Q1. $\begin{bmatrix} 2x+1 & 4x \\ y+3 & 2y-5 \end{bmatrix} = \begin{bmatrix} x+2 & 4 \\ 7 & 3 \end{bmatrix}$

(a) $x = 2, y = 2$
(b) $x = 4, y = 1$
(c) $x = 1, y = 4$
(d) $x = 3, y = 1$

Q2. The value of λ for which the vectors $3\hat{\imath} - \lambda\hat{\jmath} + 2\hat{k}$ and $2\hat{\imath} + 3\hat{\jmath} - \hat{k}$ are orthogonal is

(a) $\frac{3}{4}$
(b) $\frac{3}{2}$
(c) $\frac{4}{3}$
(d) $\frac{4}{5}$

Q3. For the following LPP, maximise $Z = 3x + 4y$ subject to constraints $x - y \geq -1$ $x \leq 3$, $x \geq 0, y \geq 0$ the maximum value Z occur at

(a) (3, 0)
(b) (0, 1)
(c) (3, 0)
(d) (3, 4)

Q4. If A and B are independent events and $P(A) = \frac{3}{5}$, $P(B) = \frac{1}{5}$, then $P(A \cap B)$ is :

(a) $\frac{3}{25}$
(b) $\frac{1}{25}$
(c) $\frac{4}{25}$
(d) $\frac{2}{25}$

Q5. Match the following columns:

Column – I (D. E.)	Column – II (I. F.)
(A) $\frac{dy}{dx} + \frac{2}{x}y = 3$	I. x^2
(B) $\frac{dy}{dx} + y = \sin x$	II. e^{-4x}
(C) $x\frac{dy}{dx} + 3y = 0$	III. e^x
(D) $\frac{dy}{dx} - 4y = 5x^2$	IV. x^3

Choose the correct option from the following

(a) A→I, B→III, C→IV, D→II

(b) A→IV, B→III, C→I, D→II

(c) A→IV, B→II, C→I, D→III

(d) A→I, B→II, C→IV, D→III

Q6. The corner points of a feasible bounded region are (0,12), (5,3), (4,8), and (12,7). The maximum value of the objective function $Z = ax + by$ is 60 , which occurs at the points (0,12) and (12,7). Determine the values of a and b.

(a) $a = 6, b = 5$
(b) $a = 4, b = 6$

(c) $a=\frac{25}{12}, b=6$

(d) $a=\frac{25}{12}, b=5$

Q7. Which of the following relations on Z is not an equivalence relation?

(a) a R b $\Leftrightarrow$ a − b is divided by 2
(b) a R b $\Leftrightarrow$ a − b is an even integer
(c) a R b $\Leftrightarrow$ a $\leq$ b
(d) a R b $\Leftrightarrow$ a = b

Q8. Angle between $\hat{\imath}+\hat{\jmath}+2\hat{k}$ and $2\hat{\imath}+2\hat{\jmath}+4\hat{k}$ is

(a) 0°

(b) 45°

(c) 90°

(d) 60°

Q9. The value of integral $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} cosx\ dx$ is

(a) 1

(b) $\frac{1}{2}$

(c) 0

(d) 2

Q10. If $x=t^3, y=t^4$ then $\frac{d^2y}{dx^2}$ at $t=2$ is

(a) $\frac{8}{3}$
(b) $\frac{1}{9}$
(c) $\frac{2}{9}$
(d) $\frac{9}{16}$

Solutions:

S1. Ans. (c)
Sol. We have

$$\begin{bmatrix} 2x+1 & 4x \\ y+3 & 2y-5 \end{bmatrix} = \begin{bmatrix} x+2 & 4 \\ 7 & 3 \end{bmatrix}$$

$2x+1=x+2$
$x=1$
$y+3=7$
$y=4$

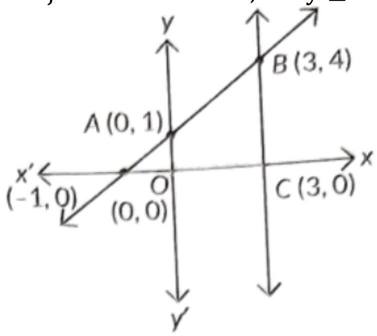
S2. Ans. (c)
Sol. Let
$\vec{a}=3\hat{\imath}-\lambda\hat{\jmath}+2\hat{k}$
$\vec{b}=2\hat{\imath}+3\hat{\jmath}-\hat{k}$
We know, $\vec{a}$ and $\vec{b}$ are orthogonal if $\vec{a}\cdot\vec{b}=0$

$\Rightarrow (3\hat{\imath} - \lambda\hat{\jmath} + 2\hat{k}).(2\hat{\imath} + 3\hat{\jmath} - \hat{k}) = 0$
$\Rightarrow 6 - 3\lambda - 2 = 0$
$\Rightarrow 4 - 3\lambda = 0$
$\Rightarrow 4 = 3\lambda$
$\Rightarrow \lambda = \frac{4}{3}$

S3. Ans. (d)

Sol. Given, Z = 3x + 4y

Subject to constraints, $x - y \geq -1, x \leq 3; x \geq 0, y \geq 0$



The shaded region OABC is the feasible region, where corner points are O(0,0), A(0,1), B(3,4)and C(3,0)

At O(0, 0), Z = 3(0) + 4(0) = 0
At A(0, 1), Z = 3(0) + 4(1) = 4
At B(3, 4), Z = 3(3) + 4(4) = 25
At C(3, 0), Z = 3(3) + 4(0) = 9
∴ Maximum value of Z is 25, which occurs at B (3,4).

S4. Ans. (a)

Sol. Given A and B are independent events and $P(A) = \frac{3}{5}$, P(B) $= \frac{1}{5}$, then

$P(A \cap B) = P(A).P(B)$
$P(A \cap B) = \frac{3}{5} \times \frac{1}{5} = \frac{3}{25}$

S5. Ans. (a)

Sol. (A) Given differential equation is

$$\frac{dy}{dx} + \frac{2}{x}y = 3$$

Integrating factor $= e^{\int Pdx} = e^{\int \frac{2}{x}dx} = e^{2\log x} = x^2$

(B) Given differential equation is

$$\frac{dy}{dx} + y = \sin x$$

Integrating factor $= e^{\int Pdx} = e^{\int 1dx} = e^x$

(C) Given differential equation is

$$x\frac{dy}{dx} + 3y = 0$$

$$\Rightarrow \frac{dy}{dx} + \frac{3}{x}y = 0$$

Integrating factor $= e^{\int Pdx} = e^{\int \frac{3}{x}dx} = e^{3\log x} = x^3$

(D) Given differential equation is

$$\frac{dy}{dx} - 4y = 5x^2$$

Integrating factor $= e^{\int Pdx} = e^{\int -4dx} = e^{-4x}$

S6. Ans. (d)

Sol. Given points are (0,12), (5,3), (4,8), and (12,7).

Also given maximum value of z is 60 which occurs at (0, 12) & (12, 7), then we have

$a(0) + b(12) = a(12) + b(7) = 60$

$12b = 12a + 7b = 60$

If $12b = 60$

$\Rightarrow b = 5$

$12a + 7b = 60 \Rightarrow 12a + 7 \times 5 = 60$

$12a = 25$

$a = \frac{25}{12}$

S7. Ans. (c)

Sol. Relation in option (c) is not an equivalence relation as it is not symmetric

$a \leq$ b then $b \geq$ a

So, if (a, b) ∈ R then (b, a) ∉ R

S8. Ans. (a)

Sol. Given

$\hat{\imath} + \hat{\jmath} + 2\hat{k}$ and $2\hat{\imath} + 2\hat{\jmath} + 4\hat{k}$

$$\cos\theta = \frac{(\hat{\imath} + \hat{\jmath} + 2\hat{k}).(2\hat{\imath} + 2\hat{\jmath} + 4\hat{k})}{\sqrt{1+1+4}\sqrt{4+4+16}}$$

$$\cos\theta = \frac{2+2+8}{12} = 1$$

$\theta = 0°$

S9. Ans. (d)

Sol. We have

$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos x \, dx = 2\int_0^{\frac{\pi}{2}} \cos x \, dx$ {since $\cos(-x) = \cos x$}

$= 2[\sin x]_0^{\frac{\pi}{2}} = 2 \times 1 = 2$

S10. Ans. (b)

Sol. $\frac{dy}{dx} = \frac{4t^3}{3t^2} = \frac{4}{3}t$

$\frac{d^2y}{dx^2} = \frac{4}{3} \times \frac{dt}{dx}$

$= \frac{4}{3} \cdot \frac{1}{3t^2} = \frac{4}{9t^2}$

At $t = 2, \frac{d^2y}{dx^2} = \frac{1}{9}$