Product Rule

We will derive this one...

given $y = f(x)g(x)$ find a formula for y'

$$y' = \lim_{h\to 0} \frac{f(x+h)g(x+h) - f(x)g(x)}{h}$$

$$= \lim_{h\to 0} \frac{f(x+h)g(x+h) - f(x+h)g(x) + f(x+h)g(x) - f(x)g(x)}{h}$$

$$= \lim_{h\to 0} f(x+h)\left[\frac{g(x+h)-g(x)}{h}\right] + g(x)\left[\frac{f(x+h)-f(x)}{h}\right]$$

$$= \lim_{h\to 0} f(x)\,g'(x) + g(x)f'(x)$$

Jan 14-12:12 PM

Find $f'(x)$

a) $f(x) = x^2 \sin(x)$

$f'(x) = x^2\cos(x) + \sin(x)\,2x$

$f'(x) = x^2\cos(x) + 2x\sin(x)$

b) $f(x) = x^3(x+1)^2$

$f'(x) = x^3\,2(x+1)^1(1) + (x+1)^2 3x^2$

$= 2x^3(x+1) + 3x^2(x+1)^2$

$= x^2(x+1)\left[2x + 3(x+1)\right]$

$= x^2(x+1)(5x+3)$

Jan 14-12:12 PM

Quotient Rule

We will ***NOT*** derive this one...

given $y = f(x)g(x)$ find a formula for y'

$$y' = \frac{g(x)f'(x) - f(x)g'(x)}{g^2(x)}$$

Jan 14-12:12 PM

(c) $f(x) = e^x \cos x$

$$f'(x) = (e^x)(-\sin(x)) + (\cos(x))(e^x)$$

$$= e^x(\cos(x) - \sin(x))$$

Jan 14-12:12 PM

$$f(x) = x \cdot \ln(x)$$

$$f'(x) = x\left(\frac{1}{x}\right) + \ln(x)(1)$$

$$= 1 + \ln(x)$$

Jan 14-12:12 PM

$$f(x) = 4xe^x$$

$$f'(x) = (4x)(e^x) + (e^x)(4)$$

$$= 4e^x(x+1)$$

Jan 14-12:12 PM

HW p. 212 #s 1-10 all

Exercise 7I

Find the derivative of each function in questions 1 to 8.

1 $f(x) = \dfrac{x^2}{x-4}$

2 $f(x) = (2x^3 + x^2 + x)(x^2 + 1)$

3 $f(x) = \dfrac{\ln x}{x}$

4 $f(x) = e^x \ln x$

5 $f(x) = \dfrac{x-2}{x+4}$

6 $f(x) = \dfrac{e^x}{e^x + 1}$

7 $f(x) = e^x (5x^3 + 4x)$

8 $f(x) = \dfrac{2-x^2}{x^3+1}$

EXAM-STYLE QUESTIONS

9 The function $f(x) = xe^x$ has a horizontal tangent line at $x = k$
Find k.

10 Write the equations for the tangent lines to the graph of $f(x) = \dfrac{x+1}{x-1}$ that are parallel to the line $x + 2y = 10$

Jan 14-12:12 PM