4.6 The Product Rule

$$y = (3x+7)^3(4x+1)^2$$

4.6 The Product Rule

Learning Targets:

1. SWBAT find the derivative using the product rule.
2. SWBAT apply the product rule to application problems.

Product Rule

If both $f(x)$ and $g(x)$ are differentiable functions, then if $y = f(x) \bullet g(x)$, then

$$y' = f(x)g'(x) + g(x)f'(x)$$

Ex. 1 Differentiate the following:

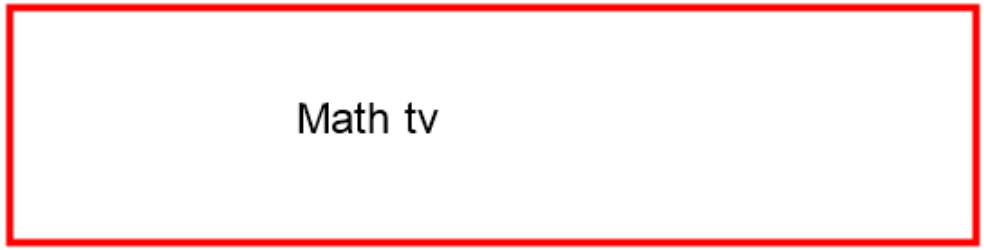
$$f(x) = (2x^3 + 5)(3x^2 - x)$$

a b

$f'(x) = (2x^3+5)(6x-1) + (3x^2-x)(6x^2)$ *

$f'(x) = 12x^4 - 2x^3 + 30x - 5 + 18x^4 - 6x^3$

$f'(x) = 30x^4 - 8x^3 + 30x - 5$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Ex. 2 Differentiate the following:

$$y = \sqrt{x}(2-3x)$$

a b

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

$$= -\frac{6}{2}\sqrt{x} + x^{-1/2} - \frac{3}{2}\sqrt{x}$$

$$= x^{-1/2} - \frac{9}{2}\sqrt{x}$$

$$= \frac{1}{\sqrt{x}} - \frac{9}{2}\sqrt{x}$$

Ex.3 Find the equation of the tangent line to the curve $f(x)=(3x^2+2)(2x^3-1)$ at the point (1,5)

$f'(x)=(3x^2+2)(6x^2)+(2x^3-1)(6x)$

$f'(1)=(3(1)^2+2)(6(1)^2)+(2(1)^3-1)(6(1))$

$=(5)(6)+6$

$=36$

$y-5=36(x-1)$

$y-5=36x-36$

$y=36x-31$

http://archives.math.utk.edu/visual.calculus/2/product_rule.1/index.html

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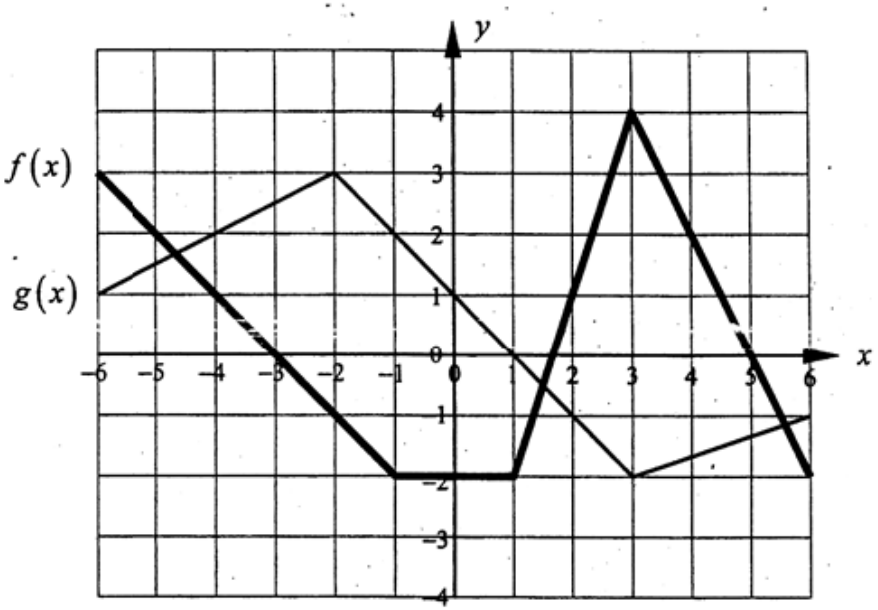
Shown at right is a graph of the functions $f(x)$ and $g(x)$. Assume that $F(x)=f(x)\cdot g(x)$. By studying the graph and using the product rule, determine the value of each of the following.

21. $F'(2)$
22. $F'(-4)$
23. $F'(0)$
24. $F'(3)$
25. If $f(x)=\left(x^2+3x\right)^5$, use the product rule to show that $f'(x)=5\left(x^2+3x\right)^4(2x+3)$.



(21) $F(x)=f(x)\,g(x)$

$F'(2)=f(2)\cdot g'(2)+g(2)f'(2)$

$=(1)(-1)+(-1)(3)=-4$

Assignment
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#'s 1-5, 7,16,
#'s 21-24
Handout
#'s 3 a,c,e, 5