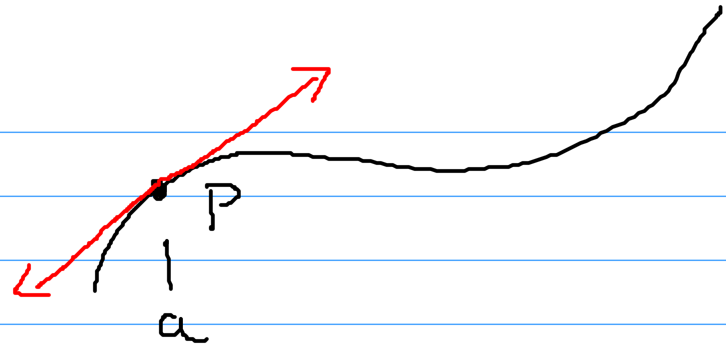
Test 1
Monday 28
6-7 pm
In person
Practice Test
up Thursday
DL students
email me!

Recall:



$f'(a)$ = slope of the tangent line at the point on the curve where $x = a$

$f'(x)$ = function that has all the slopes of all the tangent lines

$f'(x)$ is called the <u>derivative</u> of $f(x)$

1.5 Differentation Techniques: Power Rule

Alternate notation for the derivative

If $y = f(x)$ then

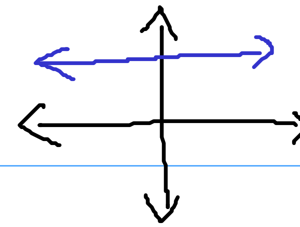
$$y' = f'(x) = \frac{dy}{dx} = \frac{d}{dx} f(x)$$

Aside $\frac{\Delta y}{\Delta x}$

So for $f(x) = x^2 + 5x$

recall $f'(x) = 2x + 5$

Can also write $\frac{dy}{dx} = 2x + 5$



Derivative of a Constant

If $f(x)=c$ c a constant
then $f'(x)=0$

Ex $f(x)=3$ $f'(x)=0$

Ex $y=7$ $y'=0$

Ex $\frac{d}{dx}(9)=0$

Power Rule

If $f(x)=x^n$
then $f'(x)=n\cdot x^{n-1}$

Ex $f(x)=x^2$ $f'(x)=2x^1$ or $2x$

$f(t)=t^6$ $f'(t)=6t^5$

$g(s)=s^{20}$ $g'(s)=20s^{19}$

$f(x)=x^3$ $f'(x)=3x^2$

$y=x^{5/4}$ $y'=\frac{5}{4}x^{1/4}$ $\frac{5}{4}-1=\frac{5}{4}-\frac{4}{4}$

$f(x)=x^{-7}$ $f'(x)=-7x^{-8}$

$f(x)=x$ x^1 $f'(x)=1$ $1x^0$

If needed, convert to x^n form.

When done, convert back to original form using exponent rules.

Ex $f(x) = \frac{1}{x} \rightsquigarrow f(x) = x^{-1}$

$f'(x) = -1x^{-2} \xrightarrow[\text{back}]{\text{convert}} f'(x) = \frac{-1}{x^2}$

Ex $f(x) = \sqrt{x} \rightsquigarrow f(x) = x^{1/2}$

$f'(x) = \frac{1}{2}x^{-1/2}_{\left(\frac{1}{2}-\frac{2}{2}\right)} \xrightarrow[\text{back}]{\text{convert}} f'(x) = \frac{1}{2x^{1/2}} = \frac{1}{2\sqrt{x}}$

Constant Times a Function

If $y = c \cdot f(x)$ c a constant

then $y' = c \cdot f'(x)$

Ex $y = 3 \cdot x^2$

$y' = 3 \cdot 2x = 6x$

Ex $f(x) = 8x^{11}$ $f'(x) = 88x^{10}$

Ex $f(x) = 4x^{3/2}$ $f'(x) = 4 \cdot \frac{3}{2}x^{1/2} = 6x^{1/2}$

Ex $h(x) = \frac{-7}{x^3} = -7x^{-3}$ $h'(x) = 21x^{-4}$

Sum Rule

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

Ex $y = x^5 + x^3$
$y' = 5x^4 + 3x^2$

Ex $y = x^7 - x^4$
$y' = 7x^6 - 4x^3$

Ex $y = 7x^2 + 3$
$y' = 14x + 0$ or $14x$

Ex $y = x^2 + 5x$
$y' = 2x + 5$

To find the slope of the tangent line at $x = a$
1. Find the derivative, $f'(x)$
2. Evaluate at a ; $f'(a)$

Ex Let $f(x) = x^9 - 2x^3 + 6x + 4$
Find $f'(1)$

$$
\begin{aligned}
f'(x) &= 9x^8 - 6x^2 + 6 \\
f'(1) &= 9(1)^8 - 6(1)^2 + 6 \\
&= 9 - 6 + 6 \\
&= 9
\end{aligned}
$$

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

Find the equation of the tangent line at $x=2$.

$$\text{slope} = m = f'(2)$$
$$f'(x) = 2x + 3$$
$$f'(2) = 2(2) + 3$$
$$m = 7$$

point: $x = 2$
$$y = f(2)$$
$$= (2)^2 + 3(2) - 1$$
$$= 9$$
$$(2, 9)$$

$$y - y_1 = m(x - x_1)$$
$$y - 9 = 7(x - 2)$$
$$y = 7x - 5$$

OR

$$y = mx + b$$
$$9 = 7 \cdot 2 + b \rightarrow b = 5$$
$$y = 7x - 5$$

Graph them!