Ch. 29 - Board Problems

① $\int (\sqrt{3x-1})^4 \, dx$

② $\int_0^{\frac{\pi}{2}} \tan^2(2x) \, dx$

Ch. 29 - Differential Equations

Separable Differential Equations

$$A(y)\frac{dy}{dx} = B(x) \quad \text{or} \quad y \cdot y' = x$$

Separate $\frac{dy}{dx}$

$=$

THE INTEGRATE BOTH SIDES.

Ex.1 $\frac{dy}{dx} = 2y^2x$

STEP 1: SEPARATE THE VARIABLES

STEP 2: INTEGRATE BOTH SIDES.

STEP 3: SOLVE FOR BOTH SIDES.

EX. 2 $\frac{dy}{dx} = 2y^2 x$ when $y(3) = -\frac{1}{4}$

EX. 3 SOLVE $\frac{2}{\cos(3x)}\left(\frac{dy}{dx}\right) = 6\sin(3x)$ WHEN $y(0) = 3$

EX. 4 SOLVE $\frac{dy}{dx} = 3x\left(e^{x^2 - \ln(21)}\right)$; $y(0) = -1$

Follow the directions.

1. Match the differential equation with the correct general solution.

A. $\frac{dy}{dx} - 5x^2 = x^2$

B. $\frac{dy}{dx} = x$

C. $2x + \frac{dy}{dx} = 4x$

i. $y(x) = x^2 + C$

ii. $y(x) = 2x^3 + C$

iii. $y(x) = \frac{1}{2}x^2 + C$

2. Which of the following differential equations are separable? Explain.

A. $\frac{dy}{dx} = e^x + \sin(y)$

B. $\frac{dy}{dx} = e^x + \sin(x)$

C. $\frac{dy}{dx} = e^y \sin(x) + e^y$

Solve the following differential equations.

3. $\frac{dy}{dx} = 2x^3y$

4. $\frac{dx}{dt} = e^x \sin(t)$

5. $\frac{dy}{dx} - 4y = 2$

6. $\left[\csc(t) + \frac{2}{\sin(t)}\right]\frac{ds}{dt} = 6$

Find a particular solution to each of the following differential equations.

7. $\left(\frac{w^5}{5 \cdot t^4}\right)\frac{dw}{dt} = e^{t^5}$ $\quad w(0) = 2$

8. $x^{-10}\frac{dz}{dx} + \frac{1}{2x^{10}}\frac{dz}{dx} = 11$ $\quad z(1) = \frac{4}{3}$

9. $\frac{dy}{dx} = \frac{e^y}{4x}$ $\quad y(1) = 0$

10. $\frac{dw}{dt} = .2w + 2$ $\quad w(0) = 10$