Select the single correct answer for the questions below.
Answer all questions and show the solution process $2 \times 5 = 10$

1. The general solution of the homogeneous equation

$$y'' + a^2 y = 0$$

is:

(A) $C_1 e^{ax} + C_2 e^{-ax}$
(B) $C_1 e^{iax} + C_2 e^{-iax}$
(C) $C_1 \cosh(ax) + C_2 \sinh(ax)$
(D) $C_1 x + C_2$

2. If two solutions of a differential equation are e^{ax} and e^{-ax}, then they are:

(A) linearly independent for $a \neq 0$
(B) linearly dependent for all a
(C) linearly independent for all a
(D) linearly dependent for $a \neq 0$

3. The differential equation

$$x\,dy + 2y\,dx = x^3\,dx$$

has the solution:

(A) $y = \dfrac{x^3}{3} + \dfrac{C}{x^2}$

(B) $y = \frac{x^3}{5} + Cx^2$

(C) $y = \frac{x^3}{3} + Cx^2$

(D) $y = \frac{x^3}{5} + \frac{C}{x^2}$

4. The partial differential equation obtained by eliminating the arbitrary constants from the equation

$$z = (x + a)(y + b), \quad z = z(x, y),$$

where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$, is:

(A) $z = p + q$

(B) $z = p - q$

(C) $z = pq$

(D) $z = xp + yq$

5. The general solution of the partial differential equation

$$xp + yq = z, \quad z = z(x, y),$$

where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$, is:

(A) $F(x + y, z) = 0$

(B) $F\left(\frac{x}{y}, \frac{z}{y}\right) = 0$

(C) $F(xy, z) = 0$

(D) $F\left(\frac{y}{x}, \frac{z}{x}\right) = 0$