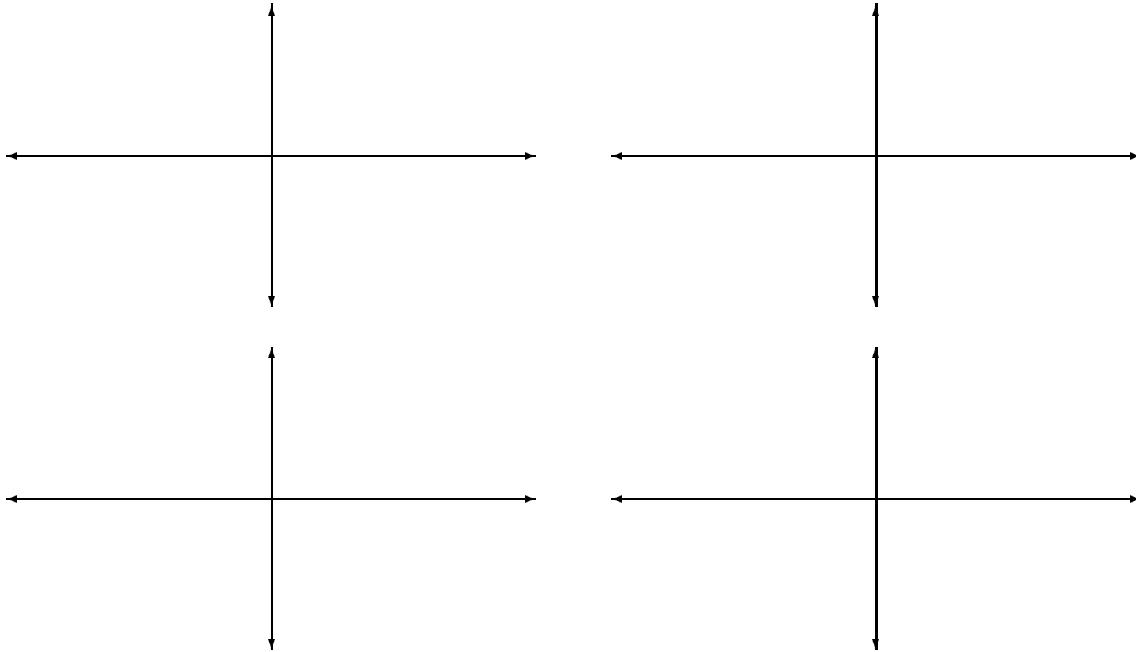


## Derivatives of Elementary Functions

**Derivative of  $\sin(x)$  and  $\cos(x)$ .** Sketch the graphs of  $y = \sin(x)$  and  $y = \cos(x)$  on the top two axes. Then, based on these graphs and class experience sketch the graph of the derivative of each function on the axes directly below its graph.



From the above we can deduce the following rules:

If  $f(x) = \sin(x)$  then  $f'(x) =$ \_\_\_\_\_.

If  $f(x) = \cos(x)$  then  $f'(x) =$ \_\_\_\_\_.

**Examples**

For each of the functions below write down the derivative.

1.  $f(r) = \frac{3}{r}$

2.  $f(x) = \sqrt{x}$

3.  $f(t) = 3 \cos(t)$

4.  $f(s) = 5 \sin(s) - 2 \cos(s)$

5.  $f(x) = x^4 + \frac{1}{x} + 2x + 7$

## Derivative of Exponential Functions.

We will try to develop formulas for the derivative of  $y = e^x$  and  $y = a^x$ ;  $a > 0$ .

If  $f(x) = e^x$  then  $f'(x) =$ \_\_\_\_\_.

### Numerical "Proof"

Let  $h = 0.01$ . Members of specific rows in class will fill in the following chart and guess the answer to the derivative of  $e^x$ .

$x$	$e^x$	diff. quotient = $\frac{e^{x+h} - e^{x-h}}{2h}$
-1		
-0.5		
0		
0.5		
1		

### General Rule

If  $f(x) = a^x$ ;  $a > 0$  then  $f'(x) =$ \_\_\_\_\_.

Let  $h = 0.01$ . Fill in the following chart and guess the answer to the derivative of  $2^x$ .

$x$	$2^x$	diff. quotient = $\frac{2^{x+h} - 2^{x-h}}{2h}$	diff. quotient / $\ln(2)$
-1			
-0.5			
0			
0.5			
1			

### Examples

For each of the functions below write down the derivative.

1.  $f(t) = 5t^2 + 4e^t$

2.  $f(x) = e^2 + x^e + e^x$

3.  $g(x) = \pi^x + x^\pi + 14 \cdot 2^x$

## ANNOUNCEMENTS

No class on Monday, October 12 due to Fall Break.

**Assignment:** HOMEWORK from Class 15: **NOW DUE on Wednesday October 14. CiC page 133–134, DO 2, 5, 6 and 9.**

**Quiz #5** is also due on **Wednesday October 14.**

**Reminder:** Exam 2 is scheduled for Thursday October 30 in lab

**The FINAL EXAM in Math 110 is scheduled for Thursday December 10 6:30-9:30 pm**