



Que. A]

- ① solve $(x+4)dx + (x-y)dy = 0$
- ② solve $(3x^2-y)dx - x dy = 0$
- ③ solve $(x^2+y)dx + (y^3+x)dy = 0$
- ④ solve $(3x^3-y)dx + (y-x)dy = 0$
- ⑤ solve $(x^3+y)dx + (y^2+x)dy = 0$
- ⑥ solve $(4x^3-y)dx + (y^2-x)dy = 0$
- ⑦ solve $(5x^2+y)dx + (y^3+x)dy = 0$
- ⑧ solve $(5x^4-y)dx - x dy = 0$
- ⑨ solve $(2xy+y^3)dx + (x^2+3xy^2)dy = 0$
- ⑩ solve $(x-2y+5)dx - (2x+y-1)dy = 0$
- ⑪ solve $(x+y-2)dx - (y-x-4)dy = 0$
- ⑫ solve $2xydx + (x^2+3y^2)dy = 0$
- ⑬ solve $(2x-y)dx - (x-y)dy = 0$

Que. B

- ① solve $x^2ydx - (x^3+y^3)dy = 0$
- ② solve $(x^2-3xy+2y^2)dx + (3x^2-2xy)dy = 0$
- ③ solve $(xy-2y^2)dx - (x^2-3xy)dy = 0$
- ④ solve $(y^2-xy)dx + x^2dy = 0$
- ⑤ solve $-y^2dx + (xy+x^2)dy = 0$
- ⑥ solve $(x^2+y^2+x)dx + xydy = 0$
- ⑦ solve $(x^2+y^2+1)dx - 2xydy = 0$
- ⑧ solve $(x+4y^3)dy - ydx = 0$
- ⑨ solve $(y^4+2y)dx + (xy^3+2y^4-4x)dy = 0$
- ⑩ solve $y(1-xy)dx - x(1+xy)dy = 0$
- ⑪ solve $(3y^2+4x)dx + 3xydy = 0$
- ⑫ solve $(3xy-y^2)dx + (x^2-xy)dy = 0$
- ⑬ solve $y(xy+2x^2y^2)dx + x(xy-x^2y^2)dy = 0$
- ⑭ solve $(x^4+y^4)dx - xy^3dy = 0$



- Que. C
- ① solve: $\frac{dy}{dx} + \frac{y}{x} = x^5$
 - ② solve: $\frac{dy}{dx} + \frac{y}{x} = x^3$
 - ③ solve: $\frac{dy}{dx} - \frac{y}{x} = x^4$
 - ④ solve: $\frac{dy}{dx} - \frac{y}{x} = x^7$
 - ⑤ solve: $\frac{dy}{dx} + y \cot x = \cosec x$
 - ⑥ solve: $\frac{dy}{dx} + y \tan x = \cos^2 x$
 - ⑦ solve: $\frac{dy}{dx} - \frac{y}{x+1} = e^x(x+1)$
 - ⑧ solve: $\frac{dy}{dx} + \left(\frac{2x}{1+x^2}\right)y = \frac{\cos x}{1+x^2}$
 - ⑨ solve: $\frac{dy}{dx} - \frac{y}{x} = x^2$

Que. D

- ① A body originally at 80°C cools to 60°C in 20 min
the temperature of air being 40°C , what will be the
temperature of body after 40 min from original?

- ② A body temperature originally at 100°C is placed
in a room whose temperature is 20°C & cools to
 60°C in 5 min, what will be its temperature after
10 min?

Ques. D (3) A body at temperature 100°C is placed in a room whose temperature is 20°C & cools to 60°C in 5 min. Find temperature after 115 min.

- Que. E (1) Find orthogonal trajectory for $y = mx$
- (2) Find orthogonal trajectory of the family of $xy = c$
 - (3) Find orthogonal trajectory of family $y^2 = 4ax$
 - (4) Find orthogonal trajectory of family $x^2 + y^2 = c^2$
 - (5) Find orthogonal trajectory of $x^2 + 2y^2 = 2c^2$
 - (6) Find orthogonal trajectory of $y = ax^2$.

Que. F (1) A resistance of $250\ \Omega$ & inductance of 640H are connected in a series with battery of 500V . Find the current in a circuit if $i=0$ at $t=0$.

(2) A resistance of $200\ \Omega$ & inductance of 20H are connected in a series with battery of 100V . Find the current in a circuit if $i=0$ at $t=0$.

(3) A resistance of $200\ \Omega$ & inductance of 600H are connected in series with battery of 400V . Find the current in the circuit if $i=0$ at $t=0$.

Que. G (1) A circuit consists of resistance $R\ \Omega$ & consider capacitance of ' c ' farad connected e.m.f ' E ' volts. If $\frac{q}{c}$ is the voltage of condenser at time t then at $q=0$ at $t=0$ show that $\frac{q}{c} = E(1 - e^{-t/RC})$



② A circuit consist of resistance of 50Ω & capacitance of 0.3 F connected in series with battery of 100 V . Find charge passing through circuit if $q=0$ at $t=0$.

③ A circuit consist of resistance of 25Ω & capacitance of 0.5 F connected in series with battery of 14 V . Find the charge passing through circuit if $q=0$ at $t=0$.

Que. H ① A steam pipe 40cm in diameter contains steam at 150°C & its protected with a covering of 10 cm thick for which $K = 0.0012$. If the temperature of outer surface of covering is 30°C , find the temperature at a distance of 25 cm from centre of pipe under steady-state condition.

② A pipe 20cm in diameter contain steam at 150°C & protected with covering of 5cm thick for which $K = 0.0025$. If the temperature of the outer surface of covering is 40°C . Find the temperature at a distance of 12.5cm from centre of pipe?

③ A pipe 20cm in diameter contain steam at 150°C & is protected with covering 10cm thick for which $K = 0.0012$. If the temperature of outer surface covering is 30°C . Find the temperature at a distance of 15cm from centre of pipe?

Ques.(I) ① Evaluate: $\int_0^{\pi} x \cdot \sin^7 x \cdot \cos^4 x dx$

② Evaluate: $\int_0^{\pi} x \cdot \sin^5 x \cdot \cos^2 x dx$

③ Evaluate: $\int_0^{\pi} x \cdot \sin^3 x \cdot \cos^2 x dx$

④ Evaluate: $\int_0^{\pi} x \cdot \sin^5 x \cdot \cos^4 x dx$

⑤ Evaluate: $\int_0^{\pi} x \cdot \sin^7 x \cdot \cos^2 x dx$

⑥ Evaluate: $\int_0^{\pi} x \cdot \sin^7 x \cdot \cos^6 x dx$

⑦ Evaluate: $\int_0^{\pi} x \cdot \sin^9 x \cdot \cos^2 x dx$

Ques.(II) ① Evaluate: $\int_0^{\infty} e^{-x} \cdot x^{10} dx$

② Evaluate: $\int_0^{\infty} e^{-t} \cdot t^7 dt$

③ Evaluate: $\int_0^{\infty} e^{-t} \cdot t^{3/2} dt$

④ Evaluate: $\int_0^{\infty} e^{-t} \cdot t^{5/2} dt$

⑤ Evaluate: $\int_0^{\infty} e^{-t} \cdot t^{7/2} dt$

⑥ Evaluate: $\int_0^{\infty} e^{-t} \cdot t^4 dt$



7) Evaluate: $\int_0^{\infty} e^{-\sqrt{x}} \cdot \sqrt[4]{x} dx$

8) Evaluate: $\int_0^{\infty} e^{-\sqrt{x}} \cdot \sqrt{x} dx$

9) Evaluate: $\int_0^{\infty} e^{-\sqrt{x}} \cdot \sqrt[3]{x} dx$

10) Evaluate: $\int_0^{\infty} e^{-\sqrt[3]{x}} \cdot \sqrt{x} dx$

11) Evaluate: $\int_0^{\infty} e^{-\sqrt{x}} \cdot \sqrt[4]{x^2} dx$

12) Evaluate: $\int_0^{\infty} e^{-\sqrt[3]{x}} \cdot \sqrt[4]{x^2} dx$

13) Evaluate: $\int_0^{\infty} e^{-x^4} dx$

Que.(k) ① Find the value of $B(2, 3)$

② Find the value of $B(5/2, 3)$

③ Find the value of $B(3/2, 5/2)$

④ Find the value of $B(3/2, 7/2)$

⑤ Find the value of $B(5/2, 7/2)$

⑥ Evaluate: $\int_0^1 x^3 (1 - \sqrt{x})^5 dx$

7 Evaluate: $\int_0^{\infty} x^4 (1-\sqrt{x})^6 dx$

8 Evaluate: $\int_0^1 x^5 (1-\sqrt{x})^7 dx$

Que. L 1 Show that $\int_0^1 \frac{x^\alpha - 1}{\log x} dx = \log(\alpha + 1)$

2 Show that $\int_0^{\infty} \left(\frac{1 - e^{-\alpha x}}{x} \right) e^{-x} dx = \log(\alpha + 1)$

3 Show that $\int_0^{\infty} \frac{e^{-\alpha x} \cdot \sin x}{x} dx = \frac{\pi}{2} - \tan^{-1} \alpha$

4 Show that $\int_0^{\infty} \frac{1 - \cos \alpha x}{x^2} dx = \frac{\pi \alpha}{2}$

Assume that $\int_0^{\infty} \frac{\sin x}{x} dx = \frac{\pi}{2}$

5 Show that $\int_0^{\infty} \frac{e^{-x} - e^{-\alpha x}}{x \sec x} dx = \frac{1}{2} \log \left(\frac{\alpha^2 + 1}{2} \right)$

6 Find $\frac{dI}{dx}$ if $I(x) = \int_x^{\pi/2} \frac{\sin \alpha x}{x} dx$

7 Find $\frac{dI}{dx}$ if $I(x) = \int_a^{a^2} \frac{\sin \alpha x}{x} dx$



Q.M

Evaluate.

(1) $\int_1^2 \int_3^4 dx dy$

(12) $\int_0^{2-x} \int_{x^2}^{2-x} y dx dy$

(2) $\int_1^2 \int_3^4 5 dx dy$

(13) $\int_0^{1-x} \int_0^{1-x} y dy dx$

(3) $\int_0^1 \int_0^1 (x+y) dx dy$

(14) $\int_0^2 \int_0^2 xy dx dy$

(4) $\int_0^1 \int_0^2 (x+y) dx dy$

(15) $\int_0^2 \int_0^1 (x+y)^2 dx dy$

(5) $\int_0^2 \int_0^2 (x+y) dx dy$

(6) $\int_0^1 \int_0^2 xy dx dy$

(7) $\int_0^2 \int_0^4 xy dx dy$

(8) $\int_0^2 \int_0^x xy dx dy$

(9) $\int_{-2}^1 \int_{x^2}^{2-x} y dx dy$

(10) $\int_0^1 \int_0^{1-x} x dx dy$

(11) $\int_0^1 \int_0^4 xy dx dy$



- Q.N
- ① Find area bounded by curve $y = x^2$ & $y = x$
 - ② Find area bounded by curve $y = x^2$ & $x = y^2$
 - ③ Find area bounded by curve $y^2 = 4x$ & $2x - y - 4 = 0$
 - ④ Find area bounded by curve $y^2 = 4x$ & $2x - 3y + 4 = 0$
 - ⑤ Find area bounded by curve $x^2 = 4y$ & $x - 2y + 4 = 0$
 - ⑥ Find the area bounded by $y^2 = 4x$ & $x - y - 8 = 0$

- Q.O
- ① Change order of integration

$$\textcircled{1} \int_0^5 \int_{\frac{2-x}{2}}^{2+x} f(x,y) dy dx$$

$$\textcircled{2} \int_0^{\infty} \int_0^x f(x,y) dy dx$$

$$\textcircled{3} \int_0^{200} \int_x^2 f(x,y) dy dx$$

$$\textcircled{4} \int_0^1 \int_x^1 f(x,y) dy dx$$

- Q.P
- Evaluate.

$$\textcircled{1} \int_0^a \int_0^b \int_0^c (x+y+z) dz dy dx$$

$$\textcircled{2} \int_0^1 \int_0^2 \int_0^2 x^2yz dz dy dx$$

$$\textcircled{3} \int_1^2 \int_2^3 \int_0^3 x^2y^2z dz dy dx$$



$$(4) \int_0^1 \int_0^{1-x} \int_0^{x+y} z dz dy dx$$

$$(5) \int_0^2 \int_0^3 \int_0^3 (x^2 + y^3 + z) dz dy dx$$

$$(6) \int_0^a \int_0^x \int_0^x xyz dz dy dx$$

$$(7) \int_0^2 \int_0^x \int_0^{x+y} e^{x+y+z} dx dy dz$$

$$(8) \int_0^2 \int_0^x \int_0^{2x+y} e^{x+y+z} dx dy dz$$

$$(9) \int_0^a \int_0^a \int_0^a (yz + zx + xy) dx dy dz$$

$$(10) \int_0^2 \int_0^3 \int_0^3 (x^2y + z) dz$$

Q. ① Evaluate $\iiint z(x^2 + y^2) dx dy dz$ over the volume of cylinder $x^2 + y^2 = 1$ intercepted by plane $z=2$ & $z=9$

② Evaluate $\iiint z^2 dx dy dz$ over the volume bounded by surfaces $x^2 + y^2 = a^2$, $x^2 + y^2 = z^2$ & $z=0$



$$(4) \int_{-1}^1 \int_0^{1-x} \int_{x+y}^{x+4} z dz dy dx$$

$$(5) \int_2^2 \int_3^3 \int_0^3 (x^2 + y^3 + z) dz dy dx$$

$$(6) \int_0^{2a} \int_0^x \int_{-y}^x xyz dz dy dx$$

$$(7) \int_0^2 \int_0^x \int_{x+y}^{x+4} e^{x+y+z} dx dy dz$$

$$(8) \int_0^2 \int_0^x \int_0^{2x+2y} e^{x+y+z} dx dy dz$$

$$(9) \int_0^a \int_0^a \int_0^a (yz + zx + xy) dx dy dz$$

$$(10) \int_0^2 \int_0^3 \int_0^3 (x^2 y + z) dz$$

Q. 10 (1) Evaluate $\iiint z(x^2 + y^2) dx dy dz$ over the volume of cylinder $x^2 + y^2 = 1$ intercepted by plane $z=2$ & $z=3$

(2) Evaluate $\iiint z^2 dx dy dz$ over the volume bounded by surfaces $x^2 + y^2 = a^2$, $x^2 + y^2 = z$ & $z=0$



Q. [R]

- ① Find volume of cylinder $x^2 + y^2 = 2ax$
intercepted between the paraboloid $x^2 + y^2 = az$
 $\& z=0$

- ② Find volume of cylinder $x^2 + y^2 = 2ay$
bounded by paraboloid $x^2 + y^2 = az$ & plane
 $z=0$.

- ③ Prove that volume bounded by cylinders
 $y^2 = x$ & $x^2 = y$ & plane $z=0$ i.e., $x+y+z=2$
is $\frac{11}{30}$.

Q. [S]

- ① Find equation of sphere passing through
 $(0,0,0), (0,-1,1), (-1,2,0), (1,2,3)$

- ② Find equation of sphere passing through
 $(1,2,3), (0,-2,4), (4,-4,2), (3,1,4)$

- ③ Find equation of sphere passing through
 $(1,0,-1), (2,1,0), (1,1,-1), (1,1,1)$

- ④ Find equation of sphere which has its centre
at $C(2,3,-1)$ & touches the line $\frac{x+1}{-5} = \frac{y-8}{3} = \frac{z-4}{4}$

- ⑤ Find the equation of right circular cylinder
of radius 2, whose axis passes through the
origin & makes equal angle with co-ordinate

$$\frac{x-0}{1} = \frac{y-0}{1} = \frac{z-0}{1}$$



⑥ Find equation of right circular cylinder whose axis is $\frac{x-2}{2} = \frac{y-1}{1} = \frac{z}{3}$ & which passes through (2, 1, 0) & radius is 3.

⑦ Find equation of right circular cylinder of radius 2, whose axis passes through (1, 2, 3) & has dr's (2, -3, 6)