

1. (a) If $f(x) = \sin x$, $g(x) = x^2$; $x \in \mathbb{R}$; then find $(f \circ g)(x)$ (1)
- (b) Let u and v be two functions defined on \mathbb{R} as $u(x) = 2x - 3$ and $v(x) = \frac{3+x}{2}$. Prove that u and v are inverse to each other. (2)

2. (a) For the symmetric matrix $A = \begin{bmatrix} 2 & x & 4 \\ 5 & 3 & 8 \\ 4 & y & 9 \end{bmatrix}$. Find the values of x and y . (1)
- (b) From Part(a), verify AA' and $A + A'$ are symmetric matrices. (2)

3. (a) Find the slope of tangent line to the curve $y = x^2 - 2x + 1$. (1)
- (b) Find the equation of tangent to the above curve which is parallel to the line $2x - y + 9 = 0$. (2)

4. (a) If $\int f(x) dx = \log |\tan x| + C$. Find $f(x)$. (1)

- (b) Evaluate $\int \frac{1}{\sqrt{1-4x^2}} dx$. (2)

5. (a) Area bounded by the curve $y = f(x)$ and the lines $x = a$, $x = b$ and the x axis = _____ (1)

(i) $\int_a^b x dy$

(ii) $\int_a^b x^2 dy$

(iii) $\int_a^b y dx$

(iv) $\int_a^b y^2 dx$

1. Find the area of the rectangle.

图 3-1-1

- $$1. \quad (a) \quad f(x) = \sin x, \quad g(x) = x^2, \quad x \in \mathbb{R} \quad \text{signifies} \quad (f(x), g(x)) \text{ are } x \text{ and } x^2. \quad (1)$$

- (b) A vector field \mathbf{v} is said to be irrotational if $\nabla \times \mathbf{v} = \mathbf{0}$. If \mathbf{v} is irrotational, then there exists a scalar function ϕ such that $\mathbf{v} = -\nabla \phi$. This is the case for the vector field $\mathbf{v} = (2x - 3, 4y - 2, 0)$. Find a scalar function ϕ such that $\mathbf{v} = -\nabla \phi$.

2. (a) $A = \begin{bmatrix} 2 & x & 4 \\ 3 & 3 & 8 \\ 4 & y & 9 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ are two matrices of order 3. Find the values of x and y if $A + B$ is a diagonal matrix.

- (b) $\cos(A + A')$ akan bernilai maksimum jika $A + A' = 0^\circ$ atau 360° atau 720° atau 1080° atau 1440° atau 1800° atau 2160° atau 2520° atau 2880° atau 3240° atau 3600° atau 3960° atau 4320° atau 4680° atau 5040° atau 5400° atau 5760° atau 6120° atau 6480° atau 6840° atau 7200° atau 7560° atau 7920° atau 8280° atau 8640° atau 9000° atau 9360° atau 9720° atau 10080° atau 10440° atau 10800° atau 11160° atau 11520° atau 11880° atau 12240° atau 12600° atau 12960° atau 13320° atau 13680° atau 14040° atau 14400° atau 14760° atau 15120° atau 15480° atau 15840° atau 16200° atau 16560° atau 16920° atau 17280° atau 17640° atau 18000° atau 18360° atau 18720° atau 19080° atau 19440° atau 19800° atau 20160° atau 20520° atau 20880° atau 21240° atau 21600° atau 21960° atau 22320° atau 22680° atau 23040° atau 23400° atau 23760° atau 24120° atau 24480° atau 24840° atau 25200° atau 25560° atau 25920° atau 26280° atau 26640° atau 27000° atau 27360° atau 27720° atau 28080° atau 28440° atau 28800° atau 29160° atau 29520° atau 29880° atau 30240° atau 30600° atau 30960° atau 31320° atau 31680° atau 32040° atau 32400° atau 32760° atau 33120° atau 33480° atau 33840° atau 34200° atau 34560° atau 34920° atau 35280° atau 35640° atau 36000° atau 36360° atau 36720° atau 37080° atau 37440° atau 37800° atau 38160° atau 38520° atau 38880° atau 39240° atau 39600° atau 39960° atau 40320° atau 40680° atau 41040° atau 41400° atau 41760° atau 42120° atau 42480° atau 42840° atau 43200° atau 43560° atau 43920° atau 44280° atau 44640° atau 45000° atau 45360° atau 45720° atau 46080° atau 46440° atau 46800° atau 47160° atau 47520° atau 47880° atau 48240° atau 48600° atau 48960° atau 49320° atau 49680° atau 50040° atau 50400° atau 50760° atau 51120° atau 51480° atau 51840° atau 52200° atau 52560° atau 52920° atau 53280° atau 53640° atau 54000° atau 54360° atau 54720° atau 55080° atau 55440° atau 55800° atau 56160° atau 56520° atau 56880° atau 57240° atau 57600° atau 57960° atau 58320° atau 58680° atau 59040° atau 59400° atau 59760° atau 60120° atau 60480° atau 60840° atau 61200° atau 61560° atau 61920° atau 62280° atau 62640° atau 63000° atau 63360° atau 63720° atau 64080° atau 64440° atau 64800° atau 65160° atau 65520° atau 65880° atau 66240° atau 66600° atau 66960° atau 67320° atau 67680° atau 68040° atau 68400° atau 68760° atau 69120° atau 69480° atau 69840° atau 70200° atau 70560° atau 70920° atau 71280° atau 71640° atau 72000° atau 72360° atau 72720° atau 73080° atau 73440° atau 73800° atau 74160° atau 74520° atau 74880° atau 75240° atau 75600° atau 75960° atau 76320° atau 76680° atau 77040° atau 77400° atau 77760° atau 78120° atau 78480° atau 78840° atau 79200° atau 79560° atau 79920° atau 80280° atau 80640° atau 81000° atau 81360° atau 81720° atau 82080° atau 82440° atau 82800° atau 83160° atau 83520° atau 83880° atau 84240° atau 84600° atau 84960° atau 85320° atau 85680° atau 86040° atau 86400° atau 86760° atau 87120° atau 87480° atau 87840° atau 88200° atau 88560° atau 88920° atau 89280° atau 89640° atau 90000° atau 90360° atau 90720° atau 91080° atau 91440° atau 91800° atau 92160° atau 92520° atau 92880° atau 93240° atau 93600° atau 93960° atau 94320° atau 94680° atau 95040° atau 95400° atau 95760° atau 96120° atau 96480° atau 96840° atau 97200° atau 97560° atau 97920° atau 98280° atau 98640° atau 99000° atau 99360° atau 99720° atau 100080° atau 100440° atau 100800° atau 101160° atau 101520° atau 101880° atau 102240° atau 102600° atau 102960° atau 103320° atau 103680° atau 104040° atau 104400° atau 104760° atau $$

3. (a) $y = 3x^2 - 2x + 1$ is a parabola opening upwards. (1)

- (5) x ಮತ್ತು y ನಡುವಿನ ಸಂಬಂಧ $2x - y + 9 = 0$ ಆಗಿದ್ದರೆ x ಮತ್ತು y ನಡುವಿನ ಸಂಬಂಧ $2x - y + 9 = 0$ ಆಗಿರುತ್ತದೆ.

6. (a)
- $\int \frac{1}{x} dx = \log |x| + C$
- and
- $\int \frac{1}{x^2} dx = -\frac{1}{x} + C$
- (b)
- $\int \frac{1}{x^2} dx = -\frac{1}{x} + C$
- and
- $\int \frac{1}{x^3} dx = -\frac{1}{2x^2} + C$
- (c)
- $\int \frac{1}{x^4} dx = -\frac{1}{3x^3} + C$
- (d)
- $\int \frac{1}{x^5} dx = -\frac{1}{4x^4} + C$
- (e)
- $\int \frac{1}{x^6} dx = -\frac{1}{5x^5} + C$
- (f)
- $\int \frac{1}{x^7} dx = -\frac{1}{6x^6} + C$
- (g)
- $\int \frac{1}{x^8} dx = -\frac{1}{7x^7} + C$
- (h)
- $\int \frac{1}{x^9} dx = -\frac{1}{8x^8} + C$
- (i)
- $\int \frac{1}{x^{10}} dx = -\frac{1}{9x^9} + C$
- (j)
- $\int \frac{1}{x^{11}} dx = -\frac{1}{10x^{10}} + C$
- (k)
- $\int \frac{1}{x^{12}} dx = -\frac{1}{11x^{11}} + C$
- (l)
- $\int \frac{1}{x^{13}} dx = -\frac{1}{12x^{12}} + C$
- (m)
- $\int \frac{1}{x^{14}} dx = -\frac{1}{13x^{13}} + C$
- (n)
- $\int \frac{1}{x^{15}} dx = -\frac{1}{14x^{14}} + C$
- (o)
- $\int \frac{1}{x^{16}} dx = -\frac{1}{15x^{15}} + C$
- (p)
- $\int \frac{1}{x^{17}} dx = -\frac{1}{16x^{16}} + C$
- (q)
- $\int \frac{1}{x^{18}} dx = -\frac{1}{17x^{17}} + C$
- (r)
- $\int \frac{1}{x^{19}} dx = -\frac{1}{18x^{18}} + C$
- (s)
- $\int \frac{1}{x^{20}} dx = -\frac{1}{19x^{19}} + C$
- (t)
- $\int \frac{1}{x^{21}} dx = -\frac{1}{20x^{20}} + C$
- (u)
- $\int \frac{1}{x^{22}} dx = -\frac{1}{21x^{21}} + C$
- (v)
- $\int \frac{1}{x^{23}} dx = -\frac{1}{22x^{22}} + C$
- (w)
- $\int \frac{1}{x^{24}} dx = -\frac{1}{23x^{23}} + C$
- (x)
- $\int \frac{1}{x^{25}} dx = -\frac{1}{24x^{24}} + C$
- (y)
- $\int \frac{1}{x^{26}} dx = -\frac{1}{25x^{25}} + C$
- (z)
- $\int \frac{1}{x^{27}} dx = -\frac{1}{26x^{26}} + C$
- (aa)
- $\int \frac{1}{x^{28}} dx = -\frac{1}{27x^{27}} + C$
- (ab)
- $\int \frac{1}{x^{29}} dx = -\frac{1}{28x^{28}} + C$
- (ac)
- $\int \frac{1}{x^{30}} dx = -\frac{1}{29x^{29}} + C$
- (ad)
- $\int \frac{1}{x^{31}} dx = -\frac{1}{30x^{30}} + C$
- (ae)
- $\int \frac{1}{x^{32}} dx = -\frac{1}{31x^{31}} + C$
- (af)
- $\int \frac{1}{x^{33}} dx = -\frac{1}{32x^{32}} + C$
- (ag)
- $\int \frac{1}{x^{34}} dx = -\frac{1}{33x^{33}} + C$
- (ah)
- $\int \frac{1}{x^{35}} dx = -\frac{1}{34x^{34}} + C$
- (ai)
- $\int \frac{1}{x^{36}} dx = -\frac{1}{35x^{35}} + C$
- (aj)
- $\int \frac{1}{x^{37}} dx = -\frac{1}{36x^{36}} + C$
- (ak)
- $\int \frac{1}{x^{38}} dx = -\frac{1}{37x^{37}} + C$
- (al)
- $\int \frac{1}{x^{39}} dx = -\frac{1}{38x^{38}} + C$
- (am)
- $\int \frac{1}{x^{40}} dx = -\frac{1}{39x^{39}} + C$
- (an)
- $\int \frac{1}{x^{41}} dx = -\frac{1}{40x^{40}} + C$
- (ao)
- $\int \frac{1}{x^{42}} dx = -\frac{1}{41x^{41}} + C$
- (ap)
- $\int \frac{1}{x^{43}} dx = -\frac{1}{42x^{42}} + C$
- (aq)
- $\int \frac{1}{x^{44}} dx = -\frac{1}{43x^{43}} + C$
- (ar)
- $\int \frac{1}{x^{45}} dx = -\frac{1}{44x^{44}} + C$
- (as)
- $\int \frac{1}{x^{46}} dx = -\frac{1}{45x^{45}} + C$
- (at)
- $\int \frac{1}{x^{47}} dx = -\frac{1}{46x^{46}} + C$
- (au)
- $\int \frac{1}{x^{48}} dx = -\frac{1}{47x^{47}} + C$
- (av)
- $\int \frac{1}{x^{49}} dx = -\frac{1}{48x^{48}} + C$
- (aw)
- $\int \frac{1}{x^{50}} dx = -\frac{1}{49x^{49}} + C$
- (ax)
- $\int \frac{1}{x^{51}} dx = -\frac{1}{50x^{50}} + C$
- (ay)
- $\int \frac{1}{x^{52}} dx = -\frac{1}{51x^{51}} + C$
- (az)
- $\int \frac{1}{x^{53}} dx = -\frac{1}{52x^{52}} + C$
- (ba)
- $\int \frac{1}{x^{54}} dx = -\frac{1}{53x^{53}} + C$
- (bb)
- $\int \frac{1}{x^{55}} dx = -\frac{1}{54x^{54}} + C$
- (bc)
- $\int \frac{1}{x^{56}} dx = -\frac{1}{55x^{55}} + C$
- (bd)
- $\int \frac{1}{x^{57}} dx = -\frac{1}{56x^{56}} + C$
- (be)
- $\int \frac{1}{x^{58}} dx = -\frac{1}{57x^{57}} + C$
- (bf)
- $\int \frac{1}{x^{59}} dx = -\frac{1}{58x^{58}} + C$
- (bg)
- $\int \frac{1}{x^{60}} dx = -\frac{1}{59x^{59}} + C$
- (bh)
- $\int \frac{1}{x^{61}} dx = -\frac{1}{60x^{60}} + C$
- (bi)
- $\int \frac{1}{x^{62}} dx = -\frac{1}{61x^{61}} + C$
- (bj)
- $\int \frac{1}{x^{63}} dx = -\frac{1}{62x^{62}} + C$
- (bk)
- $\int \frac{1}{x^{64}} dx = -\frac{1}{63x^{63}} + C$
- (bl)
- $\int \frac{1}{x^{65}} dx = -\frac{1}{64x^{64}} + C$
- (bm)
- $\int \frac{1}{x^{66}} dx = -\frac{1}{65x^{65}} + C$
- (bn)
- $\int \frac{1}{x^{67}} dx = -\frac{1}{66x^{66}} + C$
- (bo)
- $\int \frac{1}{x^{68}} dx = -\frac{1}{67x^{67}} + C$
- (bp)
- $\int \frac{1}{x^{69}} dx = -\frac{1}{68x^{68}} + C$
- (bq)
- $\int \frac{1}{x^{70}} dx = -\frac{1}{69x^{69}} + C$
- (br)
- $\int \frac{1}{x^{71}} dx = -\frac{1}{70x^{70}} + C$
- (bs)
- $\int \frac{1}{x^{72}} dx = -\frac{1}{71x^{71}} + C$
- (bt)
- $\int \frac{1}{x^{73}} dx = -\frac{1}{72x^{72}} + C$
- (bu)
- $\int \frac{1}{x^{74}} dx = -\frac{1}{73x^{73}} + C$
- (bv)
- $\int \frac{1}{x^{75}} dx = -\frac{1}{74x^{74}} + C$
- (bw)
- $\int \frac{1}{x^{76}} dx = -\frac{1}{75x^{75}} + C$
- (bx)
- $\int \frac{1}{x^{77}} dx = -\frac{1}{76x^{76}} + C$
- (by)
- $\int \frac{1}{x^{78}} dx = -\frac{1}{77x^{77}} + C$
- (bz)
- $\int \frac{1}{x^{79}} dx = -\frac{1}{78x^{78}} + C$
- (ca)
- $\int \frac{1}{x^{80}} dx = -\frac{1}{79x^{79}} + C$
- (cb)
- $\int \frac{1}{x^{81}} dx = -\frac{1}{80x^{80}} + C$
- (cc)
- $\int \frac{1}{x^{82}} dx = -\frac{1}{81x^{81}} + C$
- (cd)
- $\int \frac{1}{x^{83}} dx = -\frac{1}{82x^{82}} + C$
- (ce)
- $\int \frac{1}{x^{84}} dx = -\frac{1}{83x^{83}} + C$
- (cf)
- $\int \frac{1}{x^{85}} dx = -\frac{1}{84x^{84}} + C$
- (cg)
- $\int \frac{1}{x^{86}} dx = -\frac{1}{85x^{85}} + C$
- (ch)
- $\int \frac{1}{x^{87}} dx = -\frac{1}{86x^{86}} + C$
- (ci)
- $\int \frac{1}{x^{88}} dx = -\frac{1}{87x^{87}} + C$
- (cj)
- $\int \frac{1}{x^{89}} dx = -\frac{1}{88x^{88}} + C$
- (ck)
- $\int \frac{1}{x^{90}} dx = -\frac{1}{89x^{89}} + C$
- (cl)
- $\int \frac{1}{x^{91}} dx = -\frac{1}{90x^{90}} + C$
- (cm)
- $\int \frac{1}{x^{92}} dx = -\frac{1}{91x^{91}} + C$
- (cn)
- $\int \frac{1}{x^{93}} dx = -\frac{1}{92x^{92}} + C$
- (co)
- $\int \frac{1}{x^{94}} dx = -\frac{1}{93x^{93}} + C$
- (cp)
- $\int \frac{1}{x^{95}} dx = -\frac{1}{94x^{94}} + C$
- (cq)
- $\int \frac{1}{x^{96}} dx = -\frac{1}{95x^{95}} + C$
- (cr)
- $\int \frac{1}{x^{97}} dx = -\frac{1}{96x^{96}} + C$
- (cs)
- $\int \frac{1}{x^{98}} dx = -\frac{1}{97x^{97}} + C$
- (ct)
- $\int \frac{1}{x^{99}} dx = -\frac{1}{98x^{98}} + C$
- (cu)
- $\int \frac{1}{x^{100}} dx = -\frac{1}{99x^{99}} + C$
- (cv)
- $\int \frac{1}{x^{101}} dx = -\frac{1}{100x^{100}} + C$
- (cw)
- $\int \frac{1}{x^{102}} dx = -\frac{1}{101x^{101}} + C$
- (cx)
- $\int \frac{1}{x^{103}} dx = -\frac{1}{102x^{102}} + C$
- (cy)
- $\int \frac{1}{x^{104}} dx = -\frac{1}{103x^{103}} + C$
- (cz)
- $\int \frac{1}{x^{105}} dx = -\frac{1}{104x^{104}} + C$
- (da)
- $\int \frac{1}{x^{106}} dx = -\frac{1}{105x^{105}} + C$
- (db)
- $\int \frac{1}{x^{107}} dx = -\frac{1}{106x^{106}} + C$
- (dc)
- $\int \frac{1}{x^{108}} dx = -\frac{1}{107x^{107}} + C$
- (dd)
- $\int \frac{1}{x^{109}} dx = -\frac{1}{108x^{108}} + C$
- (de)
- $\int \frac{1}{x^{110}} dx = -\frac{1}{109x^{109}} + C$
- (df)

- (ii) $\int \frac{1}{\sqrt{1-x^2}}$ is an odd function and $\int_0^1 \frac{1}{\sqrt{1-x^2}} dx = \int_{-1}^0 \frac{1}{\sqrt{1-x^2}} dx$ (2)

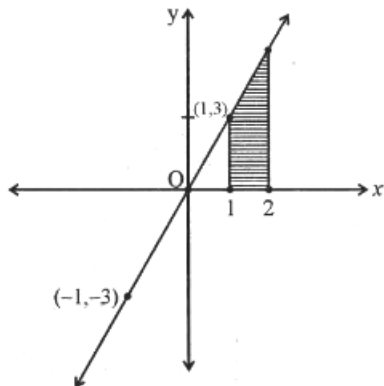
5. (a) $y = 10x^2 - 12x + 6$, $x = -1$, $x = 1$, $x = 2$

(1) 2 Gy

14

1000

$$(iv) \int_0^1 y^2 dy$$



6. (a) The order of the differential equation formed by $y = A \sin x + B \cos x + c$, where A and B are arbitrary constants is (1)
- (i) 1 (ii) 2
(iii) 0 (iv) 3
- (b) Solve the differential equation $\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$ (2)

7. A factory produces three items P, Q and R at two plants A and B. The number of items produced and operating costs per hour is as follows :

Plant	Item produced per hour			Operating cost
	P	Q	R	
A	20	15	25	₹ 1000
B	30	12	23	₹ 800

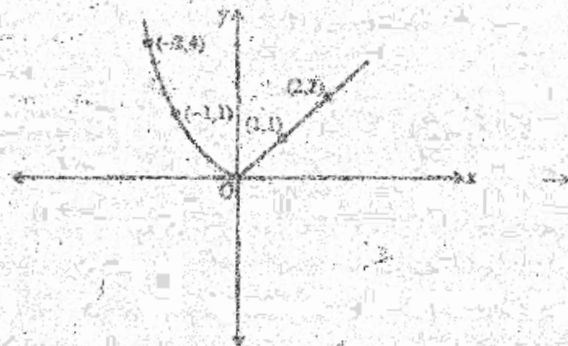
It is desired to produce atleast 500 items of type P, atleast 400 items of type Q and atleast 300 items of type R per day.

- (a) Is it a maximization case or a minimization case. Why ? (1)
- (b) Write the objective function and constraints. (2)

8. (a) The function f is defined as "To each person on the earth is assigned a date of birth". Is this function one-one? Give reason. (1)
- (b) Consider the function $f: \left[0, \frac{\pi}{2}\right] \rightarrow \mathbb{R}$ given by $f(x) = \sin x$ and $g: \left[0, \frac{\pi}{2}\right] \rightarrow \mathbb{R}$ given by $g(x) = \cos x$.
- (i) Show that f and g are one-one functions. (2)
- (ii) Is $f+g$ one-one? Why? (2)
- (c) The number of one-one functions from a set containing 2 elements to a set containing 3 elements is _____. (1)
- (i) 2 (ii) 3
- (iii) 6 (iv) 8

9. If $A = \sin^{-1} \frac{2x}{1+x^2}$, $B = \cos^{-1} \frac{1-x^2}{1+x^2}$, $C = \tan^{-1} \frac{2x}{1-x^2}$ satisfies the condition $3A - 4B + 2C = \frac{\pi}{3}$ find the value of x . (4)

10. (a) Write the function whose graph is shown below. (1)



- (b) Discuss the continuity of the function obtained in part (a). (2)
- (c) Discuss the differentiability of the function obtained in part (a). (1)

8. ප්‍රශ්න 17 ක් ඇතුළත් වූ පාඨමාලාවක මිල 4 රුපියල් බැගින් වූවාය. ඒවායේ සංඛ්‍යාව x වූ විට ප්‍රශ්න මාලාවක මිල $(3 \times 4 = 32)$ රුපියල් වූවාය.

(a) P යනු x රාශියේ වෙනස් වීම මත පදනම්ව ප්‍රශ්න මාලාවක මිල වෙනස් වීමේ වේගය දැක්වූ විෂයයකි.

“මුළු මිලට, භාගය ගනු ලැබූවාය” යනු ඉහත සමීකරණයේ ගනු ලැබූ විෂයයකි.” ඉහත පාඨමාලාවේ මුළු මිලට වෙනස් වීමේ වේගය P සාධාරණයෙන් 7 සමානතා ලෙස සොයන්න. (1)

(b) $f: \left[0, \frac{\pi}{2}\right] \rightarrow \mathbb{R}$ හි $f(x) = \sin x$ යනු $g: \left[0, \frac{\pi}{2}\right] \rightarrow \mathbb{R}$ හි $g(x) = \cos x$ යනු f හි අවම වශයෙන් 2 ගුණයක් වැඩිවීම සඳහා x හි අගය සොයන්න.

(i) f හි අවම වශයෙන් වෙනස් වීමේ වේගය සොයන්න.

(ii) $f + g$ හි අවම වශයෙන් වෙනස් වීමේ වේගය සොයන්න? (2)

(c) 2 සමානතා ලෙස, $\sin x$ හි අවම වශයෙන් වෙනස් වීමේ වේගය 3 සමානතා ලෙස, $\cos x$ හි අවම වශයෙන් වෙනස් වීමේ වේගය සොයන්න. (1)

(i) 2

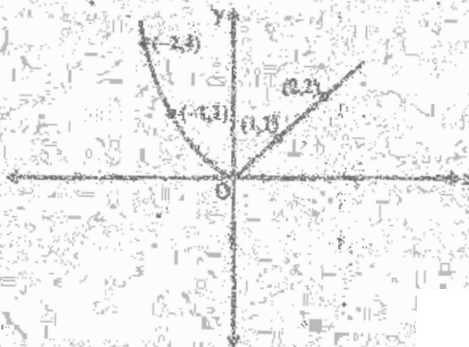
(ii) 3

(iii) 4

(iv) 5

9. $A = \sin^{-1} \frac{2x}{1+x^2}$, $B = \cos^{-1} \frac{1-x^2}{1+x^2}$, $C = \tan^{-1} \frac{2x}{1-x^2}$ යන විට $3A + 4B + 2C = \frac{\pi}{3}$ යන සමීකරණයේ x හි අගය සොයන්න. (4)

10. (a) $f(x) = \sin x$ හි අවම වශයෙන් වෙනස් වීමේ වේගය සොයන්න. (1)



(b) $f(x) = \sin x$ හි අවම වශයෙන් වෙනස් වීමේ වේගය සොයන්න. (2)

(c) $f(x) = \sin x$ හි අවම වශයෙන් වෙනස් වීමේ වේගය සොයන්න. (1)



(a) Express the surface area 's' as a function of x.

(1)

(b) Show that the surface area is minimum when it is a cube.

(3)

12. (a) If $2x + 4 = A(2x + 3) + B$, find A and B.

(1)

(b) Using part (a) evaluate $\int \frac{2x+4}{x^2+3x+1} dx$.

(3)

13. Consider the differential equation $\cos^2 x \frac{dy}{dx} + y = \tan x$. Find

(a) its degree

(1)

(b) the integrating factor

(1)

(c) the general solution.

(2)

14. The position vectors of three points A, B, C are given to be $\hat{i} + 3\hat{j} + 3\hat{k}$, $4\hat{i} + 4\hat{k}$ and $-2\hat{i} + 4\hat{j} + 2\hat{k}$ respectively.

(a) Find \vec{AB} and \vec{AC} .

(1)

(b) Find the angle between \vec{AB} and \vec{AC} .

(1)

(c) Find a vector which is perpendicular to both \vec{AB} and \vec{AC} having magnitude 9 units.

(2)

15. (a) If \vec{a} , \vec{b} , \vec{c} are coplanar vectors, write the vector perpendicular to \vec{a} .

(1)

(b) If \vec{a} , \vec{b} , \vec{c} are coplanar, prove that $\vec{a} + \vec{b}$, $\vec{b} + \vec{c}$, $\vec{c} + \vec{a}$ are coplanar.

(3)



- (a) The surface area of the cube is 6. (1)
 (b) The volume of the cube is 1. (1)

12. (a) The function $f(x) = 3x^2 + 2x - 1$ is given. (1)

- (b) Find the value of $f(2)$. (1)

13. The function $f(x) = \tan^{-1} x$ is given. (1)

- (a) Find the value of $f(1)$. (1)
 (b) Find the value of $f(0)$. (1)
 (c) Find the value of $f(-1)$. (1)

14. A, B, C are three points in a plane. (1)

- (a) AB, AC are straight lines. (1)
 (b) AB, AC are straight lines. (1)
 (c) AB, AC are straight lines. (1)

15. (a) A, B, C are three points in a plane. (1)

- (b) A, B, C are three points in a plane. (1)

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15. (a) Write all the direction cosines of x -axis. (1)
- (b) If a line makes angles α, β, γ with x, y, z -axis respectively, then prove that $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2$. (2)
- (c) If a line makes equal angles with the three co-ordinate axes, find the direction cosines of the lines. (1)

The activities of a factory are given in the following table:

Items	Expenditure			Profit per unit
	Cutting	Mixing	Packing	
A	1	2	1	2.5
B	4	1	1	2.8
Resources (time available)	24	21	9	

Solve the linear programming problem graphically and find the maximum profit subject to the above constraints. (2)

Questions from 18 to 24 carry 6 marks each. Answer any five. (3 × 6 = 18)

18. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$. Show that $A^2 - 5A + 7I = O$. Hence find A^{-1} and A^{-3} . (6)

19. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$. Show (3)

- (a) Find A^{-1} . (1)
- (b) Use A^{-1} from part (a) solve the system of equations (3)

$$2x - 3y + 5z = 11$$

$$3x + 2y - 4z = -5$$

$$x + y - 2z = -3$$

16. (a) x -axis ന്റെ എല്ലാ ഡയറക്ഷൻ കോസൈനുകളും എഴുതുക. (1)
- (b) ഒരു ലൈൻ മൂന്ന് ആക്സിസുകളുമായി α, β, γ എന്നീ കോണുകളുണ്ടാക്കുന്നു. വെങ്കിൽ $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2$ എന്ന് തെളിയിക്കുക. (2)
- (c) ഒരു ലൈൻ മൂന്ന് ആക്സിസുകളുമായി തുല്യ കോണുകൾ ഉണ്ടാക്കുന്നുവെങ്കിൽ ആ ലൈനിന്റെ ഡയറക്ഷൻ കോസൈൻസ് കാണുക. (1)

17. ഒരു ഫാക്ടറിയിലെ പ്രവർത്തനങ്ങൾ ചുവടെ ടേബിളിൽ ചേർത്തിരിക്കുന്നു :

ഇനങ്ങൾ	വിഭാഗങ്ങൾ			ലാഭം/ഉല്പന്നം
	ക്വിംഗ്	മിക്സിംഗ്	പായ്യിംഗ്	
A	1	3	1	₹ 5
B	4	1	1	₹ 8
പരമാവധി ലഭ്യമായ സമയം	24	21	9	

തന്നിരിക്കുന്ന ലിനിയർ പ്രോഗ്രാമിംഗ് പ്രോബ്ലം ഗ്രാഫുപയോഗിച്ച് നിർദ്ധാരണം ചെയ്യുക. തന്നിരിക്കുന്ന കൺസ്റ്റെയിന്റീനു വിധേയമായിട്ടുള്ള പരമാവധി ലാഭം കണക്കാക്കുക. (4)

- 18 മുതൽ 24 വരെയുള്ള ചോദ്യങ്ങൾക്ക് 6 സ്കോർ വീതമാണ്. ഏതെങ്കിലും 5 എണ്ണത്തിന് ഉത്തരമെഴുതുക. (5 × 6 = 30)

18. $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ ആയാൽ $A^2 - 5A + 7I = 0$ എന്ന് തെളിയിക്കുക. ഇതിൽ നിന്നും A^4, A^{-1} ഇവ കാണുക. (6)

19. $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$ ആയാൽ
- (a) A^{-1} കാണുക. (3)

- (b) പാർട്ട് (a) യിൽ ലഭിച്ച A^{-1} ഉപയോഗിച്ച് ചുവടെ തന്നിരിക്കുന്ന സമവാക്യങ്ങൾ സോൾവ് ചെയ്യുക (3)

$$2x - 3y + 5z = 11$$

$$3x + 2y - 4z = -5$$

$$x + y - 2z = -3$$

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20. Find $\frac{dy}{dx}$ for the following :

(a) $\sin^2 x + \cos^2 y = 1.$ (2)

(b) $y = x^x$ (2)

(c) $x = a(t - \sin t) \quad y = a(1 + \cos t)$ (2)

21. Evaluate the following integrals :

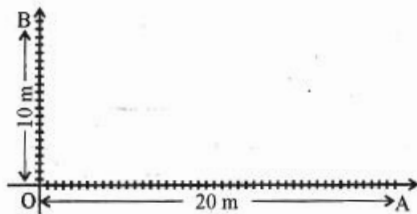
(a) $\int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x} dx$ (3)

(b) $\int_{-\pi/2}^{\pi/2} \sin^7 x dx$ (1)

(c) $\int x \sin 3x dx$ (2)

22. (a) Find the area bounded by the curve $y = \sin x$ and the lines $x = 0$, $x = 2\pi$, and x axis. (1)

(b) Two fences are made in a grass field as shown in the figure. A cow is tied at the point O with a rope of length 3 m.



(i) Using integration, find the maximum area of grass that cow can graze within the fences. Choose O as origin. (4)

(ii) If there is no fences find the maximum area of grass that cow can graze ? (1)

20. Evaluate the definite integrals $\frac{dy}{dx}$ accordingly.

(a) $\sin^2 x + \cos^2 y = 1$ (3)

(b) $y = x^2$ (3)

(c) $x = a(1 - \sin t)$, $y = a(1 + \cos t)$ (3)

21. Evaluate the definite integrals accordingly:

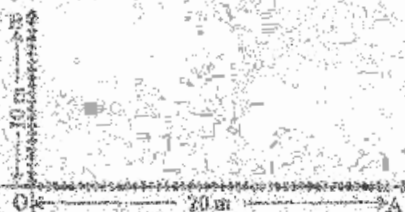
(a) $\int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x} dx$ (3)

(b) $\int_{-\pi/2}^{\pi/2} \sin^2 x dx$ (3)

(c) $\int_0^{\pi/2} x \sin 3x dx$ (3)

22. (a) $y = \sin x$ graphed on a strip, $x = 0$, $x = 2\pi$ graph area is shaded. Evaluate the area shaded accordingly. (1)

(b) A circle is graphed on a grid. A shaded sector is shown. Calculate the area of the shaded sector. The radius is 3 m. Give your answer in terms of π . (3)



(i) Give a formula for calculating the area of a sector of a circle. (1)

(ii) Give a formula for calculating the area of a sector of a circle. (1)

23. (a) Find the equation of the plane through the intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ and the point $(2, 2, 1)$. (2)

- (b) The Cartesian equation of two lines are given by $\frac{x+1}{7} = \frac{y+2}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$. Write the vector equation of these two lines. (2)

- (c) Find the shortest distance between the lines mentioned in part (b). (2)

24. (a) A bag contains 4 red and 4 black balls. Another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag and which is found to be red. Find the probability that the ball is drawn from the first bag. (2)

- (b) A random variable X has the following distribution function:

X	0	1	2	3	4
$P(X=x)$	k	$3k$	$5k$	$7k$	$9k$

- (i) Find k . (1)

- (ii) Find the mean and the variance of the random variable X . (2)

23. (a) $3x - y + 2z - 4 = 0$; $x + y + z - 2 = 0$ എന്നീ രേഖാതലങ്ങൾ സംഗമരേഖയിൽ കൂടിയും $(2, 2, 1)$ എന്ന ബിന്ദുവിൽ കൂടിയും കടന്നുപോകുന്ന തലരേഖയ്ക്ക് സമവാക്യം കണ്ടുപിടിക്കുക. (2)

- (b) താഴെ പറയുന്നവയുടെ കോർഡിനേറ്റ് സമവാക്യം ചുവടെയെഴുതുക. (2)

$$\frac{x+1}{-2} = \frac{y+1}{-6} = \frac{z+1}{1} = \frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$$

മുൻപയുടെ മുമ്പുൾ സമവാക്യം എഴുതുക.

- (c) Part (b)-യിലെ താഴെ പറയുന്നവയുടെ സമവാക്യം കണ്ടുപിടിക്കുക. (2)

24. (a) ഒരു ബാഗിൽ 4 ചുവപ്പും 4 കറുപ്പും വസ്തുക്കൾ ഉണ്ട്. അവയെ ബാഗിൽ 2 ചുവപ്പും 3 കറുപ്പും ചേർക്കുക ഉണ്ട്. ഒരു ചുവപ്പുള്ളത് നീക്കും ഒരു കറുപ്പ് വസ്തുവും തിരഞ്ഞെടുക്കപ്പെടുന്നുവോ-ആ- ഒരു ബാഗിൽ ഉണ്ടോ. ഒരു കറുപ്പ് എടുക്കുന്നു. ഈ ചുവപ്പ് ഒരു ചുവപ്പ് വസ്തുക്കളിൽ ഒരു ചുവപ്പ് വസ്തുക്കളെ ബാഗിൽ നിന്നുമാകുന്നതു് കണ്ടുപിടിക്കുക. (3)

- (b) X എന്ന ഒരു വസ്തുവം വാങ്ങുന്നതിന്റെ ചെലവ് X എന്ന ഡിസ്ക്രിട്ട് വേരിയബിളായി ചുവടെ കൊടുത്തിരിക്കുന്നു.

X	0	1	2	3	4
$P(x)$	k	$3k$	$5k$	$7k$	$6k$

- (i) k കണ്ടുതുക. (1)

- (ii) X എന്ന വസ്തുവം വാങ്ങുന്നതിന്റെ മൂല്യം, വാങ്ങേണ്ടതല്ലാത്ത കണ്ടുതുക. (2)

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