DAE / IIA - 2016

MATH - 212 APPLIED MATHEMATICS - II

PART - A (OBJECTIVE)

Time : 30 Minutes Marks : 20

Q.1: *Encircle the correct answer.*

1. Given $f(x)=\frac{1}{x}-1$ then $f(2)=?$

[a] 1 [b] 2
[c] $-\frac{1}{2}$ [d] 3

2. $\lim_{\theta\to\frac{\pi}{2}}\frac{\sin\theta}{\theta}=$

[a] 1 [b] $\frac{\pi}{2}$
[c] $\frac{2}{\pi}$ [d] $\frac{1}{2}$

3. $\frac{d}{dx}(2x+3)^4=$

[a] $8(2x+3)^3$ [b] $4(2x+3)^3$
[c] $(2x+3)^3$ [d] $4(2x+3)^2$

4. Second derivative of x^2 is;

[a] 2 [b] $2x$
[c] zero [d] $2x^2$

5. $\frac{d}{dx}(\sin x^3)=?$

[a] $\cos x^3$ [b] $-\cos x^3$
[c] $3x\cos x^3$ [d] $3x^2\cos x^3$

6. $\frac{d}{dx}(\sin^{-1}x)=?$

[a] $\frac{1}{\sqrt{x^2-1}}$ [b] $\frac{-1}{\sqrt{1-x^2}}$
[c] $\frac{\sin^{-1}x}{\sqrt{1-x^2}}$ [d] $\frac{1}{\sqrt{1-x^2}}$

7. $\frac{d}{dx}(a^x)=?$

[a] $a^x\ell na$ [b] xa^{x-1}
[c] a^{x-1} [d] a^x

8. $\frac{d}{dx}(x^a)=?$

[a] ax^{a-1} [b] x^{a-1}
[c] ax^a [d] x^a

9. For an increasing function $\frac{dy}{dx}$ is:

[a] +ve [b] −ve
[c] zero [d] None of these

10. $\int(x^3)dx=$

[a] $\frac{x^4}{4}$ [b] $\frac{x^4}{3}$
[c] $3x^2$ [d] $4x^4$

11. $\int\left(\frac{\cos x}{\sin x}\right)dx=$

[a] $\ell n\cos x$ [b] $\ell n\sin x$
[c] $\ell n\cot x$ [d] $\frac{\cos^2 x}{2}$

12. $\int(e^{2x})dx=?$

[a] $\frac{e^{2x}}{2}$ [b] $\frac{e^{x^2}}{2}$
[c] $2e^{2x}$ [d] $\frac{e^{2x+1}}{2}$

13. $\int\left(\frac{1}{\sqrt{1-x^2}}\right)dx=?$

[a] $\sin^{-1}x$ [b] $\cos^{-1}x$
[c] $\sec^{-1}x$ [d] $\tan^{-1}x$

14. $\int_0^1(1)dx=$

[a] -1 [b] 0
[c] 1 [d] 2

15. Distance between $(4, 3)$ and $(7, 5)$ is:

[a] 25 [b] $\sqrt{13}$

[c] 5 [d] 7

16. Slope of the line through (x_1, y_1) and (x_2, y_2):

[a] $\frac{x_1 + x_2}{y_1 + y_2}$ [b] $\frac{y_2 + y_1}{x_2 + y_1}$

[c] $\frac{y_2 - y_1}{x_2 - x_1}$ [d] $\frac{y_2 - y_1}{x_2 + x_1}$

17. Slope of y-axis is:

[a] 0 [b] ∞

[c] 1 [d] -1

18. $y = mx + c$ is the:

[a] Slope intercept form

[b] Intercepts form

[c] Point - Slope form

[d] Two - Points form

19. Center of the circle $x^2 + y^2 - 2x - 4y = 8$ is:

[a] $(1, 2)$ [b] $(2, 4)$

[c] $(-1, -2)$ [d] $(-2, -4)$

20. Radius of the circle $(x-1)^2 + (y-2)^2 = 16$ is:

[a] 2 [b] 1

[c] 4 [d] 16

Answer Key

1	c	2	c	3	a	4	a	5	d
6	d	7	a	8	a	9	a	10	a
11	b	12	a	13	a	14	c	15	b
16	c	17	b	18	a	19	a	20	c

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DAE / IIA - 2016

MATH - 212 APPLIED MATHEMATICS - II

PART - B (SUBJECTIVE)

Time : 2:30 Hrs Marks : 60

Section - I

Q.1 : Write short answers to any Twenty Five (25) of the follwing questions. $25 \times 2 = 50$

1. if $f(x) = \frac{x^2 - 3}{x + 4}$, find $f(-3)$

Sol. $f(x) = \frac{x^2 - 3}{x + 4}$

Put $x = -3$, we have:

$f(-3) = \frac{(-3)^2 - 3}{-3 + 4} = \frac{9 - 3}{1} = \boxed{6}$

2. Is the function even, odd or neither? $f(x) = x\sqrt{x^2 - 1}$

Sol. As, $f(x) = x\sqrt{x^2 - 1}$

Replace x by $-x$, we have:

$f(-x) = -x\sqrt{(-x)^2 - 1}$

$f(-x) = -x\sqrt{x^2 - 1}$

$f(-x) = -f(x)$

Hence $f(x)$ is an $\boxed{odd}$ function.

3. Evaluate $\lim_{x \to -2} \frac{x^2}{x + 1}$

Sol. $\lim_{x \to -2} \frac{x^2}{x + 1} = \frac{(-2)^2}{-2 + 1} = \frac{4}{-1} = \boxed{-4}$

4. Evaluate $\lim_{\theta \to 0} \frac{\sin 7\theta}{\theta}$

Sol. $\lim_{\theta \to 0} \frac{\sin 7\theta}{\theta}$ $\left(\frac{0}{0}\right)$ form

$= \lim_{\theta \to 0} 7 \times \frac{\sin 7\theta}{7\theta}$

$= 7(1) = \boxed{7}$

5. Differentiate w.r.t. 'x'

$-5+3x-\frac{3}{2}x^2-7x^3$

Sol. $\frac{d}{dx}\left(-5+3x-\frac{3}{2}x^2-7x^3\right)$

$=0+3(1)-\frac{3}{2}(2x)-7(3x^2)$

$=\boxed{3-3x-21x^2}$

6. **Differentiate $(x^2+3x+9)^{3/2}$ w.r.t. 'x'.**

Sol. $\frac{d}{dx}\left((x^2+3x+9)^{3/2}\right)$

$=\frac{3}{2}(x^2+3x+9)^{\frac{3}{2}-1}\left(\frac{d}{dx}(x^2+3x+9)\right)$

$=\frac{3}{2}(x^2+3x+9)^{1/2}(2x+3(1)+0)$

$=\boxed{\frac{3}{2}(x^2+3x+9)^{1/2}(2x+3)}$

7. **Find the derivative $\sin x^n$ w.r.t. 'x'.**

Sol. $\frac{d}{dx}(\sin x^n)=\cos x^n\frac{d}{dx}(x^n)$

$=\cos x^n.nx^{n-1}\left(\frac{d}{dx}(x)\right)$

$=n\cos x^n.x^{n-1}.(1)=\boxed{nx^{n-1}\cos x^n}$

8. **Find $\frac{dy}{dx}$ if $xy+y^2=2$**

Sol. $xy+y^2=2$

Differentiate both sides w.r.t. 'x':

$\frac{d}{dx}(xy+y^2)=\frac{d}{dx}(2)$

$\left(\frac{d}{dx}(x)\right).y+x\left(\frac{d}{dx}(y)\right)+2y\frac{d}{dx}(y)=0$

$1.y+x\frac{dy}{dx}+2y\frac{dy}{dx}=0$

$\frac{dy}{dx}(x+2y)=-y \Rightarrow \boxed{\frac{dy}{dx}=-\frac{y}{x+2y}}$

9. **Find $\frac{dy}{dx}$ $x=t+2,\ y=2t^2+2$**

Sol. Differentiate both sides w.r.t. 't':

$\frac{d}{dt}(x)=\frac{d}{dt}(t+2)$	$\frac{d}{dt}(y)=\frac{d}{dt}(2t^2+2)$
$\frac{dx}{dt}=1+0$	$\frac{dy}{dt}=2(2t)+0$
$\frac{dt}{dx}=1$	$\frac{dy}{dt}=4t$

using chain rule: $\frac{dy}{dx}=\frac{dy}{dt}\times\frac{dt}{dx}$

$\frac{dy}{dx}=(4t)(1) \Rightarrow \boxed{\frac{dy}{dx}=4t}$

10. ~~**Differentiate $\sin^{-1}\sqrt{x}$ w.r.t. 'x'.**~~

Sol. $\frac{d}{dx}(\sin^{-1}\sqrt{x})$

$=\frac{1}{\sqrt{1-(\sqrt{x})^2}}\frac{d}{dx}(\sqrt{x})$

$=\frac{1}{\sqrt{1-x}}.\frac{1}{2}(x)^{\frac{1}{2}-1}\frac{d}{dx}(x)$

$=\frac{1}{\sqrt{1-x}}.\frac{1}{2}(x)^{-\frac{1}{2}}(1)$

$=\frac{1}{\sqrt{1-x}}.\frac{1}{2\sqrt{x}}=\boxed{\frac{1}{2\sqrt{x}\sqrt{1-x}}}$

11. **Differentiate $\frac{x}{\ell nx}$ w.r.t. 'x'.**

Sol. $\frac{d}{dx}\left(\frac{x}{\ell nx}\right)$ {using Quotient Rule}

$=\frac{\ell nx.\left(\frac{d}{dx}(x)\right)-x\left(\frac{d}{dx}(\ell nx)\right)}{(\ln x)^2}$

$=\frac{\ell nx.(1)-x\left(\frac{1}{x}\right)}{(\ell nx)^2}=\boxed{\frac{\ell nx-1}{(\ell nx)^2}}$

12. ~~Find $\frac{dy}{dx}$ for $e^{\sqrt{x+1}}$~~

Sol. Let $y = e^{\sqrt{x+1}}$

Differentiate both sides w.r.t. 'x':

$$\frac{d}{dx}(y) = \frac{d}{dx}\left(e^{\sqrt{x+1}}\right)$$

$$\frac{dy}{dx} = e^{\sqrt{x+1}} \cdot \left(\frac{d}{dx}\left(\sqrt{x+1}\right)\right)$$

$$\frac{dy}{dx} = e^{\sqrt{x+1}} \cdot \frac{1}{2}(x+1)^{-1/2}\left(\frac{d}{dx}(x+1)\right)$$

$$\frac{dy}{dx} = e^{\sqrt{x+1}} \cdot \frac{1}{2\sqrt{x+1}}(1+0)$$

$$\boxed{\frac{dy}{dx} = \frac{e^{\sqrt{x+1}}}{2\sqrt{x+1}}}$$

13. ~~**Differentiate** $\sin x$ w.r.t. $\tan x$~~

Sol. Let, $y = \sin x$ & $t = \tan x$

Differentiate both equations both sides w.r.t. 'x':

$$\frac{d}{dx}(y) = \frac{d}{dx}(\sin x) \qquad \frac{d}{dx}(t) = \frac{d}{dx}(\tan x)$$

$$\frac{dy}{dx} = \cos x \qquad \frac{dt}{dx} = \sec^2 x$$

$$\frac{dx}{dt} = \frac{1}{\sec^2 x}$$

By using Chain's Rule:

$$\frac{dy}{dt} = \frac{dy}{dx} \cdot \frac{dx}{dt} = (\cos x)\left(\frac{1}{\sec^2 x}\right)$$

$$\frac{dy}{dt} = (\cos x)(\cos^2 x) \Rightarrow \boxed{\frac{dy}{dt} = \cos^3 x}$$

14. **Find the derivative of $x\cot x$ w.r.t. 'x'.**

Sol. $\frac{d}{dx}(x\cot x)$ {using Product Rule}

$$= \left(\frac{d}{dx}(x)\right)\cot x + x\left(\frac{d}{dx}(\cot x)\right)$$

$$= 1.\cot x + x\left(-\operatorname{cosec}^2 x\right)$$

$$= \boxed{\cot x - x\operatorname{cosec}^2 x}$$

15. **Differentiate $\frac{x}{x^2+1}$ w.r.t. 'x'**

Sol. Differentiate w.r.t. 'x':

$\frac{d}{dx}\left(\frac{x}{x^2+1}\right)$ {using Quotient Rule}

$$= \frac{(x^2+1)\left(\frac{d}{dx}(x)\right) - x\left(\frac{d}{dx}(x^2+1)\right)}{(x^2+1)^2}$$

$$= \frac{(x^2+1)(1) - x(2x+0)}{(x^2+1)^2}$$

$$= \frac{x^2+1-2x^2}{(x^2+1)^2} = \boxed{\frac{1-x^2}{(x^2+1)^2}}$$

16. **Find the critical values (turning points) for 'x' of the function $5x^2 - 4x + 9$**

Sol. Let $y = 5x^2 - 4x + 9$

Differentiate both sides w.r.t. 'x':

$$\frac{d}{dx}(y) = \frac{d}{dx}(5x^2 - 4x + 9)$$

$$\frac{dy}{dx} = 5(2x) - 4(1) + 0$$

$$\frac{dy}{dx} = 10x - 4$$

For critical values, put $\frac{dy}{dx} = 0$

$$10x - 4 = 0$$

$$10x = 4$$

$$x = \frac{4}{10} \Rightarrow \boxed{x = \frac{2}{5}}$$

17. **Evaluate $\int(3x^2 + 2x + 1)dx$**

Sol. $\int(3x^2 + 2x + 1)dx$

$$= 3\frac{x^3}{3} + 2\frac{x^2}{2} + x + c$$

$$= \boxed{x^3 + x^2 + x + c}$$

18. Evaluate $\int\left(e^{x}+e^{-x}\right)^{2}dx$

Sol. $\int\left(e^{x}+e^{-x}\right)^{2}dx$

$=\int\left[\left(e^{x}\right)^{2}+\left(e^{-x}\right)^{2}+2\left(e^{x}\right)\left(e^{-x}\right)\right]dx$

$=\int\left[e^{2x}+e^{-2x}+2\right]dx$

$=\frac{e^{2x}}{2}+\frac{e^{-2x}}{-2}+2x+c$

$=\boxed{\frac{1}{2}e^{2x}-\frac{1}{2}e^{-2x}+2x+c}$

19. Evaluate $\int(\sin x-\cos x)^{2}dx$

Sol. $\int(\sin x-\cos x)^{2}dx$

$=\int\left(\sin^{2}x+\cos^{2}x-2\sin x\cos x\right)dx$

$=\int(1-\sin 2x)\,dx \because \begin{Bmatrix}\sin^2 x+\cos^2 x=1\\ \sin 2x=2\sin x\cos x\end{Bmatrix}$

$=x-\left(\frac{-\cos 2x}{2}\right)+c$

$=\boxed{x+\frac{1}{2}\cos 2x+c}$

20. Find $\int(2x+9)^{-5/2}dx$

Sol. $\int(2x+9)^{-5/2}dx$

$=\frac{1}{2}\int(2x+9)^{-5/2}(2)dx$

$=\frac{1}{2}\left[\frac{(2x+9)^{-3/2}}{-3/2}\right]+c \begin{Bmatrix}\text{using}\\ \text{Rule-I}\end{Bmatrix}$

$=\boxed{-\frac{1}{3}(2x+9)^{-3/2}+c}$

21. Evaluate $\int\left(\cos^{4}x\sin x\right)dx$

Sol. $\int\left(\cos^{4}x\sin x\right)dx$

$=-\int\cos^{4}x(-\sin x)\,dx$

$=-\frac{\cos^{5}x}{5}+c=\boxed{-\frac{1}{5}\cos^{5}x+c}$

22. Evaluate $\int\left(\frac{x}{x^{2}+1}\right)dx$

Sol. $\int\left(\frac{x}{x^{2}+1}\right)dx$

$=\frac{1}{2}\int\left(\frac{2x}{x^{2}+1}\right)dx=\boxed{\frac{1}{2}\ell n\left(x^{2}+1\right)+c}$

23. Evaluate $\int\left(\frac{1}{\sqrt{x}}\sin\sqrt{x}\right)dx$

Sol. $\int\left(\frac{1}{\sqrt{x}}\sin\sqrt{x}\right)dx$

Put $\sqrt{x}=t \Rightarrow \frac{d}{dx}\left(\sqrt{x}\right)=\frac{d}{dx}(t)$

$\frac{1}{2}x^{-1/2}=\frac{dt}{dx}$

$\frac{1}{2\sqrt{x}}=\frac{dt}{dx} \Rightarrow \frac{1}{\sqrt{x}}dx=2dt$

$=\int\sin\sqrt{x}.\left(\frac{1}{\sqrt{x}}\right)dx$

$=\int(\sin t)\,(2dt)$

$=2\int(\sin t)\,dt$

$=2(-\cos t)+c=\boxed{-2\cos\sqrt{x}+c}$

24. Evaluate $\int(\ell n x)dx$

Sol. $\int(\ell n x)dx$

$=\int(\ell n x\cdot 1)dx$

Integrating by parts:

taking $u=\ell n x$ & $v=1$

$=\ell n x\int(1)dx-\int\left[\frac{d}{dx}(\ell n x)\int(1)dx\right]dx$

$=\ell n x(x)-\int\frac{1}{x}.(x)dx$

$=x\ell n x-\int(1)dx$

$=x\ell n x-(x)+c=\boxed{x(\ell n x-1)+c}$

25. Evaluate $\int_1^3 (x^2)\,dx$

Sol. $\int_1^3 (x^2)\,dx$

$= \left[\frac{x^3}{3}\right]_1^3$

$= \frac{1}{3}\left[x^3\right]_1^3$

$= \frac{1}{3}\left[(3)^3 - (1)^3\right]$

$= \frac{1}{3}[27-1] = \boxed{\frac{26}{3}}$

26. Evaluate $\int_0^{\pi/6} (2\sin 2x)\,dx$

Sol. $\int_0^{\pi/6} (2\sin 2x)\,dx$

$= 2\left[-\frac{\cos 2x}{2}\right]_0^{\pi/6} = -\left[\cos 2x\right]_0^{\pi/6}$

$= -\left(\cos 2\left(\frac{\pi}{6}\right) - \cos 2(0)\right)$

$= -(\cos 2(30°) - \cos 2(0°))$

$= -(\cos 60° - \cos 0°)$

$= -\left(\frac{1}{2} - 1\right) \left\{\begin{array}{c}\text{using calculator} \\ \cos 60° = \frac{1}{2} \ \& \ \cos 0° = 1\end{array}\right\}$

$= -\left(\frac{1-2}{2}\right) = -\left(-\frac{1}{2}\right) = \boxed{\frac{1}{2}}$

27. Evaluate $\int \left(\frac{1+x}{x}\right) dx$

Sol. $\int \left(\frac{1+x}{x}\right) dx$

$= \int \left(\frac{1}{x} + \frac{x}{x}\right) dx$

$= \int \left(\frac{1}{x} + 1\right) dx$

$= \boxed{\ell n x + x + c}$

28. Find the distance between the points $(-3, -2)$ and $(-1, 5)$.

Sol. Distance between $(-3, -2)$ & $(-1, 5)$.

$= \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

$= \sqrt{(-3-(-1))^2 + (-2-5)^2}$

$= \sqrt{(-2)^2 + (-7)^2}$

$= \sqrt{4+49} = \sqrt{53} = \boxed{7.42}$

29. Find the mid-point of the following points $A(0, -1)$ & $B(-1, 2)$.

Sol. $\text{Mid-point} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$= \left(\frac{0+(-1)}{2}, \frac{-1+2}{2}\right)$

$= \boxed{\left(\frac{-1}{2}, \frac{1}{2}\right)}$

30. Find the slope of a line which is perpendicular to the line joining $P_1(2, 4)$, $P_2(-2, 1)$.

Sol. Slope of line joining given point:

$= m_1 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-4}{-2-2} = \frac{-3}{-4} = \frac{3}{4}$

Slope of require line $= m_2 = ?$

As, both lines are perpendicular,

So, $m_1 m_2 = -1 \Rightarrow \left(\frac{3}{4}\right) m_2 = -1$

$\Rightarrow m_2 = -1 \times \frac{4}{3} \Rightarrow \boxed{m_2 = -\frac{4}{3}}$

31. ~~Find an equation on the line with the following intercepts:~~

$a = 2$ & $b = -5$.

Sol. Equation of line in intercept form:

$$\frac{x}{a}+\frac{y}{b}=1 \Rightarrow \frac{x}{2}+\frac{y}{-5}=1$$

$$\frac{5x-2y}{10}=1 \Rightarrow 5x-2y=10$$

$$\Rightarrow \boxed{5x-2y-10=0}$$

32. Show that the two lines passing through the given points are perpendicular $(8,0),(6,6)$ and $(-3,3),(6,6)$

Sol. Let

$\ell_1:(8,0)$ & $(6,6)$ | $\ell_2:(-3,3)$ & $(6,6)$

Slope of ℓ_1	Slope of ℓ_2
$=m_1=\frac{y_2-y_1}{x_2-x_1}$	$=m_2=\frac{y_2-y_1}{x_2-x_1}$
$m_1=\frac{6-0}{6-8}$	$m_2=\frac{6-3}{6-(-3)}$
$m_1=\frac{6}{-2}=-3$	$m_2=\frac{3}{9}=\frac{1}{3}$

As, $m_1m_2=(-3)\left(\frac{1}{3}\right)=-1$

Hence both lines ℓ_1 & ℓ_2 are **perpendicular**. **Proved.**

33. Reduce the given equation to slope intercept form $6x-5y=15$.

Sol. $6x-5y=15 \rightarrow (i)$

Slope-intercept form:

$$6x-5y=15$$

$$-5y=-6x+15$$

$$\frac{-5y}{-5}=\frac{-6x}{-5}+\frac{15}{-5}$$

$$\boxed{y=\frac{6}{5}x-3}$$

34. Show that the points (1, 2), (7, 6) and (4, 4) are collinear.

Sol.

$$\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}=\begin{vmatrix} 1 & 2 & 1 \\ 7 & 6 & 1 \\ 4 & 4 & 1 \end{vmatrix}$$

$$=1\begin{vmatrix} 6 & 1 \\ 4 & 1 \end{vmatrix}-2\begin{vmatrix} 7 & 1 \\ 4 & 1 \end{vmatrix}+1\begin{vmatrix} 7 & 6 \\ 4 & 4 \end{vmatrix}$$

$$=1(6-4)-2(7-4)+1(28-24)$$

$$=1(2)-2(3)+1(4)=2-6+4=0$$

Hence given points are collinear. **Proved.**

35. Find the equation of circle with center $(-2,3)$ and radius 6.

Sol. Here: Center $=(h,k)=(-2,3)$

& Radius $=r=6$

Standard form of equation of circle:

$$(x-h)^2+(y-k)^2=r^2$$

Put $h=-2,\ k=3$ & $r=6$

$$(x+2)^2+(y-3)^2=(6)^2$$

$$(x)^2+2(x)(2)+(2)^2+(y)^2-2(y)(3)+(3)^2=36$$

$$x^2+4x+4+y^2-6y+9-36=0$$

$$\boxed{x^2+y^2+4x-6y-23=0}$$

36. Find center and radius of the circle $x^2+y^2-6x+6y=0$

Sol. $x^2+y^2-6x+6y=0$

Comparing with general equation of circle.

$$x^2+y^2+2gx+2fy+c=0$$

$2g=-6$	$2f=6$	$c=0$
$g=-\frac{6}{2}=-3$	$f=\frac{6}{2}=3$	

Center $=(-g,-f)$

Center $=(-(-3),-3)=\boxed{(3,-3)}$

Radius $=r=\sqrt{g^2+f^2-c}$

$$r=\sqrt{(-3)^2+(3)^2-0}=\sqrt{9+9}$$

$$r=\sqrt{18}=\sqrt{9\times 2}=\boxed{3\sqrt{2}}$$

37. What type of circle is represented by $x^2 + y^2 - 2x + 4y + 8 = 0$

Sol. $x^2 + y^2 - 2x + 4y + 8 = 0$

Comparing this equation with general form of equation of circle:

$x^2 + y^2 + 2gx + 2fy + c = 0$

$2g = -2$	$2f = 4$	
$g = -\frac{2}{2}$	$f = \frac{4}{2}$	$c = 8$
$g = -1$	$f = 2$	

$\text{Radius} = r = \sqrt{g^2 + f^2 - c}$

$r = \sqrt{(-1)^2 + (2)^2 - 8}$

$r = \sqrt{1 + 4 - 8}$

$r = \sqrt{-3}$

$r = \boxed{\sqrt{3}i}$

So, it is an **Imaginary circle.**

Section - II

Note: Attemp any three (3) questions $\boxed{3 \times 10 = 30}$

Q.2.[a] If $f(t) = \frac{t^4 + t^2 + 1}{t^2}$, show that $f\left(\frac{1}{t}\right) = f(t)$.

Sol. See Q.8 of Ex # 1.1 (Page # 6)

[b] Differentiate $\sqrt{\frac{a + x}{a - x}}$ w.r.t. 'x'.

Sol. See Q.4(v) of Ex # 2.2 (Page # 56)

Q.3.[a] Differentiate $\ln\left(\frac{x}{\sqrt{1 + x^2}}\right)$ w.r.t. 'x'.

Sol. See Q.1(iii) of Ex # 3.3 (Page # 136)

[b] Find the maximum and minimum values of the function $2x^3 - 3x^2 - 36x + 3$

Sol. See Q.2(v) of Ex # 4.2 (Page # 188)

Q.4.[a] Evaluate $\int\left(x + \frac{1}{x}\right)\left(x^2 + \frac{1}{x^2}\right)dx$

Sol. See Q.10 of Ex # 5.1 (Page # 230)

[b] Evaluate $\int\left(\tan^4 x + \tan^2 x\right)dx$

Sol. See Q.1(vi) of Ex # 5.3 (Page # 242)

Q.5.[a] Evaluate $\int(\ell n\, x)^2\, dx$

Sol. See Q.3(iv) of Ex # 6.3 (Page # 291)

[b] Show that the points A(2, 2), B(6, 6) and C(11, 11) are the vertices of a right triangle.

Sol. See Q.2[a] of Ex # 8.1 (Page # 354)

Q.6.[a] If a line ℓ_1 contains P(2, 6) and Q(0, y). Find 'y' if ℓ_1 is parallel to ℓ_2 and that the slope of $\ell_2 = \frac{3}{4}$.

Sol. See Q.2 of Ex # 8.3 (Page # 374)

[b] Find the equation of the circle concentric with the circle $x^2 + y^2 - 6x + 4y - 12 = 0$ with radius 6 units.

Sol. See Q.5[a] of Ex # 9 (Page # 443)

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