WARM UP

1. If $y = x^2 \sin(2x)$, then $\frac{dy}{dx} =$

(A) $2x\cos(2x)$ (B) $4x\cos(2x)$ (C) $2x[\sin(2x)+\cos(2x)]$

(D) $2x[\sin(2x)-x\cos(2x)]$ (E) $2x[\sin(2x)+x\cos(2x)]$

2. What is the slope of the line tangent to the curve

$3y^2 - 2x^2 = 6 - 2xy$ at the point $(3,2)$?

(A) 0 (B) $\frac{4}{9}$ (C) $\frac{7}{9}$ (D) $\frac{6}{7}$ (E) $\frac{5}{3}$

Solving Separable Differential Equations

Objective:

- Solve separable differential equations (general and particular solutions)

A differential equation is an equation that has one or more derivatives in it.

Example: $\frac{dy}{dx} = 2xy^2$

A separable differential equation is one in which all x and dx's can be separated from all the y and dy's. In the general form:

$$\frac{dy}{dx} = f(x)g(y)$$

$\frac{dy}{dx} = 2xy^2$	$\frac{dy}{dx} = x + y$
separable	non separable

To solve a separable differential equation means to solve for y.

To solve - separate and integrate.

A general solution has +C. A particular solution requires an initial condition to find C.

Ex.1: Find the general solution of the differential equation

$$\frac{dy}{dx} = 2xy^2$$

Ex.2: Find the particular solutions to the differential equation given the initial conditions (a) f(0) = 1 and (b) f(0) = -2

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

Ex.3: Find the particular solution to the differential equation with the initial condition f(0) = 1.

$$\frac{dy}{dx} = (3 - y)\cos x$$

Ex.4: FRQ 1998-4

Let f be a function with f(1) = 4 such that for all points (x,y) on the graph of f, the slope is given by

$$\frac{dy}{dx} = \frac{3x^2 + 1}{2y}$$

a) Find the slope of the graph of f at the point where x = 1.

b) Write an equation of the line tangent to the graph of f at x = 1 and use it to approximate f(1.2)

c) Find f(x) by solving the separable differential equation with the initial condition f(1) = 4.

$$\frac{dy}{dx} = \frac{3x^2 + 1}{2y}$$

d) Use your solution from part (c) to find the exact value of f(1.2).

Find the general solution y = f(x) by algebraically manipulating the differential equation first to the separable form $\frac{dy}{dx} = f(x)g(y)$

Ex.5: $\frac{dy}{dx} = e^{x-y}$

Ex.6: Find the general solution y = f(x)

$$\frac{dy}{dx} - x = xy^2$$