TEST ID: 206

ESE- 2020 (Prelims) - Offline Test Series Test - 11

ELECTRICAL ENGINEERING

SUBJECT: Engineering Mathematics + Computer fundamentals
SOLUTIONS

01. Ans: (c)

02. Ans: (d)

Sol: Ready Queue → ~~P_1~~ ~~P_2~~ ~~P_1~~ ~~P_3~~ ~~P_2~~ ~~P_1~~ ~~P_3~~ ~~P_1~~ ~~P_3~~

P_1	P_2	P_1	P_3	P_2	P_1	P_3	P_1	P_3

0 2 4 6 8 10 12 14 16 17

Process	**Arrival time**	**Finish Time**	**Turn round time =F.T – A.T**	**Waiting time =TAT– Burst time**
P_1	0	16	16 – 0 = 16	16 – 8 = 8
P_2	1	10	10 – 1 = 9	9 – 4 = 5
P_3	3	17	17 – 3 = 14	14 – 5 = 9

Average waiting time $= \frac{8+5+9}{3} = \frac{22}{3} = 7.33$.

03. Ans: (b)

04. Ans: (b)

Sol: $\underbrace{1, 2, 3, \ldots\ldots 19,\ 20}_{\text{Page fault}}\ \underbrace{20, 19, 18}_{\text{page hit}}\ \underbrace{17, \ldots 3, 2, 1}_{\text{page fault}}$

Number of page faults = 37.

05. Ans: (d)

Sol: Only one process should be allowed in critical section at a time to avoid race condition

06. Ans: (c)

Sol: Except for Strict Alternation remaining suffers from Bounded Waiting

07. Ans: (c)

08. Ans: (d)

Sol: Maximum average turn around time leads by Round Robin.

09. Ans: (c)

Sol: Minimum instance of R = (5 – 1) + (4 – 1) + (6 – 1) + 1 = 13

10. Ans: (b)

11. Ans: (c)

Sol:

P_1		P_2		P_3		P_1		P_2		P_3		P_1		P_1		P_1	

0 2 4 6 8 9 11 13 15 17

Number of context switches = 8

12. Ans: (c)

Sol: $h_b = 0.8$, $t_b = 2ns$, $t_m = 10ns$, $N = 2$, $P = \frac{1}{10^5}$

$$EAT = h_b * (t_b + t_m) + (1 - h_b) * [(1 - P) * (t_b + (N + 1) * t_m) + P* \text{service time}]$$

$$= 0.8 * (2 + 10)\,ns + 0.2 * [\left(1 - \frac{1}{10^5}\right) * (2 + 3*10)\,ns + \frac{1}{10^5} * 10 * 10^6\,ns]$$

$$= 9.6ns + 0.2* (131.99968)$$

$$= 35.999936\ ns$$

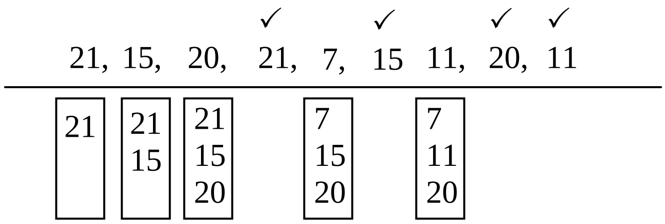
13. Ans: (c)

Sol: Offset ⇒ 7bits, page no. ⇒ 12 – 7 = 5 bits

ABC ⇒ ㉑, 7A4 ⇒ ⑮, A5A ⇒ ⑳, ACD ⇒ ㉑,

75C ⇒ ⑦, 7B3 ⇒ ⑮, 5AC ⇒ ⑪, A2D ⇒ ⑳,

5BD ⇒ ⑪.



14. Ans: (c)

15. Ans: (a)

16. Ans: (a)

17. Ans: (b)

18. Ans: (b)

19. Ans: (b)

Sol: fun(4) → fun(3) → fun(2) → fun(1) → fun(0)

print 4 ← print 3 ← print 2 ← print 1 ← return

20. Ans: (b)

Sol: It swap the values.

21. Ans: (c)

22. Ans: (c)

Sol: Maximum size of virtual memory = Size of disk

23. Ans: (b)

Sol: Return type of printf function is integer and value of this integer is exactly equal to number of characters including white space, printf function prints. So, printf("Hello world") will return 11.

24. Ans: (b)

Sol: Segmentation suffer from external fragmentation & the essential content in page table entry is frame number.

25. Ans: (b)

26. Ans: (a)

Sol: Here,

m = number of rows = 2

n = number of columns = 3

* (A[0] + 0) = A [0] [0] = 10

* (A[1] + 0) = A [1] [0] = 13

Similarly all the elements are accessed

∴ 10 13 11 14 12 15 is the output

27. Ans: (d)

Sol: ALOHA, Ethernet (CSMA/CD) and Token Bus (Token) are 3 different ways for channel Access in Bus topology.

28. Ans: (c)

29. Ans: (a)

Sol: * HTTP is stateless protocol

* FTP is statefull protocol

30. Ans: (c)

Sol:

- CRC and checksum are error detection techniques only.
- Hamming code is error detection and correction technique.

31. Ans: (b)

Sol: Poles z = 1 & 2 both are inside the $|z| = 3$

$f(z) = \cos\pi\, z^2$ is an analytic function

$$\therefore \oint_c \frac{\cos\pi z^2}{(z-1)(z-2)}dz = \oint_c \frac{\frac{\cos\pi z^2}{z-2}}{z-1}dx + \oint_c \frac{\frac{\cos\pi z^2}{z-1}}{z-2}dz$$

$= 2\pi i\, f(1) + 2\pi i\, f(2)$

$= 2\pi i\,[-\cos\pi + \cos 4\pi]$

$= 4\pi i$

32. Ans: (b)

Sol: Given that z = f(x, y), where $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$

Then $\frac{\partial z}{\partial u} = \frac{\partial z}{\partial x}\frac{\partial x}{\partial u} + \frac{\partial z}{\partial y}\frac{\partial y}{\partial u}$ and $\frac{\partial z}{\partial v} = \frac{\partial z}{\partial x}\frac{\partial x}{\partial v} + \frac{\partial z}{\partial y}\frac{\partial y}{\partial v}$

$\Rightarrow \frac{\partial z}{\partial u} = \frac{\partial z}{\partial x}(e^u) + \frac{\partial z}{\partial y}(-e^{-u})$ and $\frac{\partial z}{\partial v} = \frac{\partial z}{\partial x}(-e^{-v}) + \frac{\partial z}{\partial y}(-e^v)$

Now, $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = \left(e^u\frac{\partial z}{\partial x} - e^{-u}\frac{\partial z}{\partial y}\right) - \left(-e^{-v}\frac{\partial z}{\partial x} - e^v\frac{\partial z}{\partial y}\right)$

$\Rightarrow \frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = (e^u + e^{-v})\frac{\partial z}{\partial x} - (e^{-u} - e^v)\frac{\partial z}{\partial y}$

$\therefore \frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y}$

33 Ans: (c)

Sol: Let $u + iv = f(z) = (x^2 + c_1y^2 - 2xy) + i(c_2x^2 - y^2 + 2xy)$ be the analytic function.

Then the real and imaginary parts of an analytic functions will satisfy C-R euqaitons.

i.e., $u_x = v_y$ and $v_x = -u_y$

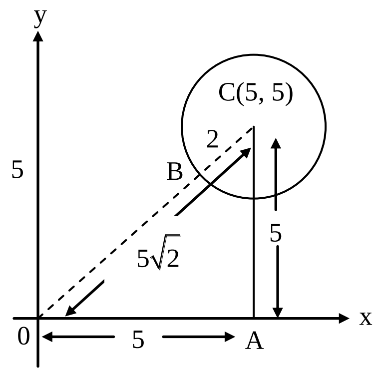
$\Rightarrow 2x - 2y = -2y + 2x$ and $2c_2x + 2y = -(2c_1y - 2x)$

$\Rightarrow 2c_2x + 2y = 2x - 2c_1y$

$\therefore c_1 = -1$ and $c_2 = 1$

34. Ans: (a)

Sol:



For a given circle centre is (5,5) and radius is 2

$OC = \sqrt{OA^2 + AC^2} = \sqrt{25+25}$

$= \sqrt{50} = 5\sqrt{2}$

OB = OC – BC

$= 5\sqrt{2} - 2$

$\therefore$ The minimum distance from the origin to the circle is $5\sqrt{2} - 2$

35. Ans: (b)

Sol: The solution to the above differential equation is

$$y(IF) = \int Q(IF)dx$$

$$\Rightarrow y(1+x^2) = \int \frac{4x^2}{(1+x^2)} \times (1 + x^2)dx$$

$$\Rightarrow y(1+x^2) = \frac{4x^3}{3} + c$$

But it is passing through origin,

we get, c = 0

$\therefore$ The equation of the curve is

$$y(1+x^2) = \frac{4x^3}{3} \quad \text{(or)}$$

$$3y(1+x^2) = 4x^3$$

36. Ans: (d)

Sol: Given $u_t = c^2 u_{xx}$……………(1)

with B.C's

$$\left.\begin{aligned} u(0,t) = 0 \\ u(\pi,t) = 0 \end{aligned}\right\}............(2)$$

& I. C u(x, 0) = sinx = f(x) …..(3)

Now, the solution of (1) is given by

$$u(x, t) = \sum_{n=1}^{\infty} a_n \sin\frac{n\pi x}{\ell} e^{\left(\frac{-n^2\pi^2c^2}{\ell^2}\right)t} \quad ……(4)$$

$$\text{where } a_n = \frac{2}{\ell}\int_0^{\ell} f(x)\sin\frac{n\pi x}{\ell}dx \quad …….(5)$$

put t = 0 in (4), we get

$$u(x, 0) = \sum_{n=1}^{\infty} a_n \sin\left(\frac{n\pi x}{\ell}\right)$$

$$\Rightarrow \sin(x) = \sum_{n=1}^{\infty} a_n \sin\left(\frac{n\pi x}{\ell}\right)$$

$$= a_1\sin(x) + a_2\sin(2x) +$$

$\Rightarrow \sin(x) = a_1\sin x + ...$ ($\ell = \pi$, n = 1)

$\therefore a_1 = 1, a_2 = 0…. a_3 = 0 ….$

From (4), the solution of (1) with (2) & (3) is

$$u(x, t) = a_1 \sin(x).\ e^{-c^2t}$$

$$\therefore u(x, t) = \sin(x).\ e^{-c^2t}$$

37. Ans: (a)

Sol: The given equation is

$(5x^3 + 3xy + 2y^2)\,dx + (x^2 + 2xy)\,dy = 0$

Let, $M = 5x^3 + 3xy + 2y^2$ and $N = x^2 + 2xy$

$$\Rightarrow \frac{\partial M}{\partial y} = 3x + 4y \quad \text{and} \quad \frac{\partial N}{\partial x} = 2x + 2y$$

$$\Rightarrow \frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} = x + 2y$$

$$\Rightarrow \frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) = \frac{x+2y}{x^2+2xy} = \frac{1}{x}$$

$$\therefore \text{I.F} = e^{\int \frac{1}{x}dx} = x$$

$\Rightarrow k = 1$

Multiplying the given Differential Equation by the integrating factor, we get

$(5x^4 + 3x^2y + 2xy^2)\,dx + (x^3 + 2x^2y)\,dy = 0$

which is exact

The solution is $\int(5x^4 + 3x^2y + 2xy^2)dx = c$

$\therefore x^5 + x^3y + x^2y^2 = c$

38. Ans: (a)

Sol: Given $f(D)y = Q(x)$ …………(1)

where $f(D) = D^2 + 4D + 4$

& $Q(x) = x^4 e^{-2x} = e^{-2x}.x^4 = e^x.V(x)$

$$\text{Now, } y_P = \frac{1}{f(D)}\left[e^{-2x}x^4\right]$$

$$\Rightarrow y_P = e^{-2x}\left[\frac{1}{f(D-2)}x^4\right]$$

$$\Rightarrow y_P = e^{-2x}\left[\frac{1}{(D-2)^2 + 4(D-2) + 4}x^4\right]$$

$$\Rightarrow y_P = e^{-2x}\left[\frac{1(x^4)}{D^2}\right]$$

$$\therefore y_P = e^{-2x}.\frac{x^6}{30}$$

39. Ans: (d)

Sol: Given

$r\sin\theta\, d\theta + (r^3 - 2r^2\cos\theta + \cos\theta)dr = 0$

Let $M = r\sin\theta$ & $N = r^3 - 2r^2\cos\theta + \cos\theta)$

$$\frac{\partial M}{\partial r} = \sin\theta \quad \text{and} \quad \frac{\partial N}{\partial \theta} = +2r^2\sin\theta - \sin\theta$$

$$\frac{1}{M}\left(\frac{\partial N}{\partial \theta} - \frac{\partial M}{\partial r}\right) = 2\left(r - \frac{1}{r}\right)$$

Integrating factor is

$$\text{I.F} = e^{\int 2\left(r - \frac{1}{r}\right)dr} = \frac{e^{r^2}}{r^2}$$

40. Ans: (c)

Sol: The given equation can be written as

$z - xy = \phi(x^2 + y^2)$ .... (1)

Differentiating (1) partially with respect to x

$p - y = \phi^1(x^2 + y^2).2x$ .... (2)

Differentiating (2) partially with respect to y

$q - x = \phi^1(x^2 + y^2).2y$ .... (3)

Dividing (2) by (3)

$$\frac{p-y}{q-x} = \frac{x}{y}$$

$\therefore qx - py = x^2 - y^2$

41. Ans: (b)

Sol: The given equation is

$$z = ax + by + a^2 + b^2 \text{ .... (i)}$$

$$\Rightarrow \quad \frac{\partial z}{\partial x} = p = a \text{ .... (ii)}$$

and $\frac{\partial z}{\partial y} = q = b$ .... (iii)

substituting the values of a & b from (ii) & (iii) in (i),

we get, $z = px + qy + p^2 + q^2$

42. Ans: (c)

Sol: The Fourier series coefficient repeat for every 'N' i.e.,

$$a_k = a_{k+N} = a_{k+2N} = \text{......}$$

$$a_2 = a_{16} = 2j$$

$$a_3 = a_{17} = 3j$$

And given that x(n) is real and odd so the Fourier series coefficient a_k will be purely imaginary and odd, $a_0 = 0$.

$$a_{-2} = -2j$$

$$a_{-3} = -3j$$

$$a_{-2} + a_{-3} + a_0 = -5j$$

43. Ans: (d)

Sol: $\text{DC value} = a_0 = \frac{1}{T_0}\int_0^{T_0} x(t)\,dt = \frac{1}{2}\int_0^2 x(t)\,dt$

$$a_0 = \frac{1}{2}\left[\int_0^1 t\,dt + \int_1^2 (2-t)\,dt\right]$$

$$= \frac{1}{2}\left[\left.\frac{t^2}{2}\right|_0^1 + 2t\Big|_1^2 - \left.\frac{t^2}{2}\right|_1^2\right]$$

$$= \frac{1}{2}\left[\frac{1}{2} + 2 - \frac{1}{2}(3)\right] = \frac{1}{2}\left(\frac{1+4-3}{2}\right)$$

$$a_0 = \frac{1}{2}$$

44. Ans: (b)

Sol: Given $2x + 3y = 0$

$$4x + qy = 0$$

$$\Rightarrow AX = O$$

$$\begin{bmatrix} 2 & 3 \\ 4 & q \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

For non-trivial solution, $|A| = 0$

i.e., $\begin{vmatrix} 2 & 3 \\ 4 & q \end{vmatrix} = 0$

$$\Rightarrow 2q - 12 = 0$$

$$\therefore q = 6$$

45. Ans: (b)

Sol: Given that $A_{m\times n} X_{n\times 1} = B_{m\times 1}$

$$\Rightarrow A_{n\times n} X_{n\times 1} = B_{n\times 1} \ (m=n)$$

In this case, the given system may (or) may not have unique solution.

If A is singular then unique solution does not exist. And if A is non – singular then unique solution exist.

$\therefore$ Option (b) is wrong statement

46. Ans: (a)

Sol: Given $A = \begin{bmatrix} 4 & -4 \\ 5 & 5 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1/4 & a \\ b & \frac{1}{5} \end{bmatrix}$

$$\Rightarrow \quad A^{-1} = \begin{bmatrix} 1/4 & a \\ b & \frac{1}{5} \end{bmatrix} = \begin{bmatrix} 5 & 4 \\ -5 & 4 \end{bmatrix} \frac{1}{40}$$

$$a = \frac{1}{10} \ \& \ b = \frac{-1}{8}$$

$$\therefore \ a - b = \frac{18}{80} = \frac{9}{40}$$

47. Ans: (a)

Sol: The given matrix A can be obtained from the unit matrix with elementary operation $R_1 \leftrightarrow R_2$. The inverse matrix corresponding to the elementary matrix A is A itself.

48. Ans: (d)

Sol: The given quadratic form is in 2 – variables x_1 and x_2.

a_{11} = The coefficient of $x_1\, x_1$ (or) $x_1^2 = 0$

$a_{12} = a_{21}$

$= \frac{1}{2}$[The coefficient of x_1x_2]

$= \frac{1}{2}(4) = 2$

a_{22} = The coefficient of $x_2.x_2$ (or) $x_2^2 = -5$

$\therefore$ The matrix $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = \begin{bmatrix} 0 & 2 \\ 2 & -5 \end{bmatrix}$

49. Ans: (d)

Sol: By a property, if A is any square matrix then

(i) $A + A^T$ is always symmetric and

(ii) $A - A^T$ is always skew-symmetric

$\therefore$ Option (d) is correct

50. Ans: (a)

Sol: Given AX = B

$$\Rightarrow \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & -1 \\ 1 & -1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 0 \\ 1 \end{bmatrix}$$

Consider the Augmented matrix [A|B]

$$[A|B] = \left[\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 1 & 0 & -1 & 0 \\ 1 & -1 & 1 & 1 \end{array}\right]$$

$R_2 \to R_2 - R_1, \quad R_3 \to R_3 - R_1$

$$\sim \left[\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 0 & -1 & -2 & -3 \\ 0 & -2 & 0 & -2 \end{array}\right]$$

$R_3 \to R_3 - 2R_2$

$$\sim \left[\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 0 & -1 & -2 & -3 \\ 0 & 0 & 4 & 4 \end{array}\right]$$

$\rho(A) = 3, \rho(A|B) = 3$

Here $\rho(A) = \rho(A \mid B) = 3 = n$

$\therefore$ Unique solution exists.

51. Ans: (c)

Sol: $P(X = x) = \dfrac{e^{-\lambda}.\lambda^x}{x!}$

P(X = 0) = P(X = 2)

$$e^{-\lambda} = \frac{e^{-\lambda}.\lambda^2}{2!} \Rightarrow \lambda = \sqrt{2}$$

$P(X \le 1.3) = P(X = 0) + P(X = 1)$

$$= e^{-\sqrt{2}} + e^{-\sqrt{2}}.\left(\sqrt{2}\right)^1$$

$$= e^{-\sqrt{2}}\left(\sqrt{2}+1\right)$$

52. Ans: (c)

Sol: $P(\text{Bonus}) = \frac{1}{3}\times\frac{4}{5}+\frac{4}{9}\times\frac{3}{10}+\frac{2}{9}\times\frac{1}{2} = \frac{23}{45}$

53. Ans: (b)

Sol: For total number of cases, first person can born in any 12 months and second person can born in any 12 months

Total cases = 12 × 12

For favorable number of cases, Two friends share same birth month means both should have same birth month i.e.,

(J, J), (F, F), (M, M), (A, A) …., (D, D)

i.e., favorable cases = 12

$$p = \frac{12}{12\times12} = \frac{1}{12}$$

54. Ans: (b)

Sol: As per the definition of regression model.

55. Ans: (a)

Sol: p = 0.1, n = 900, q = 1–p = 0.9

Mean = np = 90

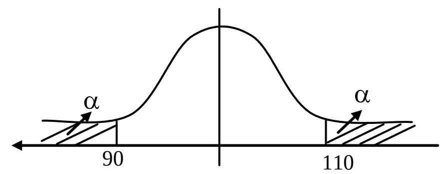
S.D = $\sigma = \sqrt{npq}$ = 9

56. Ans: (d)

Sol: $P(X>1) = \int_1^\alpha f(x)dx = \int_1^2 \frac{3}{14}\left(5x-2x^2\right)dx = \frac{17}{28}$

57 Ans: (A)

Sol:



$P(x \ge 110) = \alpha \Rightarrow P(x \le 90) = \alpha$

$\Rightarrow P(90 \le x \le 110) = 1-2\alpha$.

58. Ans: (a)

Sol: $\int_0^4 f(x)dx = \frac{h}{2}\left[(y_o + y_4) + 2(y_1 + y_2 + y_3)\right]$

$$= \frac{1}{2}\left[(0+160)+2(10+40+90)\right]$$

= 220

59. Ans: (a)

Sol: The Newton – Raphson iteration formula is

$$x_{n+1} = x_n - \frac{f(x_n)}{f^1(x_n)}$$

Let x = $\sqrt{N}$

$\Rightarrow x^2 - N = 0$

Let $f(x) = x^2 - N = 0$

$f^1(x) = 2x$

Substituting in (1)

$$x_{n+1} = x_n - \frac{\left(x_n^2 - N\right)}{2x_n}$$

$$\Rightarrow x_{n+1} = \frac{1}{2}\left(x_n + \frac{N}{x_n}\right)$$

60. Ans: (d)

Sol: All the other methods, we need two initial values near the root.

61. Ans: (A)

Sol: Probability = $p(2) + p(2^c)p(3\cup5)^c p(2) + p(2^c)p(3\cup5)^c\, p(2^c)p(3\cup5)^c\, p(2) + \ldots\ldots\ldots$

$$= \frac{1}{6}+\left(\frac{5}{6}\right)\left(\frac{2}{3}\right)\left(\frac{1}{6}\right)+\left(\frac{5}{6}\right)\left(\frac{2}{3}\right)\left(\frac{5}{6}\right)\left(\frac{2}{3}\right)\left(\frac{1}{6}\right)+\ldots.$$

$$= \frac{\frac{1}{6}}{1-\left(\frac{5}{6}\right)\left(\frac{2}{3}\right)} \text{ (Geometric Series)}$$

$$= \frac{3}{8}$$

62. Ans: (a)

Sol: $f(x) = x|x|$

$$\underset{x\to0-}{\text{Lt}} f(x) = \underset{x\to0}{\text{Lt}}\left(-x^2\right) = 0$$

$$\underset{x\to0+}{\text{Lt}} f(x) = \underset{x\to0}{\text{Lt}}\left(x^2\right) = 0$$

$f(0) = 0$

$\therefore$ f(x) is continuous at x = 0

$$f'(0-) = \underset{h\to0-}{\text{Lt}} \frac{f(0+h)-f(0)}{h}$$

$$= \underset{h\to0}{\text{Lt}} \frac{-h^2}{h} = 0$$

$$f'(0+) = \underset{h\to0+}{\text{Lt}} \frac{f(0+h)-f(0)}{h}$$

$$= \underset{h\to0}{\text{Lt}} \frac{h^2}{h} = 0$$

$\therefore$ f(x) is differentiable at x = 0

63. Ans. (b)

Sol: $\int_0^n [x]\,dx = \int_0^n x\,dx$

$$= \int_0^1 0\,dx + \int_0^1 1\,dx + \int_1^2 2\,dx + \ldots\ldots. + \int_{n-1}^n (n-1)\,dx$$

$= 0 + 1 + 2 + \ldots\ldots.. + n - 1$

$$= \frac{(n-1)n}{2}$$

64. Ans: (c)

Sol: $f(x) = e^x(\sin x - \cos x)$

$f^1(x) = e^x(\cos x + \sin x) + (\sin x - \cos x)\cdot e^x$

Consider $f^1(c) = 0$

$\Rightarrow 2e^c \cdot \sin c = 0$

$\Rightarrow \sin c = 0$

$\Rightarrow c = \pi \in \left(\frac{\pi}{4}, \frac{5\pi}{4}\right)$

65. Ans: (a)

Sol: Given $f(x, y) = 2(x^2 - y^2) - x^4 + y^4$

Consider $f_x = 4x - 4x^3 = 0$

$\Rightarrow x = 0, 1, -1$

Consider $f_y = -4y + 4y^3 = 0$

$\Rightarrow y = 0, 1, -1$

Now, $r = f_{xy} = 4 - 12x^2$, $s = f_{xy} = 0$

and $t = f_{yy} = -4 + 12y^2$

At (0,1), we have r > 0 and $(rt - s^2) > 0$

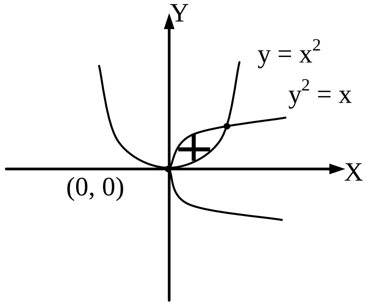
$\therefore$ f(x, y) has minimum at (0,1)

At (–1, 0), we have r < 0 and $(rt - s^2) > 0$

$\therefore$ f(x, y) has a maximum at (–1, 0)

66. Ans: (d)

Sol:



$$\oint_C \vec{A}.d\vec{r} = \oint_C (x-y)dx + (x+y)dy$$

$$= \iint_R (1+1)dx\,dy$$

[By Green's theorem]

$$= 2\int_{x=0}^{1}\int_{y=0}^{\sqrt{x}} dy\,dx$$

$$= 2\int_{x=0}^{1} (y)_{x^2}^{\sqrt{x}}$$

$$= 2\int_{x=0}^{1}\left\{\sqrt{x} - x^2\right\}dx$$

$$= 2\left\{\frac{2}{3}x^{\frac{3}{2}} - \frac{x^3}{3}\right\}_0^1$$

$$= 2\left\{\frac{2}{3} - \frac{1}{3}\right\} = \frac{2}{3}$$

67. Ans: (a)

68. Ans: (a)

Sol: Here $f = \dfrac{y}{x^2 + y^2}$

$$\frac{\partial f}{\partial x} = \frac{-2xy}{(x^2+y^2)^2},\quad \frac{\partial f}{\partial y} = \frac{x^2 - y^2}{(x^2+y^2)^2},\quad \frac{\partial f}{\partial z} = 0$$

$$\text{grad } f = i\frac{\partial f}{\partial x} + j\frac{\partial f}{\partial y} + k\frac{\partial f}{\partial z}$$

$$= \frac{-2xy}{(x^2+y^2)^2}i + \frac{(x^2-y^2)}{(x^2+y^2)^2}j$$

At (0,1), grad f = $-\vec{j}$

The unit vector along the line making angle 30^o with positive x-axis at the point (0,1) = (cos 30°i + sin 30°j)

Then, required directional derivative

$$= (\nabla f)_P.\frac{\vec{a}}{|\vec{a}|} = -j.\,(\cos 30i + \sin 30j)$$

$$= -\sin 30 = \frac{-1}{2}$$

69. Ans: (a)

Sol: $\displaystyle\int_{\frac{-1}{2}}^{\frac{1}{2}} \cos x \log\left(\frac{1+x}{1-x}\right)dx$

$$f(x) = \cos x \log\left(\frac{1+x}{1-x}\right)$$

$$f(-x) = \cos x \log\left(\frac{1-x}{1+x}\right)$$

$$= -\cos x \log\left(\frac{1+x}{1-x}\right)$$

$= -f(x)$

$\therefore$ f(x) is odd function

$\Rightarrow$ The value of the given integral is zero.

70. Ans: (a)

Sol: $u = f(r)$ where $x^2 + y^2 = r^2$

$$u_x = f^1(r).\frac{\partial r}{\partial x}$$

$$= f^1(r).\frac{x}{r}$$

$$u_{xx} = \frac{f^1(r)}{r} + x.\left\{\frac{rf^{11}(r) - f^1(r)}{r^2}\right\}.\frac{x}{r}$$

$$u_{xx} + u_{yy} + u_{zz} = \frac{f^1(r)}{r} + f^{11}(r)$$

71. Ans: (b)

Sol: Both statements 1 & 2 are individually true and 2 is correct explanation of 1.
IP is based on packet switching.

72. Ans: (a)

Sol: Statement (I) and Statement (II) are true and 'Statement (II)' is the correct explanation for Statement (I).

73. Ans: (b)

Sol: Statement (I) and Statement (II) are true but Statement (II)' is not correct explanation for Statement (I).

74. Ans: (b)

Sol: Both statements are correct, but Statement (II) is not reason for Statement (I).
Memory protection is provided by OS and specifically memory management unit of OS. But dual mode of operation protects I/O devices and other software resources.

75. Ans: (A)

Sol: Non-preemptive system cannot take away CPU from any process if it is not either terminated or it is not going to block state (for any I/O execution).
Hence process can make two transitions from running state to block/wait state or to terminate state.