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Program: _First Year (All Branches) Engineering- SEM-II

Curriculum Scheme: Rev 2019

Engineering Mathematics-II

Question Bank

MCQ

1.	The value of $\beta\left(\frac{5}{2}, \frac{3}{2}\right)$ is equal to
Option A:	$\sqrt{\pi}$
Option B:	$\sqrt{2\pi}$
Option C:	π
Option D:	$\pi/16$
2.	Length of the curve $y = \log \cos x$ from $x = 0$ to $x = \frac{\pi}{3}$ is
Option A:	$\log(1 + \sqrt{2})$
Option B:	$\log(2 + \sqrt{3})$
Option C:	$\log 2$
Option D:	$\log 5$
3.	Integrating factor of $(12y + 4y^3 + 6x^2)dx + 3(x + xy^2)dy = 0$ is
Option A:	x^3
Option B:	x^2
Option C:	$\log x$
Option D:	e^x
4.	The solution of differential equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$ is
Option A:	$(c_1 + c_2x)c_3xe^{-x}$
Option B:	$(c_1 + c_2x)e^{-2x}$
Option C:	$(c_1 + c_2x)e^{2x}$
Option D:	$(c_1 + c_2x)c_3xe^x$
5.	Particular Integral (P.I.) of differential equation $(D^3 - 3D^2)y = e^{4x}$ is
Option A:	$P.I. = \frac{1}{16}e^{-4x}$
Option B:	$P.I. = \frac{1}{64}e^{-4x}$
Option C:	$P.I. = \frac{1}{16}e^{4x}$
Option D:	$P.I. = \frac{1}{64}e^{4x}$

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6.	Value of the integral $\int_0^{\infty} \int_0^{\infty} \int_0^{\infty} e^{-(x+y+z)} dx dy dz$ is
Option A:	∞
Option B:	0
Option C:	1
Option D:	- 1
7.	Solution of the triple integral $\int_0^{\pi/2} \int_0^{\pi/2} \int_0^1 r^4 \sin\theta dr d\theta d\phi$ is
Option A:	$\pi/10$
Option B:	$\pi/6$
Option C:	1
Option D:	π
8.	Integral $\int_0^{\infty} \int_0^{\infty} \frac{dx dy}{(1+x^2)(1+y^2)}$ is equal to
Option A:	$\frac{\pi}{8}$
Option B:	$\frac{\pi}{2}$
Option C:	$\frac{\pi^2}{4}$
Option D:	$\frac{\pi^2}{8}$
9.	The value of $\int_0^1 \int_0^{\pi/2} r \sin\theta dr d\theta$ is
Option A:	$1/2$
Option B:	$\pi/2$
Option C:	$1/8$
Option D:	$\pi/8$
10.	Changing to polar co-ordinates the integral $\int_0^a \int_0^{\sqrt{a^2-x^2}} y^2 \sqrt{x^2 + y^2} dy dx$ will be
Option A:	$\int_0^{\pi/2} \int_0^a \sin^2 \theta r^4 dr d\theta$
Option B:	$\int_0^{\pi/2} \int_0^a \sin^4 \theta r^3 dr d\theta$
Option C:	$\int_0^{2\pi} \int_0^{a/2} \sin^2 \theta r^4 dr d\theta$
Option D:	$\int_0^a \int_0^a \sin^2 \theta r^4 dr d\theta$

11.	The Integrating Factor of DE $(x^2 e^x - my)dx + mx dy = 0$ is given by
Option A:	$\frac{1}{y^2}$
Option B:	$\frac{1}{x^2}$
Option C:	$-\frac{1}{y^2}$
Option D:	$-\frac{1}{x^2}$
12.	The DE $\frac{dr}{d\theta} = r \tan \tan \theta - \frac{r^2}{\cos \cos \theta}$ can be reduced to linear equation given by
Option A:	$\frac{dv}{d\theta} + \tan \tan \theta v = \sec \sec \theta$
Option B:	$\frac{dv}{d\theta} + \sec \sec \theta v = -\tan \tan \theta$
Option C:	$\frac{dv}{d\theta} + \tan \tan \theta v = \theta$
Option D:	$\frac{dv}{d\theta} + \sec \sec \theta v = \tan \tan \theta$
13.	The solution of $(D^3 - 2D + 4)y = 0$, where $D \equiv \frac{d}{dx}$ is given by
Option A:	$y = c_1 e^{-2x} + c_2 \cos \cos x + c_3 \sin \sin x$
-Option B:	$y = c_1 x e^{-2x} + c_2 \cos \cos x + c_3 \sin \sin x$
Option C:	$y = c_1 + c_2 \cos \cos x + c_3 \sin \sin x$
Option D:	$y = c_1 e^{-2x} + e^x(c_2 \cos \cos x + c_3 \sin \sin x)$
14.	The Particular Integral (P I) of the equation $(D^2 - 1)y = x e^x$ where $D \equiv \frac{d}{dx}$ is given by
Option A:	$PI = \frac{e^x}{4}(x^2 - x)$
Option B:	$PI = \frac{e^x}{4}(2x - 1)$
Option C:	$PI = \frac{e^x}{4}(x^2 + x)$
Option D:	$PI = \frac{e^x}{4}(2x + 1)$
15.	The Value of $\int_0^{\infty} e^{-x^4} dx$ is given by
Option A:	$\Gamma\left(\frac{1}{4}\right)$
Option B:	$\frac{1}{4} \Gamma\left(\frac{3}{4}\right)$

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Option C:	$\frac{1}{4} \Gamma\left(\frac{1}{4}\right)$
Option D:	$\Gamma\left(\frac{3}{4}\right)$
16.	The length of the straight line $y = 2x + 5$ from $x = 1$ to $x = 3$ is given by
Option A:	$\sqrt{5}$ units
Option B:	$3\sqrt{5}$ units
Option C:	$4\sqrt{5}$ units
Option D:	$2\sqrt{5}$ units
17.	After changing the integral $I = \int_0^1 \int_0^{\sqrt{1-x^2}} x^2 y^2 dy dx$ into polar form, the integral can be given by
Option A:	$I = \int_0^{\frac{\pi}{2}} \int_0^1 r^4 \cos^2 \theta \sin^2 \theta dr d\theta$
Option B:	$I = \int_0^{\frac{\pi}{2}} \int_0^1 r^5 \cos^2 \theta \sin^2 \theta dr d\theta$
Option C:	$I = \int_0^{\pi} \int_0^1 r^4 \cos^2 \theta \sin^2 \theta dr d\theta$
Option D:	$I = \int_0^{\pi} \int_0^1 r^5 \cos^2 \theta \sin^2 \theta dr d\theta$
18.	The value of $I = \int_0^1 \int_0^1 \int_0^1 x y z dx dy dz$ is given by
Option A:	$-\frac{1}{8}$
Option B:	$\frac{1}{4}$
Option C:	$-\frac{1}{4}$
Option D:	$\frac{1}{8}$
19.	The value of $I = \int_0^1 (1 - \sqrt[5]{x}) dx$ will be given by
Option A:	$-\frac{1}{6}$
Option B:	$\frac{1}{6}$

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Option C:	$\frac{1}{30}$
Option D:	$-\frac{1}{30}$
20.	The value of $I = \int_0^{\pi} \int_{r=0}^{a \sin \theta} dr d\theta$ is given by
Option A:	a
Option B:	$-a$
Option C:	$2a$
Option D:	$-2a$
21.	$\int_0^1 \frac{1}{\sqrt{-\log x}} dx$ is
Option A:	π
Option B:	$\sqrt{\pi}/2$
Option C:	$\sqrt{\pi}$
Option D:	$2\sqrt{\pi}$
22.	Find the complementary function of $\frac{d^4 y}{dx^4} + 6\frac{d^2 y}{dx^2} + 9y = e^{2x}$
Option A:	$(c_1 + c_2 x)\cos\sqrt{3}x + (c_3 + c_4 x)\sin\sqrt{3}x$
Option B:	$c_1 \cos\sqrt{3}x + c_2 \sin\sqrt{3}x$
Option C:	$c_1 e^{\sqrt{3}x} + c_2 e^{-\sqrt{3}x}$
Option D:	$(c_1 + c_2 x)e^{\sqrt{3}x}$
23.	The value of $\int_0^1 \int_0^2 \int_0^2 x^3 yz dx dy dz$ is
Option A:	1
Option B:	1/3
Option C:	2
Option D:	2/3
24.	The Order of the Differential Equation $\left(\frac{d^2 y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + y^4 = e^{-x}$ is
Option A:	1
Option B:	2
Option C:	3
Option D:	4
25.	The value of $\int_0^{\pi/2} \int_0^{a \cos \theta} r \sin \theta dr d\theta$ is equal to
Option A:	$a^2/9$

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Option B:	$a^2/12$
Option C:	$a^2/6$
Option D:	$a^2/3$
26.	The value of $\Gamma\left(\frac{1}{4}\right)\Gamma\left(-\frac{1}{4}\right)$
Option A:	$4\sqrt{2}\pi$
Option B:	$-4\sqrt{2}\pi$
Option C:	$\sqrt{2}\pi$
Option D:	$-\sqrt{2}\pi$
27.	Integrating factor of $(x^2 + y^2 + 1)dx - 2xy dy = 0$ is
Option A:	$\frac{-1}{x^2}$
Option B:	$\frac{1}{x^2}$
Option C:	x^2
Option D:	$-x^2$
29.	Particular Integral of DE $(D^3 + 3D^2 - 4)y = e^x$ is
Option A:	$xe^x/9$
Option B:	$xe^x/2$
Option C:	$-xe^x/9$
Option D:	$xe^x/6$
30.	The value of $\int_0^\pi \frac{\sin^4 \theta}{(1+\cos\theta)^2} d\theta$
Option A:	6π
Option B:	$3\pi/4$
Option C:	$\pi/2$
Option D:	$3\pi/2$
31.	The area bounded by the line $y = x$ and $y = 4x - x^2$
Option A:	$7/2$
Option B:	$9/2$
Option C:	$9/4$
Option D:	11
32.	The solution of DE $(D^3 - D)y = \cos x$ is
Option A:	$(c_1 + c_2x + c_3x^2)e^x + (-\frac{1}{2})\sin x$
Option B:	$(c_1 + c_2e^x + c_2e^{-x} + (-\frac{1}{2})\cos x$
Option C:	$(c_1 + c_2e^x + c_2e^{-x} + (-\frac{1}{2})\sin x$
Option D:	$(c_1 + c_2x + c_3x^2)e^x + (-\frac{1}{2})\cos x$

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34.	The value of $\iint dx dy$ over the area bounded by $x^2 = y$ and $y^2 = -x$
Option A:	-1/6
Option B:	-1/12
Option C:	1/18
Option D:	1/9
35.	The value of integral $\iiint \frac{dx dy dz}{x^2+y^2+z^2}$ over the positive octant of the sphere $x^2 + y^2 + z^2 = 4$ is
Option A:	π
Option B:	2π
Option C:	$4\pi/3$
Option D:	$2\pi/3$
36.	The length of the cardioid $r = 2(1 + \cos\theta)$ is
Option A:	16
Option B:	12
Option C:	8
Option D:	6
37.	The value of $\int_0^{2\sqrt{4-x^2}} \int_0^x xy dx dy$ is equal to
Option A:	4
Option B:	6
Option C:	2
Option D:	3
38.	The Solution of $\frac{dy}{dx} = \frac{y+1}{(y+2)e^y-x}$ is
Option A:	$x.e^y - y - 1 = c$
Option B:	$(y+1)(x - e^y) = c$
Option C:	$ye^y + x - 1 = c$
Option D:	$xy - e^y + 1 = c$
39.	Changing the order of integration in double integral $\int_0^{2-\sqrt{4-y^2}} \int_0^y f(x,y) dx dy$ leads to $\int_a^b \int_c^d f(x,y) dx dy$ then value of 'c' is
Option A:	$\sqrt{4-x^2}$
Option B:	$\sqrt{-4x+x^2}$
Option C:	$\sqrt{4x-x^2}$
Option D:	$-\sqrt{4x-x^2}$
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	Solution of the differential equations $3x^2y^4dx + 4x^3y^3dy = 0$ is
Option A:	$x^2y^4 = c$
Option B:	$x^3y^3 = c$
Option C:	$x^4y^3 = c$
Option D:	$x^3y^4 = c$
42.	The complementary function for $(D^2 + 2D + 5)y = 4e^{-x}\tan 2x + 5$, where $D = \frac{d}{dx}$ is given by
Option A:	$k_1e^{-x}\sin 2x + k_2e^{-x}\cos 2x$
Option B:	$k_1e^x\sin 2x + k_2e^x\cos 2x$
Option C:	$k_1e^{-x}\sin 2x - k_2e^{-x}\cos 2x$
Option D:	$k_1e^x\sin 2x + k_2e^{-x}\cos 2x$
43.	If $B(n, 2) = \frac{1}{6}$, n is positive integer then value of n is
Option A:	3
Option B:	2
Option C:	1
Option D:	4
44.	The value of $I = \int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2) dy dx$ is
Option A:	$\frac{3}{35}$
Option B:	$\frac{3}{15}$
Option C:	$\frac{1}{35}$
Option D:	$\frac{3}{5}$
45.	The region of integration in $\int_0^1 \int_0^{1-y} \int_0^{1-x-y} xyz dz dx dy$ represents
Option A:	Tetrahedron

Option B:	Cylinder
Option C:	Plane
Option D:	Sphere
47.	If the differential equations $ydx + x(1-3x^2y^2) dy = 0$ is non-exact then the integrating factor is
Option A:	$\frac{1}{3x^3 y^2}$
Option B:	$\frac{1}{3x^3 y^3}$
Option C:	$-\frac{1}{3x^3 y^3}$
Option D:	$\frac{1}{3x^2 y^3}$
48.	The value of the particular integral $\frac{1}{(D^3-1)} (e^x + 1)^2$ is
Option A:	$\frac{e^{2x}}{7} - \frac{2e^x}{3} + 1$
Option B:	$\frac{e^{2x}}{7} + \frac{2e^x}{3} - 1$
Option C:	$\frac{e^{2x}}{7} - \frac{2xe^x}{3} + 1$
Option D:	$\frac{e^{2x}}{7} + \frac{2xe^x}{3} - 1$
49.	Value of $\Gamma\left(-\frac{8}{5}\right)$ is given by
Option A:	$\frac{25}{24}\Gamma\left(\frac{2}{5}\right)$
Option B:	$\frac{24}{25}\Gamma\left(\frac{1}{5}\right)$

Option C:	$\frac{25}{64}\Gamma\left(\frac{3}{5}\right)$
Option D:	$\frac{5}{8}\Gamma\left(\frac{13}{5}\right)$
50.	<p>On changing the order of integration for $I = \int_0^1 \int_0^{\sqrt{1-x^2}} f(x,y)dy dx$,</p> <p>$I = \int_0^1 \int_a^1 f(x,y)dy dx$ where a=</p>
Option A:	$1 + \sqrt{1 - y^2}$
Option B:	$\sqrt{2y - y^2}$
Option C:	$\sqrt{1 - y^2}$
Option D:	$\sqrt{y^2 - y}$
51.	<p>Evaluate: $\int_2^6 \int_{x^2-6x+3}^{2x-9} dydx$</p>
Option A:	$\frac{34}{3}$
Option B:	$\frac{25}{3}$
Option C:	$\frac{32}{3}$
Option D:	$\frac{2}{3}$
53.	<p>The degree and order of the differential equation $\frac{d^4y}{dx^4} - 3x$ $\left(\frac{d^3y}{dx^3}\right)^2 + \frac{dy}{dx} - 2y = 0$ are respectively</p>
Option A:	4,1
Option B:	4,2
Option C:	2,4
Option D:	1,4
54.	<p>The value of the particular integral $\frac{1}{(D^2+1)} (2^x + \sin x \sin 2x)$ is</p>

Option A:	$\frac{4x\sin x - \cos 3x}{16} + \frac{2^x}{2\log 2 + 1}$
Option B:	$\frac{4x\sin x - \cos 3x}{16} + \frac{2^x}{\log 2 + 1}$
Option C:	$\frac{4x\sin x - \cos 3x}{16} + \frac{2^x}{(\log 2)^2 + 1}$
Option D:	$\frac{4x\sin x + \cos 3x}{16} + \frac{2^x}{2\log 2 + 1}$
55.	Evaluate: $\int_0^1 \sqrt{1 - \sqrt{1 - \sqrt{x}}} dx$
Option A:	$\frac{308}{215}$
Option B:	$\frac{208}{315}$
Option C:	$\frac{215}{308}$
Option D:	$\frac{218}{305}$
56.	Changing to polar co-ordinates $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$ the value of integral is
Option A:	$\frac{\pi}{4}$
Option B:	$\frac{\pi}{2}$
Option C:	$\frac{1}{4}$
Option D:	π
57.	Evaluate: $\iiint xyz dx dy dz$ throughout the volume bounded by $x=0, y=0, z=0, x+y+z=1$
Option A:	$\frac{1}{5040}$

Option B:	$\frac{1}{720}$
Option C:	$\frac{1}{60}$
Option D:	$\frac{1}{144}$
59.	The particular integral $\frac{1}{D^6-64} \sin 2x =$
Option A:	$\frac{x \cos 2x}{16}$
Option B:	$\frac{\sin 2x}{128}$
Option C:	$\frac{-x \sin 2x}{128}$
Option D:	$\frac{-\sin 2x}{128}$
60.	Evaluate: $\int_0^{\log 2} \int_0^{x-y} \int_0^x e^{x+y+z} dz dy dx$
Option A:	$2 \log 2 - \frac{5}{4}$
Option B:	$2 \log 2 + \frac{5}{8}$
Option C:	$\log 2 - \frac{5}{4}$
Option D:	$2 \log 2 - \frac{1}{4}$

Descriptive Questions

1.	Using Beta function, Prove that $\int_0^{\infty} \frac{1}{1+x^2} dx = \frac{\pi}{2}$
2.	Change the order of integration in the integral $I = \int_{-a}^a \int_0^{\sqrt{a^2-y^2}} f(x,y) dx dy$
3.	Using the method of variation of parameters, solve $\frac{d^2 y}{dx^2} + 4y = \tan 2x.$
4.	Solve $(D - 2)^2 = 8(e^{2x} + \sin 2x + x^2).$

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5.	Solve the Differential Equation $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$.
6.	Evaluate the integral $\int_0^2 \int_0^z \int_0^{yz} xyz \, dx \, dy \, dz$.
7.	Evaluate the integral $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{1}{\sqrt{1-x^2-y^2-z^2}} \, dx \, dy \, dz$.
8.	Solve the Differential Equation $(x^2 e^x - my)dx + mx \, dy = 0$
9.	Change to polar coordinates and Evaluate $\int_0^a \int_y^a \frac{x \, dx \, dy}{(x^2 + y^2)}$.
10.	Assuming the validity of differentiation under the integral sign, Prove that $\int_0^1 \frac{x^a - x^b}{\log x} \, dx = \log \frac{a+1}{b+1}$
11.	Solve the Differential Equation $(D^3 + D)y = \cos x$.
12.	Solve the Differential Equation $x \frac{dy}{dx} + 2y = y^2 x^3$.
13.	Prove that $\int_0^1 \frac{x^2 \, dx}{\sqrt{1-x^4}} \cdot \int_0^1 \frac{dx}{\sqrt{1+x^4}} = \frac{\pi}{4\sqrt{2}}$.
14.	Solve the Differential Equation $(1 + xy)ydx + (1 - xy)x dy = 0$
15.	Evaluate $\iint xy \, dx \, dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$.
16.	Find the entire length of cardioid $r = a(1 + \cos\theta)$
17.	Solve $\frac{d^4 x}{dt^4} + 4x = 0$.
18.	Show that the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\frac{16}{3}a^2$.
19.	Solve the DE $(2xy \cos \cos x^2 - 2xy + 1) \, dx + (\sin \sin x^2 - x^2) \, dy = 0$
20.	Using Method of variation of parameters solve $\frac{d^2 y}{dx^2} + y = \tan \tan x$
21.	Change the order of integration $I = \int_0^a \int_{-a+\sqrt{a^2-y^2}}^{a+\sqrt{a^2-y^2}} f(x, y) \, dx \, dy$
22.	Prove that $\int_0^\infty \frac{e^{-\beta x} \sin \alpha x}{x} \, dx = \left(\frac{\alpha}{\beta}\right)$

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23.	Prove that $\iiint (x + y + z) dx dy dz = \frac{1}{8}$, over the tetrahedron bounded by $x = 0, y = 0, z = 0$ and $x + y + z = 1$.
24.	Prove that $\int_0^{\frac{\pi}{2}} \sqrt{\tan \tan \theta} d\theta \cdot \int_0^{\frac{\pi}{2}} \sqrt{\cot \cot \theta} d\theta = \frac{\pi^2}{2}$
25.	Solve the DE $(D^2 - 4D + 4)y = 8(e^{2x} + \sin \sin 2x)$, where $D \equiv \frac{d}{dx}$
26.	Prove that $\int_0^{\infty} \frac{dx}{1+x^4} = \frac{\pi}{2\sqrt{2}}$.
27.	Solve the DE $\sin \sin 2x \frac{dy}{dx} = y + \tan \tan x$
28.	Evaluate the integral $I = \iint xy(x + y) dx dy$ over the region bounded by the curves $y = x^2$ & $y = x$.
29.	Show that the length of the cardioid $r = a(1 - \cos \cos \theta)$ lies outside the circle $r = a \cos \cos \theta$ is $4a\sqrt{3}$.
30.	Evaluate the integral $\iiint \frac{dx dy dz}{x^2 + y^2 + z^2}$ over throughout the volume of the sphere $x^2 + y^2 + z^2 = a^2$.
31.	Solve the DE $(xy - 2y^2) dx - (x^2 - 3xy) dy = 0$
32.	Solve the DE $(D^2 - 2D + 1)y = x^2$, where $D \equiv \frac{d}{dx}$
33.	Express into polar form and evaluate the integral $I = \int_0^a \int_0^{\sqrt{a^2 - x^2}} e^{-(x^2 + y^2)} dx dy$
34.	Evaluate the integral $\iiint \sqrt{x^2 + y^2} dx dy dz$ over the region bounded by $x^2 + y^2 = z^2, z > 0$ and $z = 0, z = 1$.
35.	Prove that $\int_0^{\infty} x e^{-x^8} dx \cdot \int_0^{\infty} x^2 e^{-x^4} dx = \frac{\pi}{16\sqrt{2}}$
36.	Show that the length of the parabola $x^2 = 4y$ which lies inside the circle $x^2 + y^2 = 6y$ is $2[\sqrt{6} + \log \log (\sqrt{2} + \sqrt{3})]$.
37.	<i>Solve the following Differential equation</i> $y \frac{dy}{dx} + \frac{4x}{3} - \frac{y^2}{3x} = 0$
38.	Find total length of $r^2 = 16 \cos 2\theta$

39.	Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ by Variation of parameters
40.	Change the order of integration for the integral $\int_0^8 \int_{(y-8)/4}^{y/4} f(x, y)$
41.	Evaluate $\iiint dx dy dz$ over the solid of the paraboloid $x^2 + y^2 = 4z$ cut off by the plane $z = 4$
42.	Solve $xy - \frac{dy}{dx} = y^3 e^{-x^2}$
43.	Evaluate $\int_0^{\infty} \frac{\log(1+ax^2)}{x^2} dx$
44.	Solve $(D^2 - 4D + 1)y = e^{2x} \sin 5x$
45.	Change it to polar and Evaluate $\int_0^{2a} \int_0^{\sqrt{2ax-x^2}} (x^2 + y^2) dy dx$
46.	Evaluate $\iint x dx dy$ throughout the area bounded by $y = x^2$ and $y = 4 - x$
47.	Solve: $\frac{dy}{dx} = \frac{y^3}{e^{2x} + y^2}$
48.	Solve: $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$, using method of variation of parameters

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49.	Find the length of the cardioid $r = a(1 - \cos\theta)$ lying outside the circle $r = a\cos\theta$.
50.	Change the order of integration and evaluate $\int_0^5 \int_{3-x}^{3+x} dx dy$
51.	Evaluate: $\iiint \frac{dx dy dz}{x^2 + y^2 + z^2}$ throughout the volume of the sphere $x^2 + y^2 + z^2 = a^2$
52.	Solve: $\frac{dx}{dy} + y^3 \sin^2 x + y \sin 2x = y^3$
53.	Solve: $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 4y = \frac{e^{-2x}}{x^5}$
54.	Prove that $\int_0^{\infty} \frac{1 - \cos ax}{x} e^{-x} dx = \frac{1}{2} \log(1 + a^2)$, assuming the validity of differentiation under the integral sign.
55.	Evaluate: $\iint_R \frac{dx dy}{\sqrt{(1+x^2+y^2)^2}}$ over one loop of the lemniscate $(x^2 + y^2)^2 = x^2 - y^2$
56.	Change to polar co-ordinates and evaluate $\int_0^1 \int_0^x x + y dy dx$