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1.	If $\emptyset$ be the angle between the tangent and radius vector at any point on the curve, $r = f(\theta)$ then $\cot\emptyset$ is equals to:			
	A)	$r\frac{dr}{d\theta}$	B)	$\frac{1}{r}\frac{dr}{d\theta}$
	C)	$r\frac{d\theta}{dr}$	D)	$\frac{1}{r}\frac{d\theta}{dr}$
2.	The radius of curvature of the curve $y = e^x$ at the point $(0, 1)$ is:			
	A)	$2\sqrt{2}$	B)	$\sqrt{2}$
	C)	2	D)	$\frac{\sqrt{2}}{2}$
3.	The derivative of arc $\frac{ds}{dy}$ for the curve $x = f(y)$ is:			
	A)	$\sqrt{1+\left(\frac{dy}{dx}\right)^2}$	B)	$1+\left(\frac{dy}{dx}\right)^2$
	C)	$1+\left(\frac{dx}{dy}\right)^2$	D)	$\sqrt{1+\left(\frac{dx}{dy}\right)^2}$
4.	Curvature of a straight line is:			
	A)	∞	B)	0
	C)	1	D)	2
5.	For a given polar curve $r = a\,sin\theta$ let φ be the angle between radius vector and tangent to the curve, then $\varphi =$			
	A)	$\frac{\theta}{2}$	B)	θ
	C)	0	D)	$\frac{\pi}{2}$
6.	For the curve $\frac{r}{a} = e^{\theta}$, derivative of arc $\frac{ds}{d\theta} =$			
	A)	$2r$	B)	$\sqrt{2}\ r$
	C)	r^2	D)	$\frac{r}{2}$
7.	The curvature of the curve $f(x) = x^3 - x + 1$ at $x = 1$ is			
	A)	$\frac{6}{5}$	B)	$\frac{3}{5}$
	C)	$\frac{6}{5^{3/2}}$	D)	$\frac{3}{5^{3/2}}$
8.	The function $f(x) = x^2$ satisfy Rolle's theorem in which of the following interval?			
	A)	[1, 2]	B)	[0, 1]
	C)	[-1, 1]	D)	[-1, 0]
9.	If $r = a\theta$ and ϕ denote the angle between the radius vector and tangent, then $\tan\phi =$			
	A)	$\frac{1}{\theta}$	B)	θ
	C)	r	D)	$\frac{a}{\theta}$
10.	The radius of curvature of the curve $x = at^2, y = 2at$ at the point $t = 0$ is			
	A)	$2a$	B)	a
	C)	2	D)	$\frac{a}{2}$

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11.	The function $f(x) = x^2$ satisfy the Rolle's theorem in which of the following intervals:			
	A)	$[1, 2]$	B)	$[0, 1]$
	C)	$[-1, 1]$	D)	$[-2, 1]$
12.	The derivative of arc, $\frac{ds}{d\theta}$, for the curve $r = f(\theta)$ is :			
	A)	$\sqrt{r^2 + \left(\frac{d\theta}{dr}\right)^2}$	B)	$\sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}$
	C)	$\sqrt{1 + r^2\left(\frac{d\theta}{dr}\right)^2}$	D)	$\sqrt{1 + r^2\left(\frac{dr}{d\theta}\right)^2}$
13.	The derivative of arc S for the curve $y = g(x)$ is $\frac{dS}{dy} =$ _____			
	A)	$\sqrt{1+\left(\frac{dy}{dx}\right)^2}$	B)	$\sqrt{1+\frac{d^2y}{dx^2}}$
	C)	$\sqrt{1+\frac{dx}{dy}}$	D)	$\sqrt{1+\left(\frac{dy}{dx}\right)^2}$
14.	Curvature of a straight line is :			
	A)	∞	B)	0
	C)	1	D)	none of these
15.	The radius of curvature of the curve y= $x^3$when $x = 1$ is :			
	A)	$\frac{(10)^{\frac{3}{2}}}{6}$	B)	$\frac{(5)^{\frac{3}{2}}}{6}$
	C)	2	D)	$\frac{1}{2}$
16.	The radius of curvature for the curve $y = f(x)$ is $\rho =$			
	A)	$\frac{(1+y_2{}^2)^{\frac{3}{2}}}{y_1}$	B)	$\frac{(1+y_1{}^2)^{\frac{3}{2}}}{y_2}$
	C)	$\frac{(1+y_1{}^2)^{\frac{2}{3}}}{y_2}$	D)	$\frac{(1-y_1{}^2)^{\frac{3}{2}}}{y_2}$
17.	If $u = y^x$ then $\frac{\partial u}{\partial y} =$			
	A)	y^x	B)	$y^x logy$
	C)	$y^x logx$	D)	xy^{x-1}
18.	If $f(x, y, z) = e^{xyz}$ then $f_x(2, 2, 2) =$			
	A)	$4e^8$	B)	$2e^8$
	C)	$8e^2$	D)	4
19.	Given $u = x + y$, $v = xy$ then $\frac{\partial(u,v)}{\partial(x,y)=}$			
	A)	$x + y$	B)	0
	C)	$x - y$	D)	1
20.	If $f(x, y) = x + y$, where $x = sint$, $y = cost$ then $\frac{df}{dt}$ at $t = \frac{\pi}{2}$ is			
	A)	-1	B)	-2
	C)	2	D)	0

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21.	Slope of the curve $y^2 + 2x^2 = 6$ at $(1,1)$ is:			
	A)	2	B)	4
	C)	3	D)	-2
22.	If $f(x)$ is a differentiable function and $f(1) = f(4)$ then			
	A)	$f'(c) = 0$ for some $c \in (1,4)$	B)	$f'(c) = 0$ for some $c \in (1,2)$
	C)	$f'(c) = 0$ for some $c \in (3,4)$	D)	$f'(c) = 0$ for some $c \in (2,4)$
23.	If $f(x,y,z) = x^2 + xyz + z$, then the value of f_x at (1,1,1)			
	A)	0	B)	1
	C)	-1	D)	3
24.	If $u = x - y$ and $v = x + y$, then the Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$ is:			
	A)	2	B)	3
	C)	-2	D)	4
25.	Given $u = x + y$, $v = xy$ then the Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$ is :			
	A)	$x + y$	B)	0
	C)	$x - y$	D)	1
26.	If $z = 6x^2y^2 + 8x^2$ then $\frac{\partial z}{\partial x}$ is :			
	A)	$6y^2 + 16x$	B)	$6x^2 + 8x^2$
	C)	$12xy^2 + 16x$	D)	$6x^2 + 6y^2 + 8x^2$
27.	If $f(x)$ is a function such that $f_{xx} = 6xy^3$ then $f_{xyx} =$			
	A)	$3xy^2$	B)	$3x^2y^3$
	C)	$6y^3$	D)	$18xy^2$
28.	If $f(x,y) = 2x^3 - 4y^2$, what is the value of f_x and f_y at (3,2)			
	A)	$f_x = 54,\ f_y = -16$	B)	$f_x = 16,\ f_y = -54$
	C)	$f_x = 54,\ f_y = 0$	D)	$f_x = -54\ f_y = -16$
29.	If $f(x,y,z) = x^2 + xyz + z$, then the value of f_x at (1,1,1)			
	A)	3	B)	2
	C)	0	D)	1
30.	If $z = 3x^2y + 5y$ then $\frac{\partial^2 z}{\partial x \partial y}$ is :			
	A)	6x	B)	3xy
	C)	5x	D)	5xy
31.	If $u = y^x$ then $\frac{\partial u}{\partial x}$ is			
	A)	y^x	B)	$y^x logy$
	C)	$y^x logx$	D)	xy^{x-1}
32.	If $x = rcos\theta$, $y = rsin\theta$ then the value of $\frac{\partial(x,y)}{\partial(r,\theta)}$ is_____			
	A)	r	B)	1
	C)	0	D)	2
33.	$\vec{F}$ is said to be solenoidal if			
	A)	$\nabla \times \vec{F} = \vec{0}$	B)	$\nabla . \vec{F} = 0$
	C)	$\nabla . (\nabla . \overrightarrow{F}) = 0$	D)	$\nabla \times (\nabla . \overrightarrow{F}) = 0$
34.	If $f(x,y) = xy + x^2$ then Hessian of f is			

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	A)	$\begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix}$	B)	$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$
	C)	$\begin{bmatrix} 2 & 0 \\ 0 & 0 \end{bmatrix}$	D)	$\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$
35.	If $\vec{r} = x\,\hat{\imath} + y\hat{\jmath} + z\hat{k}$ then $curl(\vec{r})$=			
	A)	1	B)	$\vec{r} = \hat{\imath} + \hat{\jmath} + \hat{k}$
	C)	3	D)	$\vec{0}$
36.	The gradient of $\varphi = xyz$ is			
	A)	0	B)	1
	C)	$yz\,\hat{\imath} + xz\hat{\jmath} + xy\hat{k}$	D)	$xz\,\hat{\imath} + yz\hat{\jmath} + xy\hat{k}$
37.	If $f(x,y) = 2xy + 7x^2$ then Hessian of f is			
	A)	$\begin{bmatrix} 1 & 2 \\ 2 & 0 \end{bmatrix}$	B)	$\begin{bmatrix} 14 & 2 \\ 2 & 0 \end{bmatrix}$
	C)	$\begin{bmatrix} 7 & 1 \\ 1 & 0 \end{bmatrix}$	D)	$\begin{bmatrix} 2 & 1 \\ 7 & 0 \end{bmatrix}$
38.	If $\varphi = x^2 + y^2 + z^2$ then $\nabla\varphi$ at (1,1,1) is			
	A)	$\hat{\imath} + 3\hat{\jmath} + 5\hat{k}$	B)	$\hat{\imath} + \hat{\jmath} + \hat{k}$
	C)	$2\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$	D)	$\hat{\imath} + 2\hat{\jmath} + \hat{k}$
39.	A vector field with curl zero is called			
	A)	an irrotational vector field	B)	solenoidal vector field
	C)	scalar field	D)	Convergent field
40.	If $\vec{F} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, the divergence of $\vec{F}$ is:			
	A)	0	B)	1
	C)	3	D)	2
41.	If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ then $div\left(\vec{r}\right)$ is :			
	A)	1	B)	3
	C)	$\hat{\imath} + \hat{\jmath} + \hat{k}$	D)	0
42.	If $f(x,y) = 5xy + 2x^2$ then Hessian of f is			
	A)	$\begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix}$	B)	$\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$
	C)	$\begin{bmatrix} 4 & 5 \\ 5 & 0 \end{bmatrix}$	D)	$\begin{bmatrix} 4 & 1 \\ 1 & 0 \end{bmatrix}$

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43.	If $\vec{F} = ax\hat{i} - by\hat{j}$ is solenoidal then which of the following is true?			
	A)	$\boldsymbol{a = b}$	B)	$\boldsymbol{a^2 - b^2 = 0}$
	C)	$\boldsymbol{a + b = 0}$	D)	$\boldsymbol{a^2 + b^2 = 0}$
44.	If $\vec{\boldsymbol{F}} = \boldsymbol{6\hat{i} + \hat{j} + by\hat{k}}$ is an irrotational vector, then			
	A)	$\boldsymbol{b = 2}$	B)	$\boldsymbol{b = -1}$
	C)	$\boldsymbol{b = 0}$	D)	$\boldsymbol{b = 1}$
45.	If $\phi = x^3 + y^3 - 2z$,then $\nabla\phi$ at (1,-1.1) is _____			
	A)	$\hat{i} + \hat{j} + 2\hat{k}$	B)	$3\hat{i} + 3\hat{j} - 2\hat{k}$
	C)	$\hat{i} + 3\hat{j} - 2\hat{k}$	D)	$3\hat{i} - 3\hat{j} - 2\hat{k}$
46.	If $\vec{F} = x\hat{i} + z\hat{j} + y\hat{k}$, then curl of $\vec{F}$ = _____			
	A)	$\hat{i} + 2\hat{k}$	B)	$\hat{i} + \hat{j}$
	C)	$\hat{i} + \hat{j} + 2\hat{k}$	D)	$\vec{0}$
47.	$\phi = xyz$, then $\nabla\phi$ = _____			
	A)	$yx\hat{i} + 4xz\hat{j} + xy\hat{k}$	B)	$yx\hat{i} + 2xz\hat{j} + 2xy\hat{k}$
	C)	$yx\hat{i} + xz\hat{j} + xy\hat{k}$	D)	$yx\hat{i} + 2xz\hat{j} + xy\hat{k}$
48.	A vector field with vanishing divergence is called _____			
	A)	Solenoidal vector field	B)	Scalar field
	C)	Irrotational vector field	D)	Rotational vector field
49.	If two roots of the auxiliary equation of a second order linear differential equation with constant coefficients are real and equal, then the complementary solution is of the form:			
	A)	$\boldsymbol{y_c = Ae^{m_1 x} + Be^{m_2 x}}$	B)	$\boldsymbol{y_c = Ae^{mx} + Be^{mx}}$
	C)	$\boldsymbol{y_c = Ae^{m} + Bxe^{m}}$	D)	$\boldsymbol{y_c = Ae^{mx} + Bxe^{mx}}$
50.	The solution of the differential equation $\boldsymbol{x\,dx + y\,dy = 0}$ represents			
	A)	Hyperbola	B)	Circle with center at the origin
	C)	Parabola whose vertex is at the origin	D)	Straight line passing through the origin
51.	The following second order partial differential equation is $\boldsymbol{x\frac{\partial^2 u}{\partial x^2} - x^2\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0}$			
	A)	Parabolic	B)	Hyperbolic
	C)	Elliptic	D)	Circular
52.	The particular integral of $\boldsymbol{(D^2 + 2)y = 2cosx}$ is			
	A)	$\boldsymbol{cosx}$	B)	$\boldsymbol{2\,sinx}$

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	C)	$2\,cosx$	D)	$4\,cosx$
53.	Which of the following equation is not a first order linear differential equation in y?			
	A)	$\frac{dy}{dx} + x^2y = \cos^2 x$	B)	$\frac{dy}{dx} + y\sec^2 x = e^x$
	C)	$\frac{dy}{dx} + y\sin^2 x = x^3$	D)	$\frac{dy}{dx} + x^2y^2 = \tan x$
54.	If two roots of the auxiliary equation of a second order linear differential equation with constant coefficients are purely imaginary, then the complementary solution is of the form:			
	A)	$y_c = A\cos\beta x$	B)	$y_c = A\cos\beta x + B\sin\beta x$
	C)	$y_c = A\sin\beta x$	D)	$y_c = e^{\alpha x}(A\cos\beta + B\sin\beta)$
55.	The partial differential equation of the expression $z = ax - by$, where a and b are arbitrary constants, is:			
	A)	$z = px - qy$	B)	$z = px + qy$
	C)	$z = p + q$	D)	$px + qy = 0$
56.	The following second order partial differential equation is: $2\frac{\partial^2 u}{\partial x^2} - x^2\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$			
	A)	Parabolic	B)	Hyperbolic
	C)	Elliptic	D)	Circular
57.	Which of the following function is a solution of the differential equation $\frac{dy}{dx} = y$?			
	A)	$y = 3e^{2x}$	B)	$y = 2e^x$
	C)	$y = e^{3x}$	D)	$y = e^{-x}$
58.	If the roots of the auxiliary equation of a differential equation are $0,\ 1,\ -1$ then the differential equation is:			
	A)	$D^3y = 0$	B)	$(D^3 - D^2)y = 0$
	C)	$(D^3 - 1)y = 0$	D)	$(D^3 - D)y = 0$
59.	The partial differential equation of the expression $z = e^y g(x)$, where $g(x)$ an arbitrary function, is:			
	A)	$z = \frac{\partial z}{\partial y}$	B)	$z = \frac{\partial z}{\partial x}$
	C)	$\frac{\partial z}{\partial x} = 0$	D)	$\frac{\partial z}{\partial y} = 0$
60.	Which of the following equation is not a hyperbolic partial differential equation?			
	A)	$-2\frac{\partial^2 u}{\partial x^2} - x^2\frac{\partial^2 u}{\partial y^2} = 0$	B)	$\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 u}{\partial y^2} = 0$
	C)	$xy\frac{\partial^2 u}{\partial x^2} - 3xy\frac{\partial^2 u}{\partial y^2} = 0$	D)	$\frac{\partial^2 u}{\partial x^2} - y^2\frac{\partial^2 u}{\partial y^2} = 0$
61.	The function $y = C_1e^{-2x} + C_2e^{3x}$ is the general solution of the equation:			
	A)	$(D^2 + D - 6)y = 0$	B)	$(D^2 - D + 6)y = 0$
	C)	$(D^2 + D + 6)y = 0$	D)	$(D^2 - D - 6)y = 0$
62.	The partial differential equation obtained from $z = ay + bx$, by eliminating a and b is			
	A)	$z = px + qy$	B)	$z = qx + py$
	C)	$z = p + q$	D)	$z = px - qy$
63.	Which of the following differential equation is first order linear differential equation in y?			
	A)	$x^2y^2 + \frac{dy}{dx} = 0$	B)	$x + y\frac{dy}{dx} = y^3$

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	C)	$x^4 + \frac{dy}{dx} = ay$	D)	$x^2y - y\frac{dy}{dx} = siny$
64.	Which of the following function is a solution of the differential equation $\left(\frac{dy}{dx}\right)^2 = 0$?			
	A)	$y = e^x$	B)	$y = x^2$
	C)	$y = 25x$	D)	$y = cos\ cosx$
65.	The value of $\int_0^1 \int_0^2 xy\ dx\ dy$ is			
	A)	2	B)	4
	C)	0	D)	1
66.	The value of $\Gamma\left(\frac{1}{2}\right)$ is			
	A)	$\sqrt{\pi}$	B)	$\sqrt{\frac{\pi}{2}}$
	C)	$\frac{\sqrt{\pi}}{2}$	D)	$\frac{\sqrt{\pi}}{2}$
67.	The value of $\int_0^a \int_0^x \int_0^y dz\ dy\ dx =$			
	A)	1	B)	0
	C)	$\frac{a}{6}$	D)	$\frac{a^3}{6}$
68.	The value of $\beta\left(\frac{1}{2}, \frac{1}{2}\right)$ is:			
	A)	1	B)	π
	C)	-1	D)	$\sqrt{\pi}$
69.	Area of a region R in terms of polar co-ordinate is			
	A)	$\iint_R r\ dr\ d\theta$	B)	$\iint_R dr\ d\theta$
	C)	$\iint_R r^2 dr\ d\theta$	D)	$\iint_R (r+1)\ dr\ d\theta$
70.	The value of $\int_0^1 \int_0^1 \int_0^1 2z\ dz\ dx\ dy$ is:			
	A)	2	B)	1
	C)	$\frac{1}{8}$	D)	$\frac{1}{4}$
71.	The value of $\left(\Gamma\left(\frac{1}{2}\right)\right)^2$ is:			
	A)	$\sqrt{\pi}$	B)	$\frac{\pi}{2}$
	C)	π	D)	$\frac{\pi}{4}$
72.	For any $m > 0,\ \beta(m, 1) =$			
	A)	1	B)	m
	C)	0	D)	$\frac{1}{m}$
73.	The value of $\int_0^2 \int_0^y x\ dx\ dy$ is equal to			
	A)	$4/5$	B)	$2/3$
	C)	$4/3$	D)	$1/5$
74.	The value of integral $\iint_D dxdy$ where D is the region above the $x-axis$ and within a circle centered at the origin of radius 2.			
	A)	4π	B)	8π

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	C)	$\frac{5}{4}\pi$	D)	2π
75.	The volume of the solid bounded by the planes $x = 0,\ y = 0,\ z = 0$ and $x + y + z = 1$ is given by:			
	A)	$\int_0^1 \int_0^{1-x} \int_0^{1-x-y} dz\,dy\,dx$	B)	$\int_0^1 \int_0^x \int_0^{x+y} dz\,dy\,dx$
	C)	$\int_0^1 \int_0^{1-x} \int_0^{1-y} dz\,dy\,dx$	D)	$\int_0^1 \int_0^x \int_0^{x-y} dz\,dy\,dx$
76.	The value of $\beta(3,2)$ is:			
	A)	$1/12$	B)	$1/2$
	C)	$1/10$	D)	$1/24$
77.	$\gamma(\frac{1}{2}) =$ _____			
	A)	$\sqrt{\pi}$	B)	$2\sqrt{\pi}$
	C)	1	D)	0
78.	$\int_0^1 \int_0^x ydydx$ = _____			
	A)	$\frac{1}{2}$	B)	$\frac{1}{4}$
	C)	$\frac{1}{6}$	D)	$\frac{1}{8}$
79.	$\int_0^1 \int_0^2 dxdy$ = _____			
	A)	1	B)	0
	C)	2	D)	3
80.	The value of $\int_0^c \int_0^b \int_0^a dzdydx$ is _____			
	A)	$\frac{ab}{c}$	B)	$\frac{ab}{2c}$
	C)	abc	D)	ab