CLASSWORK 66

1. Find the derivative of each function.

a) $y = 4x^5 \ln x$ b) $y = 4x^5 - \ln x$ c) $y = 5x \cdot e^x$

d) $y = e^x \cos x + 7x$ f) $y = 4e^x$ g) $y = e^x \ln x + x$

2. Another awesome proof !!!   How can we be **sure** the derivative of e^x is really e^x ?

Remember: 1) Definition of e   2) Definition of a derivative   3) $x^a \cdot x^b = x^{a+b}$

3. An object is moving according to the equation $d = \ln t$ where d is distance in meters and t is time in seconds.

a) Find the object's position at t = 10.

b) Find the object's speed at t = 10.

c) Find the object's acceleration at t = 10.

d) Show that the object never stops & turns around.

e) Draw a graph to show that your answers are reasonable.

4. Find the derivative of each function in the chart below using the product rule. What pattern do you notice?

function	derivative	function	derivative
$y = e^x$		$y = (e^x)^2$	
$y = \sin x$		$y = \sin^2 x$	
$y = \ln x$		$y = (\ln x)^2$	
$y = \cos x$		$y = \cos^2 x$	
$y = e^x$		$y = (e^x)^3$	
$y = \sin x$		$y = \sin^3 x$	
$y = \ln x$		$y = (\ln x)^3$	
$y = \cos x$		$y = \cos^3 x$	
$y = e^x$		$y = (e^x)^4$	
$y = \sin x$		$y = \sin^4 x$	
$y = \ln x$		$y = (\ln x)^4$	
$y = \cos x$		$y = \cos^4 x$	

What pattern do you notice?

This rule is called the **chain rule.** Let's use some simplifiable functions to show it works.

5. Find the derivative of each function by **simplifying (i)** and then **using the chain rule (ii)**.

a) $(x + 3)^2$
      i. Simplify and take the derivative   ii. Use the chain rule

b) $(5x)^3$
      i. Simplify and take the derivative   ii. Use the chain rule

c) $(3x^4)^3$
      i. Simplify and take the derivative   ii. Use the chain rule

d) $(2x + 4)^2$
      i. Simplify and take the derivative   ii. Use the chain rule

e) $\dfrac{1}{8x^4}$
      i. Simplify and take the derivative   ii. Use the chain rule

f) $\sqrt{16x^4}$
      i. Simplify and take the derivative   ii. Use the chain rule