

## Second derivative quiz

Sunday, November 03, 2013

3:48 AM

Find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  for the following:  
( $y'$  and  $y''$ )

①  $y = x^3$

②  $y = \sqrt{x}$

③  $y = \frac{1}{4x^2}$

④  $y = (5x^2 + 3)^4$  (requires Chain rule - see Chain rule tutorial)  
+ product rule - see product rule tutorial

Answers:

①  $y' = 3x^2$   
 $y'' = 6x$

②  $y = \sqrt{x} = x^{\frac{1}{2}}$   
 $y' = \frac{1}{2}x^{-\frac{1}{2}}$   
 $y'' = -\frac{1}{4}x^{-\frac{3}{2}}$

③  $y = \frac{1}{4x^2} = \frac{1}{4}x^{-2}$   
 $y' = -\frac{2}{4}x^{-3} = -\frac{1}{2}x^{-3}$   
 $y'' = \frac{3}{2}x^{-4}$

④  $y' = 4(5x^2 + 3)^3 \times 10x$   
 $= 40x(5x^2 + 3)^3$

$$\begin{aligned} f &= 40x & g &= (5x^2 + 3)^3 \\ f' &= 40 & g' &= 3(5x^2 + 3)^2 \times 10x \\ & & g' &= 30x(5x^2 + 3)^2 \end{aligned}$$

$$\begin{aligned} y'' &= f \cdot g' + g \cdot f' \\ &= 40x \times 30x(5x^2 + 3)^2 + (5x^2 + 3)^3 \times 40 \end{aligned}$$

$$= 1200x^2(5x^2+3)^2 + 40(5x^2+3)^3$$