

# Multiple-Choice Test

## Chapter 08.01 Background

- The differential equation  $2\frac{dy}{dx} + x^2y = 2x + 3$ ,  $y(0) = 5$  is
  - linear
  - nonlinear
  - linear with fixed constants
  - undeterminable to be linear or nonlinear
- A differential equation is considered to be ordinary if it has
  - one dependent variable
  - more than one dependent variable
  - one independent variable
  - more than one independent variable
- Given
$$2\frac{dy}{dx} + 3y = \sin 2x, y(0) = 6$$
 $y(2)$  most nearly is
  - 0.17643
  - 0.29872
  - 0.32046
  - 0.58024
- The form of the exact solution to
$$2\frac{dy}{dx} + 3y = e^{-x}, y(0) = 5$$
is
  - $Ae^{-1.5x} + Be^{-x}$
  - $Ae^{-1.5x} + Bxe^{-x}$
  - $Ae^{1.5x} + Be^{-x}$
  - $Ae^{1.5x} + Bxe^{-x}$

5. The following nonlinear differential equation can be solved exactly by separation of variables.

$$\frac{d\theta}{dt} = -10^{-6}(\theta^2 - 81), \theta(0) = 1000$$

The value of  $\theta(100)$  most nearly is

- (A) -99.99  
 (B) 909.10  
 (C) 1000.32  
 (D) 1111.10
6. A solid spherical ball taken out of a furnace at 1200 K is allowed to cool in air. Given the following,

radius of the ball = 2 cm

density of the ball = 7800 kg/m<sup>3</sup>

specific heat of the ball = 420 J/kg · K

emmittance = 0.85

Stefan-Boltzman constant =  $5.67 \times 10^{-8}$  J/s · m<sup>2</sup> · K<sup>4</sup>

ambient temperature = 300 K

convection coefficient to air = 350 J/s · m<sup>2</sup> · K

the differential equation governing the temperature  $\theta$  of the ball as a function of time  $t$  is given by

(A)  $\frac{d\theta}{dt} = -2.2067 \times 10^{-12}(\theta^4 - 81 \times 10^8)$

(B)  $\frac{d\theta}{dt} = -1.6026 \times 10^{-2}(\theta - 300)$

(C)  $\frac{d\theta}{dt} = 2.2067 \times 10^{-12}(\theta^4 - 81 \times 10^8) + 1.6026 \times 10^{-12}(\theta - 300)$

(D)  $\frac{d\theta}{dt} = -2.2067 \times 10^{-12}(\theta^4 - 81 \times 10^8) - 1.6026 \times 10^{-2}(\theta - 300)$

For a complete solution, refer to the links at the end of the book.