

## 4.2 day 2

Tuesday, October 3, 2017 8:22 PM

Skill check:

A. Find  $y'$  for

$$y = 2 \sin^7(3x-5)$$

$$y' = 2 \cdot 7 \cdot \sin^6(3x-5) \cdot \cos(3x-5) \cdot 3$$

$$= 42 \sin^6(3x-5) \cdot \cos(3x-5)$$

B. Factor and simplify

$$\frac{10x^{1/2}(5x+7)^8 - 20x^{-1/2}(5x+7)^7}{x(5x+7)^3}$$

$$= \frac{10x^{-1/2}(5x+7)^4 [x^{1/2}(5x+7) - 2]}{x}$$

$$= \frac{10(5x+7)^4 [5x^2 + 7x - 2]}{x^{3/2}}$$

① Evaluate  $\frac{d^2y}{dx^2} = \frac{xy - x \frac{dy}{dx}}{x-y}$  at  $x=4$ ,  $y=8$ , and  $\frac{dy}{dx} = -3$ .

$$\frac{d^2y}{dx^2} = \frac{4 \cdot 8 - 4 \cdot (-3)}{4 - 8} = \frac{32 + 12}{-4} = \frac{44}{-4} = -11$$

② Let  $\frac{dy}{dx} = x+y$  and  $\frac{d^2y}{dx^2} = x \frac{dy}{dx} - xy + 8$

Write a simplified form of  $\frac{d^2y}{dx^2}$ .

\* Kudos to Tara! She realized that this  $\frac{d^2y}{dx^2}$  does not come

$$\begin{aligned}\frac{d^2y}{dx^2} &= x(x+y) - xy + 8 \\ &= x^2 + xy - xy + 8 \\ &= x^2 + 8\end{aligned}$$

from this  $\frac{dy}{dx}$ . Whoops!

It should. Mrs. Green was just trying to get us to substitute  $\frac{dy}{dx}$  as a learning step. ★

③ Find  $\frac{d^2y}{dx^2}$  if  $\frac{dy}{dx} = 1 + \sin y$

$$\begin{aligned}\frac{d^2y}{dx^2} &= \cos y \cdot \frac{dy}{dx} \\ &= \cos y (1 + \sin y)\end{aligned}$$

④ Find  $\frac{d^2y}{dx^2}$  for  $x^2 + y^2 = 4$

$$2x + 2y \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = -\frac{x}{y}$$

$$\frac{d^2y}{dx^2} = \frac{y \cdot -1 - (-x) \cdot \frac{dy}{dx}}{y^2}$$

$$= \frac{-y + x \cdot \frac{-x}{y}}{y^2}$$

$$= \frac{-y^2 - x^2}{y} \cdot \frac{1}{y^2}$$

$$= \frac{-y^2 - x^2}{y^3}$$

But  $x^2 + y^2 = 4!$

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

$$= \frac{-4}{y^3}$$

⑤ Find  $\frac{d^2y}{dx^2}$  for  $3x^2 - 2y^2 = 6$

$$6x - 4y \frac{dy}{dx} = 0$$

$$-4y \frac{dy}{dx} = -6x$$

$$\frac{dy}{dx} = \frac{-6x}{-4y} = \frac{3x}{2y}$$

$$\frac{d^2y}{dx^2} = \frac{2y \cdot 3 - 3x \cdot 2 \frac{dy}{dx}}{4y^2}$$

$$= \frac{6y - 6x \cdot \frac{3x}{2y}}{4y^2}$$

$$= \frac{12y^2 - 18x^2}{2y} \cdot \frac{1}{4y^2}$$

$$= \frac{12y^2 - 18x^2}{8y^3}$$

$$= \frac{6y^2 - 9x^2}{4y^3}$$

$$= \frac{-3(3x^2 - 2y^2)}{4y^3}$$

Looks done, but not quite!

$$4y^3$$

$$= \frac{-3 \cdot 6}{4y^3}$$

$$= \frac{-9}{2y^3}$$