

How to use this sheet. First identify the type of equation: variable separable, linear, or homogeneous. Variable separable equations split into $f(y)dy = g(x)dx$. Linear equations need an integrating factor. Homogeneous equations need the substitution $y = vx$.

Quick reference — Order = highest derivative present · General solution of order n has n arbitrary constants · Linear form $dy/dx + Py = Q$, integrating factor = $e^{\int P dx}$

Section A · Level 1

Seven questions. None should take more than twenty seconds.

1. The order of a differential equation is:

(1) The number of arbitrary constants (2) The highest power of the highest derivative present (3) The highest order derivative that appears in the equation (4) The degree of the independent variable

2. The degree of a differential equation is:

(1) The number of terms in the equation (2) The highest order derivative present (3) The power of the highest order derivative, once the equation is a polynomial in derivatives (4) Always equal to the order

3. The order and degree of the equation $(d^2y/dx^2)^3 + (dy/dx)^2 = 0$ are respectively:

(1) 2 and 3 (2) 3 and 2 (3) 2 and 2 (4) 3 and 3

4. The general solution of a differential equation of order n contains:

(1) n dependent variables (2) Exactly n arbitrary constants (3) n independent variables (4) No arbitrary constants

5. A differential equation is formed from a family of curves by:

(1) Integrating the equation of the family (2) Differentiating the equation enough times to eliminate every arbitrary constant (3) Substituting $x = 0$ (4) Adding a constant of integration

6. Eliminating the constant C from $y = Cx^2$ gives the differential equation:

(1) $dy/dx = 2y/x$ (2) $dy/dx = 2x/y$ (3) $dy/dx = y/x^2$ (4) $dy/dx = 2Cx$

7. A differential equation is called variable separable if it can be written in the form:

(1) $f(x, y) dx = g(x, y) dy$ (2) $f(y) dy = g(x) dx$ (3) $f(x) + g(y) = 0$ (4) $f(x)g(y) = \text{constant only}$

Section B · Level 2

Six questions. Identify the type before choosing a method.

8. The solution of $dy/dx = x/y$ is:

(1) $y^2 - x^2 = C$ (2) $y^2 + x^2 = C$ (3) $y = x + C$ (4) $xy = C$

9. The solution of $dy/dx = 2x$, given that $y = 3$ when $x = 0$, is:

(1) $y = x^2 + 3$ (2) $y = 2x + 3$ (3) $y = x^2 - 3$ (4) $y = 2x^2 + 3$

10. The solution of $dy/dx = x/y$, given that $y = 2$ when $x = 1$, is:

(1) $y = \sqrt{x^2 + 3}$ (2) $y = \sqrt{x^2 - 3}$ (3) $y^2 = x^2 + 4$ (4) $y = x + 1$

11. For the linear differential equation $dy/dx + Py = Q$, where P and Q are functions of x , the integrating factor is:

(1) e^P (2) $e^{\int Q dx}$ (3) $e^{\int P dx}$ (4) $\int P dx$

12. The general solution of $dy/dx + y = 0$ is:

- (1) $y = Ce^n$ (2) $y = Ce^{-n}$ (3) $y = C + x$ (4) $y = Cx$

13. The integrating factor for the equation $dy/dx + 2y = x$ is:

- (1) e^{2n} (2) e^n (3) e^{-2n} (4) $2x$

Section C · Level 3

Seven questions. Count the arbitrary constants to predict the order.

14. A differential equation of the form $dy/dx = f(x, y)$, where $f(x, y)$ can be written as a function of y/x alone, is called:

- (1) Linear (2) Variable separable (3) Homogeneous (4) Exact

15. To solve a homogeneous differential equation $dy/dx = f(y/x)$, the standard substitution is:

- (1) $y = vx$ (2) $x = vy$ (3) $v = x + y$ (4) $y = v + x$

16. The differential equation representing the family of curves $y = A \cos x + B \sin x$, where A and B are arbitrary constants, is:

- (1) $d^2y/dx^2 + y = 0$ (2) $d^2y/dx^2 - y = 0$ (3) $dy/dx + y = 0$ (4) $d^2y/dx^2 = 0$

17. The number of arbitrary constants eliminated to form the differential equation for the family $y = A \cos x + B \sin x$ is:

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

18. Which of the following is an example of a linear differential equation?

- (1) $dy/dx + y^2 = x$ (2) $dy/dx + xy = \sin x$ (3) $(dy/dx)^2 + y = x$ (4) $dy/dx = y^2$

19. A general solution differs from a particular solution of the same differential equation in that the particular solution:

- (1) Has more arbitrary constants (2) Has specific numerical values in place of the arbitrary constants, usually found from given conditions (3) Cannot be verified by substitution (4) Has a higher order

20. The order of the differential equation obtained by eliminating the arbitrary constants a and b from $y = a e^n + b e^{-n}$ is:

- (1) 0 (2) 1 (3) 2 (4) Cannot be determined

Answer key: 1. (3) 2. (3) 3. (1) 4. (2) 5. (2) 6. (1) 7. (2) 8. (1) 9. (1) 10. (1) 11. (3) 12. (2) 13. (1) 14. (3) 15. (1) 16. (1) 17. (3) 18. (2) 19. (2) 20. (3)

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