

This Unit's Schedule

Thursday: Limits AND Derivatives of
Exponential fⁿ's (8.1 + 8.2)

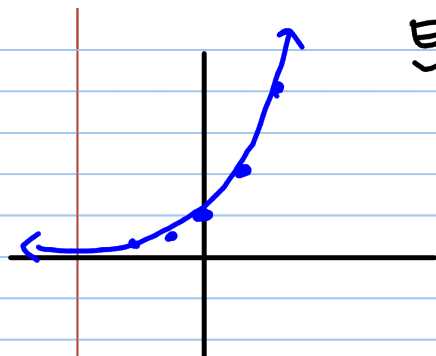
Fri: Limits AND Derivatives of
Logarithmic fⁿ's (8.3 + 8.4)

Mon: Logarithmic Differentiation (8.6)

TUES / WED: REVIEW & WORKSHEETS

Thurs: Chapter 8 TEST

EXPONENTIAL FUNCTIONS



$$f(x) = b^x \quad \text{or} \quad y = b^x$$

$$y = 2^x$$

$$y = \left(\frac{1}{2}\right)^x$$

$$y = (2^{-1})^x$$

$$y = 2^{-x}$$

$$b > 0$$

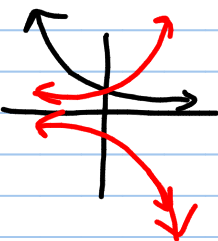
$$b \neq 1$$

x	y
0	1
1	2
2	4
-1	1/2
-2	1/4

$$\lim_{x \rightarrow -\infty} 2^x = 0$$

$$\lim_{x \rightarrow \infty} 2^x = \infty \quad (\text{really means } d_{n.e.})$$

$$\lim_{x \rightarrow -\infty} \left(\frac{1}{2}\right)^x = \infty \quad \lim_{x \rightarrow \infty} \left(\frac{1}{2}\right)^x = 0$$



$$\lim_{x \rightarrow \infty} -2^x = -\infty$$

• If $b > 1$ then $\lim_{x \rightarrow -\infty} b^x = 0$

and $\lim_{x \rightarrow \infty} b^x = \infty$

• If $0 < b < 1$ then $\lim_{x \rightarrow -\infty} b^x = \infty$

and $\lim_{x \rightarrow \infty} b^x = 0$

Ex 1 $y = 3 + 2^x$ What is the limit?
 $y = 2^x + 3$ as $x \rightarrow -\infty$

$$\lim_{x \rightarrow -\infty} (3 + 2^x) = 3$$

Recall:
 $\lim f(x) + g(x)$

$$= \lim_{x \rightarrow -\infty} 3 + \lim_{x \rightarrow -\infty} \underline{2^x} = 3$$

$$= \lim f(x) + \lim g(x)$$

$$\begin{array}{ccc} \downarrow & & \swarrow \\ 3 & + & 0 \\ & & \underline{\underline{3}} \end{array}$$

Ex 2 $\lim_{x \rightarrow \underline{\underline{3^-}}} 2^{\frac{1}{x-3}} \stackrel{?}{=} \underline{\underline{0}}$

x	$f(x)$
1	$1/\sqrt{2}$
2	$1/2$
2.5	$1/4$

$t = \frac{1}{x-3}$ then $2^{\frac{1}{x-3}} = 2^t$

$x \rightarrow 3^-$

what happens to t as $x \rightarrow 3^-$

as $x \rightarrow 3^-$, $t \rightarrow -\infty$

$$\lim_{t \rightarrow -\infty} 2^t = 0$$

Derivatives of Exponential #'s

8.1 & 8.2

$$\frac{d}{dx} e^x = e^x$$

$$\frac{d}{dx} e^{f(x)} = e^{f(x)} \cdot f'(x)$$

~~8.4~~ $\frac{d}{dx} b^x = b^x \ln b$

$$\frac{d}{dx} b^{f(x)} = b^{f(x)} \ln b \cdot f'(x)$$

Ex: $y = x^2 e^x$

$$y' = x^2 \cdot e^x + 2x e^x = x e^x (x + 2)$$

Ex: $y = e^{4x^2}$

$$y' = e^{4x^2} \cdot 8x = 8x e^{4x^2}$$

Ex: $y = e^{-3x \sin x} \cos 2x$

$$y' = e^{-3x \sin x} (+) 2 \sin 2x + \cos 2x \cdot e^{-3x \sin x} (-) (+) 3x \cos x + (+) 3 \sin x$$

$$= e^{-3x \sin x} [2 \sin 2x + \cos 2x (3x \cos x + 3 \sin x)]$$