \cot A = 1$

31) If $A + B + C = \frac{\pi}{2}$, *Prove that*: $\tan A \tan B + \tan B \tan C + \tan C \tan A = 1$

32) If $A + B + C = \pi$, *Prove that*: $\tan A + \tan B + \tan C = \tan A \tan B \tan C$

### III. FIVE mark questions:

1) Prove that: $\cos 20^0 \cos 40^0 \cos 80^0 = \frac{1}{8}$ **[Apr 2015]**

2) Prove that: $\frac{\cos 7x + \cos 3x - \cos 5x - \cos x}{\sin 7x - \sin 3x - \sin 5x + \sin x} = \cot 2x$ **[Apr 2016]**

3) Prove that: $\frac{\sin 5A + \sin 4A + \sin 2A + \sin A}{\cos 5A + \cos 4A + \cos 2A + \cos A} = \tan 3A$ **[Apr 2018]**

4) Show that: $\frac{\sin^3\theta + \sin 3\theta}{\sin\theta} + \frac{\cos^3\theta - \cos 3\theta}{\cos\theta} = 3$

5) Prove that: $\sin 20^0 \sin 40^0 \sin 60^0 \sin 80^0 = \frac{3}{16}$ **[July 2017, 2018]**

6) Prove that: $\cos 20^0 \cos 40^0 \cos 60^0 \cos 80^0 = \frac{1}{16}$

7) Prove that: $\cos 10^0 \cos 30^0 \cos 50^0 \cos 70^0 = \frac{3}{16}$

8) Prove that: $\cos^2\theta + \cos^2(60^0 + \theta) + \cos^2(60^0 - \theta) = \frac{3}{2}$

If $A + B + C = 180^0$, Prove the following:

9) Prove that: $\sin 2A + \sin 2B + \sin 2C = 4\sin A \sin B \sin C$ **[Apr 2019]**

10) In any $\Delta ABC$, Prove that: $\sin 2A + \sin 2B - \sin 2C = 4\cos A \cos B \sin C$ **[Apr 2017, 2018]**

11) Prove that: $\sin 2A - \sin 2B + \sin 2C = 4\cos A \sin B \cos C$

12) Prove that: $\sin 4A + \sin 4B + \sin 4C = -4\sin 2A \sin 2B \sin 2C$

13) Prove that: $\cos 2A + \cos 2B + \cos 2C = -1 - 4\cos A \cos B \cos C$

14) Prove that: $\cos 2A + \cos 2B - \cos 2C = 1 - 4\sin A \sin B \cos C$

15) Prove that: $\cos 2A - \cos 2B + \cos 2C = 1 - 4 \sin A \cos B \sin C$
16) Prove that: $\sin^2 A + \sin^2 B + \sin^2 C = 2 + 2 \cos A \cos B \sin C$
17) Prove that: $\sin^2 A + \sin^2 B - \sin^2 C = 2 \sin A \sin B \cos C$
18) Prove that: $\cos^2 A + \cos^2 B + \cos^2 C = 1 - 2 \cos A \cos B \cos C$
19) Prove that: $\cos^2 A + \cos^2 B - \cos^2 C = 1 - 2 \sin A \sin B \cos C$
20) Prove that: $\frac{\sin 3\theta}{1+2\cos 2\theta} = \sin\theta$. Hence deduce the value of $\sin 15^0$ **[June 2019]**

# 15. CIRCLES

## I. ONE mark questions:

1) Find the equation of a circle with centre $(-1,-2)\ and\ r = 5cms$ **[Apr 2015]**
2) If $x^2 + y^2 - 4x - 8y + k = 0\ represents\ a\ point\ circle, find\ k.$ **[July 2015]**
3) If the radius of the circle $x^2 + y^2 + 4x - 2y - k = 0\ is\ 4\ units, find\ k.$ **[Apr 2016]**
4) Find the length of the chord of the circle $2x^2 + 2y^2 + 6x - 2y - 12 = 0$ intercepted by $y - axis.$ **[July 2016]**
5) Find the length of the chord of the circle $x^2 + y^2 - 6x - 4y - 12 = 0$ on the co-ordinate axes **[Apr 2018]**
6) Find the equation of a circle whose centre $(4,-2)$ and passes through the origin **(2 Mark)[July 2017]**
7) Find the centre of the circle $x^2 + y^2 - 4x - y - 5 = 0$ **[Apr 2019]**
8) Find the radius of the circle $x^2 + y^2 - 4x - 5 = 0$
9) Find the centre of the circle $x^2 + y^2 = 25$
10) Find the equation of a circle whose end points of it's diameter are $(3,4)\ and\ (1,-2)$
11) Find the equation of the point circle with centre at $(3,-5)$ **[June 2019]**
12) Find the equation of the point circle with centre at $(4,-3)$

## II. THREE mark questions:

1. If one end of the diameter of the circle $x^2 + y^2 + 2x + 6y - 22 = 0$ is $(3,-7)$. Find the co-ordinates of the other end point. **[July 2018]**
2. Find the equation of a circle two of whose diameters are $x + y = 4\ and\ x - y = 2$, having radius 10 units **[Apr 2018]**

## III. FIVE/SIX mark questions:

1) Show that the points $(2,-4),(3,-1),(3,-3)\ and\ (0,0)\ are\ concyclic.$ **[Apr 2015]**
2) Show that the points $(0,0),(1,1),(5,-5)\ and\ (6,-4)\ are\ concyclic.$ **[Apr 2016] [June 2019]**
3) Show that the points $(1,0),(2,-7),(8,1)\ and\ (9,-6)\ are\ concyclic.$
4) Show that the points $(2,0),(-1,3),(-2,0)\ and\ (1,-1)\ are\ concyclic.$
5) Show that the points $(1,1),(-2,2),(-2,-8)\ and\ (-6,0s)\ are\ concyclic.$
6) Find the equation of a circle passing through the points $(5,3),(1,5),(3,-1)$ **[Apr 2019][July 2015]**
7) Find the equation of a circle passing through the points $(1,1),(2,-1)\ and\ (3,2)$
8) Find the equation of a circle passing through the points $(0,2),(3,0)\ and\ (3,2)$ **[Apr 2018]**
9) Find the equation of a circle passing through the points $(0,5)\ and\ (6,1)$ and has its centre on the line $12x + 5y = 25$ **[Apr 2016]**
10) Find the equation of a circle passing through the points $(1,-4)\ and\ (5,2)$ and has its centre on the line $x - 2y + 9 = 0$ **[Apr 2017]**
11) Find the equation of a circle passing through the points $(1,2)\ and\ (2,1)$ and has its centre on $y - axis$ **[July 2018]**
12) Find the equation of a circle passing through the points $(0,0)\ and\ (1,1)$ and has its centre on $x - axis$ **[Apr 2018]**
13) A circle has its centre on $x - axis$ and passes through $(5,1)\ and\ (3,4)$. Find its equation.

# 16. PARABOLA

## I. TWO mark questions:

1) Find the equation of the parabola whose vertex is $(0,0)$ $and\ directrix\ is\ y=2$ **[June 2019]**
2) Find the equation of the parabola with focus $(0,-3)$ $and\ directrix\ y=3$ **[Apr 2015]**
3) Find the equation of the parabola with focus $(0,-4)$ $and\ directrix\ y=4$ **[Apr 2018]**
4) Find the equation of the parabola whose vertex is $(0,0)$ and focus is $(3,0)$ **[Apr 2019]**
5) Find the focus and equation of the directrix of the parabola $x^2=-16y$ **[July 2015]**
6) Find the coordinates of the focus of the parabola $y^2+4x=0$ **[July 2016]**
7) Find the coordinates of the focus of the parabola $y^2-16x=0$ **[Apr 2018]**
8) Find the length of the latus rectum of the parabola $3x^2+8y=0$ **[Apr 2017]**
9) If the length of the latus rectum of the parabola $x^2=4ky\ is\ 8$, find k. **[July 2017]**
10) Find the equation of directrix for a given parabola $x^2=6y$ **[Apr 2018]**
11) Find the equation of the parabola given that vertex $(0,0)$ and directrix $x=-5$ **[July 2018]**
12) Find the focus and equation of the directrix of the parabola $x^2-16y=0$
13) If $y^2=16x$ find the focus and latus rectum of the parabola.
14) Find the equation of the parabola with focus $(0,-6)$ $and\ directrix\ y=6$

## II. THREE mark questions:

1) Find the coordinates of the focus, equation to the directrix and coordinate ends of the latus rectum of the parabola $y^2=8x$. **[Apr 2015]**
2) Find the equation of the parabola given that its vertex is $(0,0)$, axis is $y-axis$ and passes through $(-1,-3)$

**[July 2015] [Apr 2016, 2019]**

3) Find the equation of the parabola whose vertex is $(0,0)$, axis is $y-axis$ and passes through $\left(\frac{1}{2},2\right)$. Also find equation of directrix. **[Apr 2017]**
4) Find the equation of the parabola whose vertex is $(0,0)$, axis is $y-axis$ and passing through the point $(3,-4)$ **[July 2016]**
5) Find the equation of the parabola whose vertex is $(0,0)$ and passing through the point $P(5,2)$ and symmetric with respect to the $y-axis$ **[Apr 2018]**
6) Find the focus, equation of directrix and length of latus rectum of $x^2+16y=0$ **[Apr 2016]**
7) Find the focus, equation of directrix and length of latus rectum of $y^2-12x=0$ **[June 2019]**
8) Find the equation of the parabola, if its focus is $(4,0)$ and directrix is $x=-4$. Also find the equation of the tangent at the vertex. **[July 2017]**
9) Find the equation of the parabola whose focus is $(-5,0)$ and directrix is $x=5$
10) Find the coordinates of the vertex, focus and equation of directrix of the parabola $5x^2+24y=0$

# 17. LIMITS & CONTINUITY OF A FUNCTION

## I. ONE mark questions:

1) Evaluate: $\lim_{x\to 0}\left(\frac{\sin ax}{bx}\right)$ **[Apr 2015, 2018]**
2) Evaluate: $\lim_{x\to 0}(1+3x)^{1/x}$ **[July 2015]**
3) Evaluate: $\lim_{x\to 3}\left(\frac{x^2-4x}{x-2}\right)$ **[Apr 2015, 2019]**
4) Evaluate: $\lim_{x\to 0}\left(\frac{\sin 4x}{\sin 2x}\right)$ **[July 2016]**
5) Evaluate: $\lim_{x\to -3}\left(\frac{x^3+27}{x+3}\right)$ **[Apr 2017]**
6) Evaluate: $\lim_{x\to 3}\left(\frac{x^2-x}{x-2}\right)$ **[July 2017]**
7) Evaluate: $\lim_{x\to 3}\frac{2}{x}\log(1+x)$ **[July 2018]**
8) Evaluate: $\lim_{n\to\infty}\left(\frac{n+1}{n}\right)^{3n}$ **[June 2019]**
9) Evaluate: $\lim_{x\to 4}\left(\frac{4x+3}{x-2}\right)$ **[Apr 2018]**
10) Evaluate: $\lim_{x\to 2}\left(\frac{x^2-4}{x-2}\right)$
11) Evaluate: $\lim_{x\to -4}\left(\frac{x^2-256}{x+4}\right)$
12) Evaluate: $\lim_{x\to -1}\left(\frac{x^3+1}{2x^2+5x+3}\right)$
13) Evaluate: $\lim_{\theta\to 0}\left(\frac{\sin 3\theta}{\tan 2\theta}\right)$

## II. TWO mark questions:

1) Verify whether the function $f(x)=\begin{cases}x^2-1, & x\le 1\\ -x^2-1, & x>1\end{cases}$ is continuous or not at $x=1$ **[Apr 2019]**
2) Prove that the function $f(x)=\begin{cases}x^2+1, & x<2\\ 5, & x=2\\ 4x-3, & x>2\end{cases}$ is continuous or not at $x=2$ **[June 2019]**
3) Find k if the function $f(x)=\begin{cases}\frac{e^{2x}-1}{x}, & x\neq 0\\ k, & x=0\end{cases}$ is continuous at $x=0$ **[Apr 2015, 2017][July 2018]**
4) Find k if the function $f(x)=\begin{cases}\frac{x^4-256}{x-4}, & x\neq 4\\ k, & x=4\end{cases}$ is continuous at $x=4$ **[Apr 2018][July2015]**
5) Find k if the function $f(x)=\begin{cases}k+x, & x=1\\ 4x+3, & x\neq 1\end{cases}$ is continuous at $x=1$ **[Apr 2016, 2018]**
6) Find k if the function $f(x)=\begin{cases}(1+2x)^{1/x}, & x\neq 0\\ k, & x=0\end{cases}$ is continuous at $x=0$ **[July 2015]**
7) Show that the function $f(x)=\begin{cases}(1+3x)^{1/x}, & x\neq 0\\ e^3, & x=0\end{cases}$ is continuous at $x=0$ **[July 2017]**

8) Find k if the function $f(x) = \begin{cases} \frac{e^{5x}-1}{2x}, & x \neq 0 \\ k/2 \ , & x = 0 \end{cases}$ is continuous at $x = 0$

9) Evaluate: $\lim_{x\to 0}\left(\frac{\sin 3x \ \tan 4x}{x^2}\right)$

10) Evaluate: $\lim_{\theta\to 0}\left(\frac{\tan 5\theta \sin^2\theta}{\theta^3}\right)$

**III. SIX mark questions:**

1) Show that: $\lim_{x\to a}\left(\frac{x^n-a^n}{x-a}\right) = na^{n-1}$, for all rational values of n. **[Apr 2015, 16, 18, 19] [June 2016,17,19]**

2) Show that: $\lim_{\theta\to 0}\left(\frac{\sin\theta}{\theta}\right) = 1$ and hence deduce that $\lim_{\theta\to 0}\left(\frac{\tan\theta}{\theta}\right) = 1$ **[July 2015, 18][Apr 2017,18]**

# 18. DIFFERENTIAL CALCULUS

**I. ONE mark questions:**

1) Find $\frac{dy}{dx}$ if $\sqrt{x} + \sqrt{y} = 3$ **[Apr 2015]**

2) If $y = \cos x^3 \ find \ \frac{dy}{dx}$ **[July 2015]**

3) If $y^2 = 4ax \ find \ \frac{dy}{dx}$ **[Apr 2016]**

4) If $y = e^x + x^e + e^e, \ find \ \frac{dy}{dx}$ **[July 2016]**

5) If $y = e^{\log(cotx)}, \ find \ \frac{dy}{dx}$ **[Apr 2017]**

6) Differentiate: $e^x - \log x - 3\sqrt{x} \ w.r.t.x$ **[July 2017]**

7) Differentiate: $5e^x - \log x - 3\sqrt{x} \ w.r.t.x$ **[Apr 2019]**

8) Differentiate: $\frac{1}{x^7} w.r.t.x$ **[June 2019]**

9) If $y = 5a^x - \log x - 3\sqrt{x}, find \ \frac{dy}{dx}$ **[Apr 2018]**

10) If $y = 2\sqrt{x} - \cos 2x + 2, \ find \ \frac{dy}{dx}$ **[July 2018]**

11) If $y = \frac{1}{\sqrt[3]{x^5}}, find \ \frac{dy}{dx}$ **[Apr 2018]**

12) If $y = \sec(\sec x), find \ \frac{dy}{dx}$

13) If $y = \sqrt[3]{x}, find \ \frac{dy}{dx}$

14) If $x^2 - y^2 = a^2, \ find \ \frac{dy}{dx}$

15) Find $\frac{dy}{dx}$ if $\sqrt{x} + \sqrt{y} = \sqrt{a}$

16) If $f(x) = x^n \ and \ f'(1) = 10. Find \ the \ value \ of \ n$

17) If $y = x + \frac{1}{x} \ show \ that \ x^2\frac{dy}{dx} - xy + 2 = 0$

## II. TWO mark questions:

1) Differentiate: $\sqrt{\tan(x^2)}$ $w.r.t.x$ **[June 2019]**
2) If $y=\sqrt{x+\sqrt{x+\sqrt{x+\cdots\cdots\infty}}}$, $then\ Prove\ that: \frac{dy}{dx}=\frac{1}{2y-1}$ **[Apr 2015, 2018]**
3) If $y=x^x\ find\ \frac{dy}{dx}$ **[July 2015, 2018]**
4) If $y=\log\left(\frac{1-\cos x}{1+\cos x}\right), then\ Prove\ that: \frac{dy}{dx}=2\operatorname{cosec} x$ **[Apr 2015]**
5) Find $\frac{dy}{dx}$, if $x^y=y^x$ **[July 2016]**
6) If $y=x^{\sin x}, find\ \frac{dy}{dx}$ **[Apr 2017]**
7) If $y=(a^2-x^2)^{10}, find\ \frac{dy}{dx}$ **[Apr 2019]**
8) If $y=x^{5+\log x}, find\ \frac{dy}{dx}$
9) If $\sin y=x\sin(a+y), prove\ that\ \frac{dy}{dx}=\frac{\sin^2(a+y)}{\sin a}$ **[July 2017]**
10) If $y=\sqrt{\frac{1-\cos 2x}{1+\cos 2x}}$ $then\ Prove\ that: \frac{dy}{dx}=\sec^2 x$ **[Apr 2018]**
11) If $y=e^{\log_e\left(x+\sqrt{x^2+a^2}\right)}\ find\ \frac{dy}{dx}$
12) If $y=\log[\log(\log x)]\ find\ \frac{dy}{dx}$
13) If $y=\log[\log(\tan x)]\ find\ \frac{dy}{dx}$
14) If $y=\log\left(\frac{1+\sin x}{1-\sin x}\right), then\ find\ \frac{dy}{dx}$

## III. THREE mark questions:

1) Differentiate $e^x$ w.r.t. x from first principle **[Apr 2015]**
2) Differentiate $x^n$ w.r.t. x from first principle **[Apr 2016]**
3) Differentiate $\sin x$ w.r.t. x from first principle **[July 2018]**
4) Differentiate $y=\frac{e^x-1}{e^x+1}$ w.r.t. x **[Apr 2019]**
5) If $x=\frac{1-t^2}{1+t^2}$, $y=\frac{2t}{1+t^2}\ find\ \frac{dy}{dx}$ **[July 2015]**
6) If $x=a\cos(\log t), y=a\log(\cos t)\ find\ \frac{dy}{dx}$ **[July 2016]**
7) If $x=a(\theta-\sin\theta),\ y=a(1-\cos\theta)\ then\ prove\ that\ \frac{dy}{dx}=\cot(\theta/2)$ **[Apr 2017, 2018] [June 2019]**
8) If $x=a\cos^4\theta, y=a\sin^4\theta, show\ that\ \frac{dy}{dx}=-\tan^2\theta$ **[July 2017]**
9) If $x=a\sec\theta,\ y=b\tan\theta, find\ \frac{dy}{dx}\ at\ \theta=\frac{\pi}{4}$ **[Apr 2018]**
10) If $x=a\cos^4 t, y=a\sin^4 t\ find\ \frac{dy}{dx}\ at\ t=\frac{\pi}{4}$
11) If $x=a\log(\sec\theta),\ y=a(\tan\theta-1), find\ \frac{dy}{dx}=2\operatorname{cosec} 2\theta$
12) If $x=e^{\log(\cos 4\theta)},\ y=e^{\log(\sin 4\theta)}, show\ that\ \frac{dy}{dx}=-\frac{x}{y}$
13) If $x=e^t(\cos t+\sin t),\ y=e^t(\cos t-\sin t),\ show\ that\ \frac{dy}{dx}=-\tan t$

14) If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \cdots\cdots \infty}}}$ $find\ \frac{dy}{dx}$

15) If $y = \frac{\cos x + \sin x}{\cos x - \sin x}$ $show\ that\ \frac{dy}{dx} = \sec^2\left(x + \frac{\pi}{4}\right)$

16) If $e^y = \sin(x+y)$ $Prove\ that: \frac{dy}{dx} = \frac{\cos(x+y)}{e^y - \cos(x+y)}$

17) If $x^y = e^{y-x}, show\ that: \frac{dy}{dx} = \frac{2 - \log x}{(1 - \log x)^2}$

18) If $x\sqrt{1+y} + y\sqrt{1+x} = 0, Show\ that: \frac{dy}{dx} = -\frac{1}{(1+x)^2}$

19) If $e^x + e^y = e^{x+y}, show\ that: \frac{dy}{dx} = -e^{y-x}$

20) If $2^x + 2^y = 2^{x+y}$, $then\ \ find\ \frac{dy}{dx}$

21) If $\sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = a$, $show\ that: x\frac{dy}{dx} = y$

22) If $x^m y^n = (x+y)^{m+n}, show\ that: \frac{dy}{dx} = \frac{y}{x}$

23) If $(xe)^y = e^x, show\ that: \frac{dy}{dx} = \frac{\log x}{(1 + \log x)^2}$

24) If $y = (x+1)^2(x+2)^3(x+3)^4$ $find\ \frac{dy}{dx}$

25) If $y = \sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}$ $find\ \frac{dy}{dx}$

26) If $y = x^2 e^{x^2} \log x$, $find\ \frac{dy}{dx}$

**IV. FIVE mark questions:**

1) If $y = (x^2 + a^2)^6$, $Prove\ that: (x^2 + a^2)\frac{d^2y}{dx^2} - 10x\frac{dy}{dx} - 12y = 0$ **[Apr 2015] [July 2018]**

2) If $y = \left(x + \sqrt{1+x^2}\right)^m$ $Prove\ that: (1+x^2)y_2 + xy_1 - m^2 y = 0$ **[Apr 2018] [July 2015]**

3) If $y = \left(x + \sqrt{a^2 + x^2}\right)^n$ $Prove\ that: (a^2 + x^2)y_2 + xy_1 - n^2 y = 0$

4) If $y = x + \sqrt{x^2 - 1}$, $Prove\ that: (x^2 - 1)y_2 + xy_1 - y = 0$ **[June 2017, 2019]**

5) If $y = \log\left(x - \sqrt{x^2 + 1}\right)$ $Prove\ that: (x^2 + 1)y_2 + xy_1 = 0$ **[Apr 2017]**

6) If $y = \log\left(x + \sqrt{x^2 + 1}\right)$ $Prove\ that: (x^2 + 1)y_2 + xy_1 = 0$ **[Apr 2019]**

7) If $y = e^x \log x, then\ Show\ that: xy_2 - (2x-1)y_1 + (x-1)y = 0$

8) If $y = a\cos(\log x) + b\sin(\log x)$, $Prove\ that: x^2 y_2 + xy_1 + y = 0$ **[Apr 2016, 2018]**

9) If $xy + 6y = 2x$, $then\ show\ that: \frac{d^2y}{dx^2} = \frac{-24}{(x+6)^3}$ **[July 2016]**

10) If $x^2 + 2xy + 3y^2 = 1$, $then\ show\ that: \frac{d^2y}{dx^2} = \frac{-2}{(x+3y)^3}$

11) If $x^2 + xy + y^2 = a^2$, $then\ show\ that: \frac{d^2y}{dx^2} = \frac{-6a^2}{(x+2y)^3}$

12) If $x^2 - xy + y^2 = a^2$, $then\ show\ that: \frac{d^2y}{dx^2} = \frac{6a^2}{(x-2y)^3}$

13) Differentiate: $x^{\log x} + (\log x)^x$

# 19. APPLICATION OF DERIVATIVES

## I. TWO mark questions:

1) The displacement 's' of a particle at time 't' is given by $s = 4t^3 - 6t^2 + t - 7$. Find the velocity and acceleration when $t = 2\ seconds$ **[Apr 2015, 2018]**
2) When brakes are applied to a moving car, the car travels a distance's' feet in 't' sec is given by $s = 20t - 40t^2$.When **and where** does the car stop? **[July 2015]**
3) The radius of the sphere is increasing at the rate of $0.5mts/sec$. Find the rate of increase of its volume when $r = 1.5mts$ **[July 2015]**
4) If the sum of two numbers is 48, find the numbers whose product is maximum. **[Apr 2016]**
5) If $s = 5t^2 + 4t - 8$, find the initial velocity and acceleration. **[July 2016] [Apr 2018]**
6) If total cost of production is given by $C(x) = 5x^2 + 2x + 3$, find the Average and marginal cost for an output of 10 units. **[Apr 2017]**
7) If $s = at^3 + bt, find\ a\ and\ b\ given\ when\ t = 3, velocity\ is\ 0\ and\ the\ acceleration\ is\ 14\ units.$ **[July 2017]**
8) If the cost function of a firm is given by $C(x) = x^3 - 3x + 7$, find the marginal cost and average cost **[Apr 2019]**
9) If the total cost $C(x) = x^2 + 2x + 1$, find the marginal cost and average cost
10) If $s = \sqrt{t-1}$ find velocity (or S.T: velocity is inversely proportional to the displacement) **[July 2018]**

## II. THREE mark questions:

1) A circular patch of oil spreads on water, the area growing at the rate of $16cm^2/min$.How fast are the radius and the circumference increasing when the diameter is 12cms? **[Apr 2015]**
2) If $s = 2t^3 - 5t^2 + 4t - 3$, find
   i. The time when the acceleration is $14ft/sec^2$
   ii. The velocity and displacement at that time **[Apr 2016]**
3) Find the maximum and minimum values of the function $f(x) = 2x^3 - 3x^2 - 12x + 12$ **[July 2016, 2019]**
4) Find the maximum and minimum values of the function $f(x) = 3x^3 - 9x^2 - 27x + 30$ **[July 2018]**
5) Find the maximum and minimum values of the function $f(x) = 9x^2 + 12x + 2$ **[Apr 2017,2018]**
6) Find the maximum and minimum values of the function $f(x) = x^3 - 9x^2 + 15x - 1$ **[Apr 2019]**
7) Find the maximum and minimum values of the function $f(x) = x^5 - 5x^4 + 5x^3 - 1$
8) Find two positive numbers whose sum is 14 and the sum of the squares of the numbers is minimum. **[July 2017]**
9) Show that $x^x\ is\ minimum\ \ at\ x = \frac{1}{e}$ **[Apr 2018]**
10) Divide 20 into two parts so that the product is maximum
11) A square plate is expanding uniformly, the side is increasing at the rate of $5cm/s$. What is the rate at which the area and its perimeter is increasing when the side is 20cm long? **[Apr 2019]**
12) The surface area of a spherical bubble is increasing at the rate of $0.6cm^2/sec$. Find the rate at which its volume is increasing when its radius is 3cm **[Apr 2017]**
13) The surface area of a spherical bubble is increasing at the rate of $0.8cm^2/sec$. Find the rate at which its volume is increasing when its radius is 2.5cm
14) A circular plate of metal is heated so that its radius increases at the rate of $0.1mm/min$. At what rate is the plate's area increasing when the radius is 25cm.

15) The side of an equilateral triangle is increasing at the rate $\sqrt{3}cm/s$. Find the rate at which its area is increasing when its side is 200cms. **[July 2017]**
16) The volume of a sphere is increasing at the rate $4\pi\ cc/sec$.Find the rate at which the area of its surface increases when its radius is 10cm. **[Apr 2018]**
17) The volume of a spherical ball is increasing at the rate $4\pi\ cc/sec$. Find the rate of increase of the radius of the ball when the volume is $288\pi\ cc$
18) The height of a cone is 30cm and it is constant, the radius of the base is increasing at the rate $0.25cm/sec$.Find the rate of increase of volume of the cone when the radius is 10cm?
19) Water is being poured at the rate 30 $m^3/min$ into a cylindrical vessel whose base is a circle of radius 3mt. Find the rate at which the level of water is rising?
20) The side of a square is increasing at the rate of $10cm/sec$. If the side 20cm, find the rate of increase of its area.
21) If the total cost function is given by $C(x) = 350 + 12x + \frac{x^2}{4}$ and revenue function is given by $R(x) = 75x - 2x^2$, find the level of output at which profit is maximum. **[July 2015]**
22) A man 2mt height walks at a uniform sped of 6 km/hr away from the lamp post 6 mt. Find the rate at which the
    i. Length of his shadow increase
    ii. Rate of which the tip of the shadow is moving **[July 2018]**
23) A ladder 17 feet long leans against a smooth vertical wall.If the upper end is moving at the rate of 2ft/min. Find the rate at which the lower end is moving when the lower end is 8ft from the wall. **[June 2019]**
24) A ladder 15 feet long leans against a smooth vertical wall.If the upper end is moving at the rate of 2ft/sec. Find how fast the lower end is moving when the lower end is 12ft away from the wall. **[Apr 2018]**
25) Find a point on the parabola $y^2 = 4x$ at which the ordinate increases at twice the rate of the abscissa.

### III. FOUR mark questions:

1) The total revenue function is given by $R = 400x - 2x^2$ and the total cost function given by $C = 2x^2 + 40x + 4000$ find
    i. The marginal revenue and marginal cost function
    ii. The average revenue and average cost **[June 2017, 2019]**
2) The total cost of C of output Q is given by $C = 300Q - 10Q^2 + \frac{Q^3}{3}$, find the output level at which the marginal cost and the average cost attain their respective minimum.

# 20. INDEFINITE & DEFINITE INTEGRALS

## I. ONE mark questions:

1) Evaluate: $\int \frac{1}{\sqrt[3]{x^5}}\, dx$ **[Apr 2015]**
2) Evaluate: $\int (x^e + e^x - \log a)dx$ **[July 2015, 2019]**
3) Evaluate: $\int \left(x^e + e^x - \frac{1}{x}\right) dx$ **[July 2018]**
4) Integrate: $\left(x^2 - \frac{6}{x} + 5e^x\right)$ $w.r.t\ x$ **[Apr 2019]**
5) Evaluate: $\int \frac{3}{x} dx$ **[Apr 2016]**
6) Evaluate: $\int \sec x\,(\sec x - \tan x)dx$ **[Apr 2017]**
7) Evaluate: $\int \sec^2(x-5)\, dx$ **[July 2017]**
8) Evaluate: $\int \frac{1}{5e^{-x}} dx$ **[Apr 2018]**
9) Evaluate: $\int \left(\sin x - \frac{2}{x} + e^x\right) dx$ **[Apr 2018]**
10) Evaluate: $\int \frac{1}{7x+8} dx$
11) Evaluate: $\int \left(\frac{1}{x} - \sin x + 3\right) dx$
12) Evaluate: $\int e^{3x} dx$
13) Evaluate: $\int \left(\frac{1+x^2}{x}\right) dx$

## II. TWO mark questions:

1) Evaluate: $\int \sin 3x \cos 2x\ \ dx$ **[Apr 2015]**
2) If the MC is given by $f'(x) = 10 + 6x - 6x^2$, where x is the output, then find the total cost assuming that the fixed cost is ₹125. **[Apr 2015][July 2016]**
3) Evaluate: $\int \frac{e^x}{e^x+1} dx$ **[July 2015]**
4) Evaluate: $\int \frac{3^x \log 3}{(3^x+1)} dx$ **[July 2017]**
5) Evaluate: $\int \frac{4x+3}{2x^2+3x+5} dx$ **[Apr 2019]**
6) Evaluate: $\int \frac{x}{x^2+4} dx$
7) Evaluate: $\int \frac{3x^2}{1+x^3} dx$ **[July 2018]**
8) Evaluate: $\int_1^2 (x + e^x)\, dx$ **[July 2015]**
9) Evaluate: $\int_1^2 (x^3 + e^x)\, dx$ **[Apr 2017, 2018]**
10) Evaluate: $\int \frac{\sin^2 x}{1+\cos x} dx$ **[Apr 2016, 2018]**
11) Evaluate: $\int_{-\pi/4}^{\pi/4} \text{cosec}^2\, x\ \ dx$ **[Apr 2016]**
12) Evaluate: $\int_{-\pi/4}^{\pi/4} \sec^2 x\ \ dx$ **[June 2019]**
13) Evaluate: $\int \frac{1}{x(2\log x+5)} dx$ **[June 2019]**

14) Evaluate: $\int \frac{\sec^2 x \tan x}{3+\sec^2 x}\,dx$ **[July 2016]**

15) Evaluate: $\int \frac{1}{\sqrt{x}+x}\,dx$ **[Apr 2016]**

16) Evaluate: $\int_1^2 \frac{1}{2x+3}\,dx$ **[July 2017]**

17) Evaluate: $\int_1^2 \frac{1}{x}\,dx$ **[Apr 2018]**

18) Evaluate: $\int (4x^2 - 2x + 7)^{3/2}(4x - 1)\,dx$ **[Apr 2018]**

19) Evaluate: $\int_0^{\pi/4} \sec^2 3x\,dx$ **[July 2018]**

20) Find the area enclosed by the curve $y = x^2 + 2x$ between the ordinates $x = 0\ and\ x = 2$

21) The demand function of a firm is $2x - 5y = 7$ (x is the output, y is the price/unit). Find the marginal revenue

**III. THREE mark questions:**

1) Evaluate: $\int_1^2 xe^x\,dx$ **[Apr 2015, 2019]**

2) Evaluate: $\int \frac{4x+5}{(x-1)(x+2)}\,dx$ **[Apr 2015, 2018]**

3) Evaluate: $\int x^2 \log x\ dx$ **[July 2015] [Apr 2018]**

4) Evaluate: $\int x^2 \sin x\ dx$ **[Apr 2019]**

5) Evaluate: $\int \frac{1+\cos x}{1-\cos x}\ dx$ **[July 2015]**

6) Evaluate: $\int \frac{1+\cos 2x}{1-\cos 2x}\ dx$ **[July 2017]**

7) Evaluate: $\int x \sin x\ dx$ **[Apr 2016]**

8) Evaluate: $\int x \cos x\ dx$ **[July 2018]**

9) Evaluate: $\int \frac{1+e^x}{(x+e^x)^5}\,dx$ **[Apr 2016]**

10) Evaluate: $\int_0^1 (6x + 1)\sqrt{3x^2 + x + 5}\,dx$ **[July 2017]**

11) Evaluate: $\int (2x + 3)(x^2 + 3x + 5)^{3/2}\,dx$ **[Apr 2019]**

12) Evaluate: $\int x^3 \log x\ dx$ **[July 2016]**

13) Evaluate: $\int_0^{\pi/4} \sin 3x \cos x\,dx$ **[July 2016]**

14) Evaluate: $\int x \log x\ dx$ **[Apr 2017]**

15) Evaluate: $\int_0^1 \frac{2x+5}{x^2+5x+3}\,dx$ **[Apr 2017]**

16) Evaluate: $\int \operatorname{cosec} x\,(\operatorname{cosec} x + \cot x)\,dx$ **[Apr 2018]**

17) Evaluate: $\int \frac{1}{1+\cos x}\ dx$ **[July 2018]**

18) Evaluate: $\int \frac{x}{\sqrt{x+9}}\,dx$ **[June 2019]**

19) Evaluate: $\int x^2 e^{3x}\ dx$ **[June 2019]**

20) Evaluate: $\int \frac{5x}{(x-3)(x+4)}\,dx$

21) Evaluate: $\int \frac{4x+3}{(x-1)(x+2)}\,dx$

22) Evaluate: $\int x^2 \cos 3x\,dx$

23) Evaluate: $\int e^{\sin x} \cos x\,dx$ **[Apr 2018]**

24) Evaluate: $\int \frac{1}{e^x+e^{-x}}\,dx$

25) Evaluate: $\int_0^{\pi/2} \sin 5x \cos 3x \, dx$

**IV. FIVE mark questions:**

1) Find the area under the curves $y^2 = 4x \ and \ x^2 = 4y$ **[Apr 2015, July 2017]**
2) Find the area enclosed between the curves $y^2 = x \ and \ x^2 = y$ **[July 2016] [Apr 2018]**
3) Find the area under the curves $y^2 = 4ax \ and \ x^2 = 4ay$
4) Find the area enclosed between parabola $y^2 = x \ and \ the \ line \ x + y = 2$ **[Apr 2018][July 2015]**
5) Find the area bounded between the parabola $y^2 = 4x \ and \ the \ line \ y = 2x - 4$ **[July 2018]**
6) Find the area bounded by the parabola $y^2 = 5x \ and \ the \ line \ y = x$ **[Apr 2016]**
7) Find the area bounded by the parabola $y^2 = 4x \ and \ the \ line \ x = y$ **[Apr 2019]**
8) Find the area enclosed between the parabola $y^2 = 4ax \ and \ the \ line \ y = mx$
9) Find the area enclosed between the curves $4y = 3x^2 \ and \ the \ line \ 3x - 2y + 12 = 0$ **[Apr 2017]**
10) Find the area enclosed between the parabola $y^2 = 4ax \ and \ its \ latus \ rectum$
11) Find the area enclosed between the parabola $y^2 = 16x \ and \ its \ latus \ rectum$
12) Find the area enclosed between the parabola $x^2 = 4y \ and \ the \ line \ x = 4y - 2$ **[June 2019]**