1. The difference between degree and order of a differential equation that represents the family of curves given by $y^2 = a\left(x + \frac{\sqrt{a}}{2}\right), a > 0$ is _______.

2. Let $y = y_1(x)$ and $y = y_2(x)$ be the solution curves the differential equation $\frac{dy}{dx} = y + 7$ with initial conditions $y_1(0) = 0$ and $y_2(0) = 1$ respectively. Then the curves $y = y_1(x)$ and $y = y_2(x)$ intersect at

(1) no point
(2) two points
(3) one point
(4) infinite number of points

3. If $\frac{dy}{dx} + \frac{2^{x-y}\left(2^y-1\right)}{2^x-1} = 0, x, y > 0, y(1) = 1$, then $y(2)$ is equal to

(1) $2 + \log_2 3$
(2) $2 + \log_2 2$
(3) $2 - \log_{-2} 3$
(4) $2 - \log_2 3$

4. If the solution curve of the differential equation $\frac{dy}{dx} = \frac{x+y-2}{x-y}$ passes through the point $(2, 1)$ and $(k+1, 2)$, k > 0, then

(1) $2\tan^{-1}\left(\frac{1}{k}\right) = \log_e\left(k^2+1\right)$
(2) $\tan^{-1}\left(\frac{1}{k}\right) = \log_e\left(k^2+1\right)$
(3) $2\tan^{-1}\left(\frac{1}{k+1}\right) = \log_e\left(k^2+2k+2\right)$
(4) $2\tan^{-1}\left(\frac{1}{k}\right) = \log_e\left(\frac{k^2+1}{k^2}\right)$

5. If $y = y(x)$ is the solution of the differential equation $\left(1+e^{2x}\right)\frac{dy}{dx} + 2\left(1+y^2\right)e^x = 0$ and $y(0) = 0$, then $6\left(y'(0) + \left(y\left(\log_e\sqrt{3}\right)\right)^2\right)$ is equal to:

(1) 2
(2) -2
(3) -4
(4) -1

6. Let a curve $y = y(x)$ be given by the solution of the differential equation $\cos\left(\frac{1}{2}\cos^{-1}\left(e^{-x}\right)\right)dx = \left(\sqrt{e^{2x}-1}\right)dy$. If it intersects y-axis at $y = -1$, and the intersection point of the curve with $x-$axis is $(\alpha, 0)$, then e^α is equal to

7. Let $y = y(x)$ be the solution of the differential equation $x\ \tan\left(\frac{y}{x}\right)dy = \left(y\ \tan\left(\frac{y}{x}\right) - x\right)dx$, $-1 \le x \le 1$, $y\left(\frac{1}{2}\right) = \frac{\pi}{6}$. Then the area of the region bounded by the curves $x = 0, x = \frac{1}{\sqrt{2}}$ and $y = y(x)$ in the upper half plane is:

(1) $\frac{1}{8}(\pi - 1)$
(2) $\frac{1}{12}(\pi - 3)$
(3) $\frac{1}{4}(\pi - 2)$
(4) $\frac{1}{6}(\pi - 1)$

8. The solution of the differential equation $\frac{dy}{dx} - \frac{y+3x}{\log_e(y+3x)} + 3 = 0$ is

(where C is a constant of integration)

(1) $x - \frac{1}{2}\left(\log_e(y+3x)\right)^2 = C$
(2) $x - \log_e(y+3x) = C$
(3) $y + 3x - \frac{1}{2}\left(\log_e x\right)^2 = C$
(4) $x - 2\log_e(y+3x) = C$

9. The slope of tangent at any point $(x,\ y)$ on a curve $y = y(x)$ is $\frac{x^2+y^2}{2xy}$, $x > 0$. If $y(2) = 0$, then a value of $y(8)$ is

(1) $-4\sqrt{2}$
(2) $2\sqrt{3}$
(3) $-2\sqrt{3}$
(4) $4\sqrt{3}$

10. If a curve $y = f(x)$, passing through the point $(1,\ 2)$, is the solution of the differential equation $2x^2dy = \left(2xy + y^2\right)dx$, then $f\left(\frac{1}{2}\right)$ is equal to

(1) $\frac{1}{1+\log_e 2}$
(2) $\frac{1}{1-\log_e 2}$
(3) $1 + \log_e 2$
(4) $\frac{-1}{1+\log_e 2}$

11. Let $\mathrm{y} = \mathrm{y}(\mathrm{x})$ be the solution of the differential equation $\left(\mathrm{x}^2 - 3\mathrm{y}^2\right)\mathrm{dx} + 3\,\mathrm{xy}\ \mathrm{dy} = 0,\ \mathrm{y}(1) = 1$. Then $6\mathrm{y}^2(\mathrm{e})$ is equal to

(1) $3\mathrm{e}^2$
(2) e^2
(3) $2\mathrm{e}^2$
(4) $\frac{3\mathrm{e}^2}{2}$

12. If $y\frac{\mathrm{d}y}{\mathrm{d}x} = x\left[\frac{y^2}{x^2} + \frac{\phi\left(\frac{y^2}{x^2}\right)}{\phi'\left(\frac{y^2}{x^2}\right)}\right]$, $x > 0,\ \phi > 0$, and $y(1) = -1$, then $\phi\left(\frac{y^2}{4}\right)$ is equal to:

(1) $2\phi(1)$
(2) $\phi(1)$
(3) $4\phi(2)$
(4) $4\phi(1)$

13. Let a smooth curve $y = f(x)$ be such that the slope of the tangent at any point (x, y) on it is directly proportional to $\left(\frac{-y}{x}\right)$. If the curve passes through the points $(1, 2)$ and $(8, 1)$, then $\left|y\left(\frac{1}{8}\right)\right|$ is equal to

(1) $2\log_e 2$
(2) 4
(3) 1
(4) $4\log_e 2$

14. If $y = y(x)$ is the solution curve of the differential equation $\frac{dy}{dx} + y\tan x = x\sec x$, $0 \le x \le \frac{\pi}{3}$, $y(0) = 1$, then $y\left(\frac{\pi}{6}\right)$ is equal to

(1) $\frac{\pi}{12} - \frac{\sqrt{3}}{2}\log_e\left(\frac{2}{e\sqrt{3}}\right)$
(2) $\frac{\pi}{12} + \frac{\sqrt{3}}{2}\log_e\left(\frac{2\sqrt{3}}{e}\right)$
(3) $\frac{\pi}{12} - \frac{\sqrt{3}}{2}\log_e\left(\frac{2\sqrt{3}}{e}\right)$
(4) $\frac{\pi}{12} + \frac{\sqrt{3}}{2}\log_e\left(\frac{2}{e\sqrt{3}}\right)$

15. Let $\mathrm{y} = \mathrm{f}(\mathrm{x})$ be the solution of the differential equation $y(x+1)dx - x^2dy = 0,\ y(1) = e$. Then $\lim_{x \to 0^+} f\left(x\right)$ is equal to

(1) 0
(2) $\frac{1}{e}$
(3) e^2
(4) $\frac{1}{e^2}$

16. If a curve passes through the point $(1, \ -2)$ and has slope of the tangent at any point $(x, \ y)$ on it as $\frac{x^2-2y}{x}$, then the curve also passes through the point

(1) $\left(\sqrt{3}, \ 0\right)$
(2) $(-1, 2)$
(3) $\left(-\sqrt{2}, 1\right)$
(4) $(3, 0)$

17. Let $y=y(x), \ y>0$, be a solution curve of the differential equation $\left(1+x^2\right)dy=y(x-y)dx$. If $y(0)=1$ and $y\left(2\sqrt{2}\right)=\beta$, then

(1) $e^{3\beta-1}=e\left(3+2\sqrt{2}\right)$
(2) $e^{3\beta-1}=e\left(5+\sqrt{2}\right)$
(3) $e^{\beta-1}=e^{-2}\left(3+2\sqrt{2}\right)$
(4) $e^{\beta-1}=e^{-2}\left(5+\sqrt{2}\right)$

18. Suppose $y=y(x)$ be the solution curve to the differential equation $\frac{dy}{dx}-y=2-e^{-x}$ such that $\lim\limits_{x\to\infty} y(x)$ is finite. If a and b are respectively the x and $y-$ intercept of the tangent to the curve at $x=0$, then the value of $a-4b$ is equal to _______.

19. If $y=y(x)$ is the solution of the differential equation $2x^2\frac{dy}{dx}-2xy+3y^2=0$ such that $y(e)=\frac{e}{3}$, then $y(1)$ is equal to

(1) $\frac{1}{3}$
(2) $\frac{2}{3}$
(3) $\frac{3}{2}$
(4) 3

20. Let $y=y(x)$ be the solution of the differential equation $x\left(1-x^2\right)\frac{dy}{dx}+\left(3x^2y-y-4x^3\right)=0, x>1$ with $y(2)=-2$. Then $y(3)$ is equal to

(1) -18
(2) -12
(3) -6
(4) -3

21. Let $y=y(x)$ be the solution of the differential equation $x\log_e x\frac{dy}{dx}+y=x^2\log_e x, \left(x>1\right)$. If $y(2)=2$, then $y(e)$ is equal to

(1) $\frac{4+e^2}{4}$
(2) $\frac{1+e^2}{4}$
(3) $\frac{2+e^2}{2}$
(4) $\frac{1+e^2}{2}$

22. Let $\mathrm{y}=\mathrm{y}(\mathrm{x})$ be the solution curve of the differential equation $\frac{dy}{dx}=\frac{y}{x}\left(1+x^2\left(1+\log_e x\right)\right), \mathrm{x}>0, \mathrm{y}(1)=3$. Then $\frac{\mathrm{y}^2(\mathrm{x})}{9}$ is equal to :

(1) $\frac{x^2}{5-2x^3\left(2+\log_e x^3\right)}$
(2) $\frac{x^2}{2x^3\left(2+\log_e x^3\right)-3}$
(3) $\frac{x^2}{3x^3\left(1+\log_e x^2\right)-2}$
(4) $\frac{x^2}{7-3x^3\left(2+\log_e x^2\right)}$

23. Let f be a differentiable function such that $x^2f(x)-x=4\int_0^x t\ f(t)\ dt, \ f(1)=\frac{2}{3}$. Then $18\ f(3)$ is equal to

(1) 210
(2) 160
(3) 150
(4) 180

24. Let $f:\mathbb{R}\to\mathbb{R}$ be a differentiable function such that $f'(x)+f(x)=\int_0^2 f(t)dt$. If $f(0)=e^{-2}$, then $2f(0)-f(2)$ is equal to _____ .

25. If $\frac{dy}{dx}+e^x\left(x^2-2\right)y=\left(x^2-2x\right)\left(x^2-2\right)e^{2x}$ and $y(0)=0$, then the value of $y(2)$ is

(1) -1
(2) 1
(3) 0
(4) e

26. Let $y=y(x)$ be the solution of the differential equation $xdy=\left(y+x^3\cos x\right)dx$ with $y(\pi)=0$, then $y\left(\frac{\pi}{2}\right)$ is equal to:

(1) $\frac{\pi^2}{4}+\frac{\pi}{2}$
(2) $\frac{\pi^2}{2}+\frac{\pi}{4}$
(3) $\frac{\pi^2}{2}-\frac{\pi}{4}$
(4) $\frac{\pi^2}{4}-\frac{\pi}{2}$

27. Let $y=y(x)$ be the solution of the differential equation $\left(x-x^3\right)dy=\left(y+yx^2-3x^4\right)dx, x>2$ If $y(3)=3$, then $y(4)$ is equal to:

(1) 4
(2) 12
(3) 8
(4) 16

28. Let $y=y(x)$ be the solution curve of the differential equation
$\sin\left(2x^2\right)\log_e\left(\tan x^2\right)dy+\left(4xy-4\sqrt{2}x\sin\left(x^2-\frac{\pi}{4}\right)\right)dx=0, \ 0<x<\sqrt{\frac{\pi}{2}}$, which passes through the point $\left(\sqrt{\frac{\pi}{6}}, 1\right)$. Then $\left|y\left(\sqrt{\frac{\pi}{3}}\right)\right|$ is equal to _______.

29. Let $x=x(y)$ be the solution of the differential equation $2ye^{\frac{x}{y^2}}dx+\left(y^2-4xe^{\frac{x}{y^2}}\right)dy=0$ such that $x(1)=0$. Then, $x(e)$ is equal to

(1) $e\log_e(2)$
(2) $-e\log_e(2)$
(3) $e^2\log_e(2)$
(4) $-e^2\log_e(2)$

30. Let $y=y(x)$ be the solution of the differential equation $\left((x+2)e^{\left(\frac{y+1}{x+2}\right)}+(y+1)\right)dx=(x+2)dy, \ y(1)=1$. If the domain of $y=y(x)$ is an open interval $(\alpha, \ \beta)$, then $|\alpha+\beta|$ is equal to ___________.