MULTIPLE COICE QUESTIONS (1 MARK EACH)

1. The order and the degree of the differential equation $\left(1+3\frac{dy}{dx}\right)^2 = 4\frac{d^3y}{dx^3}$ respectively are:

   (a) $1, \frac{2}{3}$ (b) 3,1 (c) 3,1 (d) 1,2

2. Write the order and the degree of the differential equation $\left(\frac{d^4y}{dx^4}\right)^2 = \left[x+\left(\frac{dy}{dx}\right)^2\right]^3$

   (a) 4,2 (b) 3,1 (c)3,3 (d)1,2

3. The degree of the differential equation

   $$\left(\frac{d^{2y}}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 = x\sin\left(\frac{dy}{dx}\right) \text{ is } 0$$

   (a) 1 (b) 2 (c) 3 (d) not defined

4. The order of differential equation $\frac{d^4y}{dx^4} + \sin\left(\frac{d^2y}{dx^2}\right) = 0 is$

   (a) 2 (b) 4 (c) 1 (d) None of these

5. Integrating factor of the differential equation $(x+y)\frac{dy}{dx} = 1$ is

   (a) $\cos x$ (b) $\tan x$ (c) $\sec x$ (d) $\sin x$

6. Which of the following differential equation satisfied by $y = e^{mx}$

(a) $\frac{dy}{dx}+my=0$ (b) $\frac{dy}{dx}-my=0$ (c) $\frac{d^2y}{dx^2}+m^2y=0$ (d) $\frac{d^2y}{dx^2}-m^2y=0$

7. The General solution of differential equation $(x+y)\frac{dy}{dx}=1$ is

(a) $2x+y=ce^{-y}$ (b) $x+y=ce^{-y}$ (c) $(x+y+1)=ce^{y}$ (d) $x-y=ce^{-y}$

8. The degree of $2x^2\frac{d^2y}{dx^2}=3\frac{dy}{dx}+y=0$ is

(a) 2 (b) 1 (c)) (d) not defined

9. General solution of the differential equation are $\frac{ydx-xdy}{y}=0$ is

(a) $xy=c$ (b) $x=cy^2$ (c) $y=cx$ (d) $y=cx^2$

10. If $x\frac{dy}{dx}=y(\log y-\log x+1)$ then the solution is

(a) $\log\left(\frac{x}{y}\right)=cy$ (b) $\log\left(\frac{y}{x}\right)=cx$ (c) $x\log\left(\frac{y}{x}\right)=cy$ (d) $y\log\left(\frac{x}{y}\right)=cx$

11. The sum of order and degree of differential equation $\left(\frac{d^2y}{dx}\right)^2+x^2\left(\frac{dy}{dx}\right)^3=0$ is

(a) 3 (b) 4 (c) 5 (d) 7

12. The number of solution of $\left(\frac{dy}{dx}\right)=\frac{y+1}{x-1}$ *when* y(1) =2 is

(a) 1 (b) 2 (c) infinite (d) none

13. The order of the differential equation $2x^2\frac{d^2y}{dx^2}-3\frac{dy}{dx}+y=0$ is

(a) 2 (b) 1 (c) 0 (d) not defined

14. The general solution of $\frac{dy}{dx}\neq y\tan x=\sec x$ is

(a) $y\sec x=\tan x+c$ (b) $y\tan x=\sec x+c$

(c) $\tan x=y\tan y+c$ (d) $x\sec x=\tan y+c$

15. The general solution of the differential equation $e^xdy+(ye^x+2x)dx=0$*is*

(a) $xe^y+x^2=c$ (b) $xe^y+y^2=c$ (c) $ye^x+x^2=c$ (d) $ye^y+x^2=c$

16. A homogenous differential equation of the form $\frac{dx}{dy} = h\left(\frac{x}{y}\right)$ can be solved by making the substitution

(a) $y = vx$ (b) $v = yx$ (c) $x = xy$ (d) $x = v$

17. The general solution of the differential equation 18. Which of the following differential equations has $y = c_1e^x + c_2e^{-x}$ has the general solution

(a) $\frac{d^2}{dx^2} + y = 0$ (b) $\frac{d^2y}{dx^2} - y = 0$ (c) $\frac{d^2y}{dx^2} + 1 = 0$ (d) $\frac{d^2y}{dx^2} - 1 = 0$

18. The number of arbitrary constants in the general solution of a differential equation of fourth order are

(a) 0 (b) 2 (c) 3 (d) 4

19. The number of arbitrary constants in the particular solution of a differential equation of third order are

(a) 3 (b) 2 (c) 1 (d) 0

ASSERTION-REASON BASED QUESTIONS (1 MARK EACH)

Direction: Each of these questions contains two statement, Assertion and Reason. Each of these questions also has fur alternative choices have to select one of the codes (a), (b), (c) and (d) given below-

(a) Assertion is correct, Reason is correct Reason is a correct explanation for Assertion.
(b) Assertion is correct, Reason is correct Reason is a correct. Reason is not correct explanation for Assertion
(c) Assertion is correct, Reason is wrong
(d) Assertion is incorrect, Reason is correct.

20. **Assertion(A)** : Order of the differential equation whose solution is

$$y = C_1e^{x+c_2} + C_3e^{x+c4}$$ is 4

Reason(R): Order of the differential equation is equal to the number of independent arbitrary constant mentioned in the solution of differential equation.

21. **Assertion(A):** The Degree of the differential equation $\frac{d^2y}{dx} + 3\left(\frac{dy}{dx}\right)^2 = x^2 \log\left(\frac{d^2x}{dx^2}\right)$ is not defined.

Reason(R): If the differential equation is a polynomial in terms of its derivatives then its degree is defined.

VERY SHORT ANSWER TYPE QUESTIONS (2 MARKS EACH)

1. Write the sum of the order and degree of the differential equation.

$$1+\left(\frac{d^2y}{dx^2}\right)^5=7\left(\frac{d^3y}{dx^3}\right)^4$$

2. The integrating factor of the differential equation $x\frac{dy}{dx}-y=\log x$ is ?
3. The solution of the differential equation $x\frac{dy}{dx}+y=e^x$ is ?
4. The difference of degree and order of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}=\frac{d^2y}{dx^2}$.
5. Show that the differential equation given by $x^2\frac{dy}{dx}=x^2-2y^2+xy$ is Homogeneous.
6. Write the degree and the order of the differential equation $y'''+y^2+e^{y'}=0$
7. The integrating factor of $\sin x\frac{dy}{dx}+(2\cos x)y=\sin x.\cos x$ is ?
8. The General solution of $\frac{dy}{dx}=\sqrt{4-y^2}$ where -2<y<2
9. Form the differential equation of the family of the curves $y=a\sin(x+b)$ where a.b are arbitrary

   constants.
10. Find the differential equation of a curve passing through the point (0,-2) given that at any point

    (x, y) on the curve, the product of the slope of its tangent and y coordinate of the point is equal to the x - coordinate of the point.

SHORT ANSWER TYPE QUESTIONS (3 MARKS EACH)

1. Find a particular solution of the differential equation ; given y=0 when x=1
2. Solve the differential equation $(1+x^2)\frac{dy}{dx}+2xy-4x^2=0$. subject to the initial condition y(0)=0
3. Find the solution of the differential equation $\log\left(\frac{dy}{dx}\right)=ax+by$
4. Find the general solution of the differential equation $\frac{dy}{dx}+\frac{1}{x}=\frac{e^y}{x}$
5. Solve the differential equation $(e^x+1)ydy=e^x(y+1)dx$
6. Find the particular solution of the differential equation $\frac{dy}{ds}=y\tan x$ when y(0)=1
7. Solve the differential equation $x(x^2-1)\frac{dy}{dx}=1$, y=0 when x=2
8. Find the particular solution of the differential equation $xdx-ye^y\sqrt{1+x^2}dy=0$, given that y=1 when x=0
9. Solve the differential equation $\frac{dy}{dx}+2xy=y$

10. Solve the differential equation $xcox\left(\frac{y}{x}\right)\frac{dy}{dx} = y\cos\left(\frac{y}{x}\right) + x$

11. Find the particular solution of the differential equation $x\frac{dy}{dx} + y + \frac{1}{1+x^2} = 0$

12. Find the general solution of the differential equation $x\left(y^3 + x^3\right)dy = \left(2y^4 + 5x^3y\right)dx$

13.

Find the general particular solution of the differential equation

$\frac{dy}{dx} + y\sec x = \tan x$ where $x \in \left[0, \frac{\pi}{2}\right]$ given that $y = 1$ when $x = \frac{\pi}{4}$

14.

Solve the differential equation $\frac{dy}{dx} = \frac{x+y}{x-y}$

15.

Solve the differential equation $\left(1+x^2\right)dy + 2xydx = \cot xdx$

LONG ANSWER TYPE QUESTIONS (5 MARKS EACH)

1. Find the particular solution of the differential equation $(x+y)\frac{dy}{dx} = (x+2y)$
2. Find the particular solution of the differential equation $x\frac{dy}{dx} + y - x + xy\cot x = 0$
3. Solve the differential equation $\left(\tan^{-1}y - x\right)dy = \left(1+y^2\right)dx$ given that $x = 1$ when $y = 0$
4. Find the particular solution of the differential equation $\frac{dy}{dx} = \frac{xy}{x^2+y^2}$ given that $y = 1$ when $x = 0$
5. Find the particular solution of the differential equation $\left(3xy + y^2\right)dx + \left(x^2 + xy\right)dy = 0$ for $x = 1$, $y = 1$.

CASE STUDY BASED QUESTIONS (4 – MARKS EACH)

CASE STUDY -1

1. An equation involving derivatives of the dependent variable with respect to the equation. A differential equation of the form $\frac{dy}{dx} = F(x,y)$ is said to be homogeneous if F(x,y) is a homogeneous function of degree zero whereas a function F(x,y) is a homogeneous function of degree n.

If $F(\lambda x, xy) = \lambda^n F(x,y))$ To solve a homogeneous differential equation of the type $\frac{dy}{dx} = F(x,y) = g\left(\frac{y}{x}\right)$.

We make the substitution y=vx and the separate the variables. Based on the above, answer the following questions:

(i) Show that $(x^2 - y^2)dx + 2xy = 0$ is differential equation of the type $\frac{dy}{dx} = g\left(\frac{y}{x}\right)$

(ii) Solve the above equation to find its general solution.

CASE STUDY -2

2.

A first order – first degree differential equation is of the form $\frac{dy}{dx} = F(x,y)$

If F(x,y) can be expressed as product of g(x).h(y) where g(x) is a function of x and h(y) is a function

of y then

$$\frac{dy}{dx} = g(x).h(x) \Rightarrow \int \frac{1}{h(x)} dy = \int g(x).dx$$

The solution of differential equation by this method is called variable separable.

Based on the above information answer the following questions.

(i) Find the general solution of differential equation : $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$

(ii) What is solution of differential equation

$$\frac{dy}{dx} = -4xy^2$$

MULTIPLE COICE QUESTIONS (1 MARK EACH)

1. Find a unit vector in the direction of vector a$\vec{a}$ = $6\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$

(A) $\frac{6\hat{\imath}+2\hat{\jmath}+3\hat{k}}{|7|}$ (B) $\frac{6\hat{\imath}+2\hat{\jmath}+3\hat{k}}{|6|}$ (C) $\frac{6\hat{\imath}+2\hat{\jmath}+3\hat{k}}{|5|}$ (D) $\frac{6\hat{\imath}+2\hat{\jmath}+3\hat{k}}{|1|}$

2. Write direction ratio of the vector $\vec{a} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$

(A) $(1,1,-2)$ (B) $(1,1,2)$ (C) $(1,-1,2)$ (D) $(-1,1,2)$

3. Write the value of$(\hat{\imath} \times \hat{\jmath}).\hat{k} + (\hat{\jmath} \times \hat{k}).\ \hat{\imath} + (\hat{k} \times \hat{\imath}).\ \hat{\jmath}$

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

4. Find $|\vec{x}|$ if for a unit vector $\vec{a}$, $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 15$

(A) ± 1 (B) ± 4 (C) ± 2 (D) ± 3

5. Find the angle between $\vec{a}$ &$\vec{b}$ if $|\vec{a}.\vec{b}| = |\vec{a} x\, \vec{b}|$

(A) 0^0 (B) 30^0 (C) 60^0 (D) 90^0

6. Find Projection of $\vec{a}$ on $\vec{b}$ if $\vec{a}.\vec{b} = 8$, $\vec{b} = 6\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$

(A) $\frac{8}{3}$ (B) $\frac{8}{5}$ (C) $\frac{8}{7}$ (D) $\frac{8}{9}$

7. Find the angle between two vectors vector$\vec{a}$ on the vector$\vec{b}$ with magnitudes $\sqrt{3}$ and 2 respectively having $\vec{a}.\vec{b}. = \sqrt{6}$

(A) $\frac{1}{5}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{1}{\sqrt{2}}$

8. Let the vector $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$ and the angle between $\vec{a}$ and$\vec{b}$. So that $\vec{a}\, x\vec{b}$ is a unit vector.

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{5}$ (D) $\frac{\pi}{4}$

9. Find $|\vec{x}|$ if for a unit vector $\vec{a}$, $(\vec{x} - \vec{a}),(\vec{x} + \vec{a}) = 15$

(A) ± 1 (B) ± 4 (C) ± 2 (D) ± 3

10. What are the direction cosines of line which makes equal angles with the coordinate axis.

(A) $l = m = n = \pm\frac{1}{\sqrt{3}}$ (B) $l = m = n = \pm\frac{1}{\sqrt{7}}$ (C) $l = m = n = \pm\frac{1}{5}$

(D) $l = m = n = \pm\frac{1}{\sqrt{2}}$

ASSERTION-REASON BASED QUESTIONS (1 MARK EACH)

Each of the following questions contains statement -1(Assertion) and statement-2(Reason) and has following four choices (a),(b),(c),(d), only one of which is correct answer.Mark the correct choice

(a) Statement 1 is true,Statement 2 is true and 2 is correct explanation of 1

(b) Statement 1 is true,Statement 2 is true and 2 is not correct explanation of 1

(c) Statement 1 is true,Statement 2 is false

(d) Statement 1 is false,Statement 2 is true

1. **ASSERTION:** In triangle ABC, $\overrightarrow{AB} + \overrightarrow{AB} + \overrightarrow{AB} = 0$

   REASON: If $\overrightarrow{OA} = \vec{a}$ $\overrightarrow{OB} = \vec{b}$ then $\overrightarrow{AB} = \vec{a} + \vec{b}$

2. **ASSERTION:**

   $\vec{a} = \hat{\imath} + p\,\hat{\jmath} + 2\hat{k}$, $\vec{b} = 2\,\hat{\imath} + 3\hat{\jmath} + q\hat{k}$ are parallel vectors if p=3/2, q=4

   REASON:

   If $\vec{a} = a\,\hat{\imath} + b\,\hat{\jmath} + c\hat{k}$, $\vec{b} = d\,\hat{\imath} + e\hat{\jmath} + f\,\hat{k}$ are parallel if a/d = b/e = c/f

VERY SHORT ANSWER TYPE QUESTIONS (2 MARKS EACH)

1. Write the position vector of the mid-point of the vector joining the points P(2 ,3 ,4) and Q(4 ,1 ,-2)
2. If $\hat{\imath} + \hat{\jmath} + \hat{k}$, $2\hat{\imath} + 5\hat{\jmath}$, $3\hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ and $\hat{\imath} - 6\hat{\jmath} - \hat{k}$ are the position vectors of the points A ,B ,C and D , Find the angle between $\overrightarrow{AB}$ and $\overrightarrow{CD}$. Deduce that $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are collinear.
3. Find the position vectors of the point R which divides the line joining two points P and Q whose position vectors are $(2\vec{a} + \vec{b})$ and $(\vec{a} - 3\vec{b})$ respectively in the ratio 1:2 .

SHORT ANSWER TYPE QUESTIONS (3 MARKS EACH)

1. What is the angle between vectors $\vec{a}$ & $\vec{b}$ with magnitude $\sqrt{3}$ and 2 respectively? Given $\vec{a} \cdot \vec{b} = 3$
2. Write the position vector of a point dividing the line segment joining points A and B with position vectors $\vec{a}$ & $\vec{b}$ externally in the ratio 1:4.
3. If $\vec{a} = \hat{\imath} + \hat{\jmath}$, $\vec{b} = \hat{\jmath} + \hat{k}$, $\vec{\imath} = \hat{k} + \hat{\imath}$, find a unit vector in the direction of $\vec{a} + \vec{b} + \vec{c}$.
4. Let $\vec{a}$ & $\vec{b}$ be two vectors such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$ and $\vec{a} \times \vec{b}$ is a unit vector. Then what is the angle between $\vec{a}$ & $\vec{b}$?
5. Write the value of p for which $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 9\hat{k}$ and $\vec{b} = \hat{\imath} + p\hat{\jmath} + 3\hat{k}$ are parallel vectors and perpendicular vectors.

CASE STUDY BASED QUESTIONS (4 – MARKS EACH)

1. Geetika house is situated at Kanke at point o, for going to Alok's house she first travels 8 km by bus in the East. Here at point A a hospital is situated, from Hospital, Geetika take an auto and goes

6 km in the North, here at point B school is situated. From school she travels by bus to reach Alok's house which is 30^0 East,6km from B

Based on the above information, answer the following questions

(i) What is the vector distance between Geetika's house and school?

(ii) What is the Vector distance Geetika's house and school? (ii)How much Geetika travels to reach school? Ans: 14km

(iii) What is the vector distance from school to Alok's house? Ans: $3\sqrt{3}\hat{\imath} + 3\hat{\jmath}$,

OR

What is the total distance travelled by Geetika for her house to Alok's house? Ans: 20km

2. A plane started from airport at o with a velocity of 120km/s towards East. Air is blowing at a velocity of 50km/s towards the North. The plane traveled 1 hr in OP direction with the resultant velocity, from P To R the plane traveled 1hr keeping velocity of 120m/s and finally landed at R.

Based on the above information, answer the following questions:

(i) What is the resultant velocity from O to P?

(ii) What is the direction of travel from O to P ?

(iii) What is the Displacement from O to P?

Activity

1. To understand the concepts of decreasing and increasing functions.
2. To understand the concepts of local maxima, local minima and point of inflection.
3. To verify that amongst all the rectangles of the same perimetre, the square has the maximum area.
4. To verify geometrically that $\vec{c} \times (\vec{a}+\vec{b}) = \vec{c} \times \vec{a} + \vec{c} \times \vec{b}$