1. The general solution of the equation
\[ \frac{d^2y}{dx^2} + y = 0 \]
is
   a. \( y = C_1 \cos(x) + C_2 \sin(x) \) b. \( y = C_1 \sin(x + C_2) \) c. \( y = C_1 \cos(x + C_2) \) d. all of above e. none of above

2. The general solution of the equation
\[ \frac{d^2y}{dx^2} - y = 0 \]
is:
   a. \( y = C_1 x + C_2 \) b. \( y = C_1 \cosh(x) + C_2 \sinh(x) \) c. \( y = e^{C_1 x} + e^{C_2 x} \) d. all of above e. none of above

3. Find the general solution of the equation:
\[ \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + y = e^x \]

4. Suppose \( \frac{dy}{dx} = f(x,y) \). Express \( \frac{d^2y}{dx^2} \) and \( \frac{d^3y}{dx^3} \) in terms of \( f, f_x, f_y, f_{xx}, f_{xy}, f_{yy} \).

5. Fill in the missing information on the second iterated integral.
   \[ \int_0^3 \int_{0-2x}^6 f(x,y)dydx = \int \int f(x,y)dxdy \]
   \[ \int_{-2}^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} (x^2 + y^2)dydx = \int \int r^2drd\theta \]
   \[ \int_{-1}^1 \int_{x^2}^1 f(x,y)dydx = \int \int f(x,y)dxdy \]

6. Find the centroid of the hollow shell \( S = \{(x,y,z) : z = 1 - x^2 + y^2, z \geq 0\} \)

7. Find \( \oint_c xdx + 2xydy + y^2dz \) where \( c \) is the curve \( c : [1, 2] \mapsto \mathbb{R}^3 \) defined by \( c(t) = ti + t^2j + \log(t)k \).

8. Show that the area bounded by a closed curve \( C \) is given by \( \oint_C xdy \). Use this to find the area of the loop in the curve given by the parametric equations \( x = (t - 1)t(t + 1), \ y = 1 - t^2 \).
Answers

1. d
2. b
3. $y = C_1 e^x + C_2 xe^x + \frac{x^2}{2} e^x$
4. $\frac{\partial^2 y}{\partial x^2} = f_x + f_y f, \quad \frac{\partial^3 y}{\partial x^3} = f_{xx} + f_{xy} f + (f_{xx} + f_{yy} f) f + f_y (f_x + f_y f)$
5. $\int_0^6 \int_{(-1/2)h+3}^3 f(x, y) dxdy, \quad \int_0^2 \int_0^{2\pi} r^3 d\theta dr, \quad \int_0^1 \int_{\sqrt{y}}^{y} f(x, y) dxdy$
6. $(0, 0, a/b)$ where $b = \pi/6(5^{3/2} - 1)$ and $a = \pi/4((5/6)u^{3/2} - (1/10)u^{5/2}) [5]$ 
7. 601/20
8. $\frac{8}{15}$