AP Calculus AB – Unit 3 Outline – Basic Derivative Rules

Monday 9/21 – (1,3) **Tuesday 9/22 – (2,4)**	**Today's Topic**: **Average Rates of Change**

In-class examples: **Ex. 1** Find the average rate of change of $f(x) = x^3 - x$ over the interval $[1,3]$.

Ex. 2 The population of Kentucky was 4,042,000 in 2000 and 4,468,000 in 2018. Determine the average rate of change of the population of Kentucky over this 18-year period.

Ex. 3 The table shows the position *r* (in miles) of a vehicle from its starting postion after *t* seconds:

t	5	10	15	20	25	30
r	57	74	85	84	61	43

a) Determine the average rate of change of the vehicle over the time interval $[5,30]$.

b) Estimate the **instantaneous** rate of change of the vehicle right at $t = 17$ seconds.

Ex. 4 A ball dropped at time $t = 0$ travels a distance $s(t) = 4.9t^2$ m in *t* seconds.

a) Compute the average rate of change of the ball over the first 5 seconds of free fall.

b) Estimate the ball's **instantaneous** rate of change at the precise moment of $t = 2$ seconds.

Homework: Worksheet 20

Wednesday 9/23	**Today's Topic**: **The Derivative and Tangent Line Problem;** Derivative as the limit of the difference quotient; Definition of the Derivative = slope of the tangent line to a graph; Finding the slope of a graph or its tangent line at a point; Notations for the derivative.

In-class examples:

Ex. 1 Find the equation of the line that is tangent to the graph of $f(x) = x^2$ at the point $(3,9)$.

Ex. 2 Find the derivative of $f(x) = x^2 - 6x + 11$

Ex. 3 Find $\frac{dy}{dx}$ when $y = 2x + 3$.

Ex. 4 Find the derivative of $y = \sqrt{x}$.

Homework: Worksheet 21 and **Pearson Worksheet 21**

Thursday 9/24	**Today's Topic**: **The Power Rule –** In the next few weeks we will be learning how to find the derivative of a number of different types of functions. Today, we will look at constant functions and functions that involve $a \bullet x^n$. **Remember:** Finding the derivative means that we are finding the slope of a function.

In-class examples: Differentiate each function. Label each function appropriately (i.e. y' = ___ or *f'(x)* = ____)

Ex. 1 a) $f(x) = x^2 - 6x + 11$ b) $y = \frac{2}{t}$ c) $y = \sqrt{x}$

Ex. 2 a) $y = 3x^2 + 2x - 1$ b) $f(x) = 4\sqrt{x} - \frac{1}{x}$ c) $h(t) = -5t^{-3} + \frac{3}{\sqrt[3]{t^4}} - 5t + 4$

d) $s(t) = -16t^2 + 16t + 32$ e) $s(t) = -4.9t^2 + 120t$

Ex. 3 Find the slope of $f(x) = x^3 + 3x - 1$ at $x = 2$.

Homework: Worksheet 22 and **Pearson Worksheet 22**

Friday 9/25	**Today's Topic**: We will be using the **Power Rule** in order to find equations of tangent lines. We will also be determining the points at which a graph has a horizontal tangent line..

In-class examples: Ex. 1 Find an equation for the line tangent to the curve $f(x) = x^3 + 2x^2 - 4x + 1$ at the point $(1, 0)$

Ex. 2 Find the equations of the tangent and normal lines to the graph of $f(x) = x^3 - 3x + 2$ when $x = 2$.

Ex. 3 For what value(s) of *x* does $y = x^4 - 4x^2 + 1$ have a horizontal tangent line?

Homework: Worksheet 23 and **Pearson Worksheet 23**

Monday 9/28	**Today's Topic**: **The Package Rule -** We will be using this rule to find the derivate of composite functions in the form of $f(x) = a \cdot \boxed{stuff}^n$, where the $\boxed{stuff}$ is some function other than *x*.

In-class examples: Find the derivative of each of the following:

Ex. 1 $f(x) = (3x^2 - 4x + 1)^3$ **Ex. 2** $y = \left(\frac{1}{2}x^2 - x^{\frac{1}{2}}\right)^3$ **Ex. 3** $f(x) = \sqrt[3]{(x^2 - 1)^5}$ **Ex. 4** $f(x) = \sin^3 x$

Ex. 5 Find the equation of the normal line to $f(x) = \sqrt{x - 1}$ when $x = 5$.

Homework: Worksheet 24 and **Pearson Worksheet 24 (Do Not Simplify)**

Tuesday 9/29	**Today's Topic**: **Product and Quotient Rules** "Boxes and Triangles" **-** To find the derivative of a function using the **Product and Quotient Rules**.

In-class examples:

Ex. 1 Find $\frac{dy}{dx}$ if $y=(2x+1)(x^2-2)$ **Ex. 2** Find $f'(x)$ if $f(x)=\frac{x^2-1}{x^2+3x+2}$

Ex. 3 Find $f'(x)$ for $f(x)=x^2(x-2)^4$.

Homework: Worksheet 25 and **Pearson Worksheet 25 (Do Not Simplify)**

Wednesday 9/30	**Today's Topic**: **Quiz** - Avg ROC, Derivative (Limit Definition), Power Rule, Equation of Tangent Line **Derivative Using a Calculator**

In-class Example: For $f(x)=x^3-3x+7$, evaluate $f'\left(\frac{2}{3}\right)$ using a calculator.

Homework: Worksheet 26 and **Pearson Quiz – Basic Derivatives**

Thursday 10/1	**Today's Topic**: **Derivatives Using Tables/ Derivatives on the Calculator**

In-class examples: Ex. 1 Let $f(x)$ and $g(x)$ be differentiable functions with the values for $f(x)$, $g(x)$, $f'(x)$, and $g'(x)$ as shown in the table below.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	6	4	2	5
2	9	-2	3	1
3	10	-4	4	7
4	-1	-3	6	8

Determine each of the following values:

a) $h(x)=f(x)+g(x)$. Find $h'(1)$.

b) $p(x)=f(x)\cdot g(x)$. Find $p'(1)$.

c) $q(x)=\frac{f(x)}{g(x)}$. Find $q'(3)$.

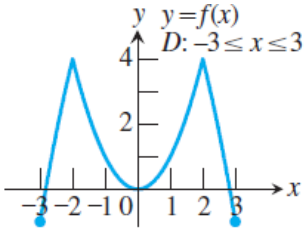
d) $r(x)=\left[f(x)\right]^4$. Find $r'(1)$.

e) $c(x)=f(g(x))$. Find $c'(3)$.

Homework: Worksheet 27 and **Pearson Worksheet 27**

Friday 10/2	**Today's Topic**: **Differentiability:** The term "differentiable" means that a function's derivative can be found. Some functions will not be differentiable at certain values of *x*.

In-class examples: **Ex. 1** The graph of $f(x)$ is given below. State the values at which $f(x)$ is (a) continuous and (b) differentiable.



Ex. 2 State the values for which $f(x) = 2x^2 - 4x$ is differentiable.

Ex. 3 State the values for which $f(x) = |x|$ is differentiable.

Ex. 4 For the function, $f(x) = x^{2/3}$, determine if $f(x)$ is differentiable at $x = 0$.

Ex. 5 Determine if $f(x) = \begin{cases} x^2, & x < 1 \\ -2x + 3, & x \geq 1 \end{cases}$ is differentiable at $x = 1$.

Homework: Worksheet 28 and **Pearson Worksheet 28**

Monday 10/5	**Today's Topic**: Review for our test.

In-class examples: None

Homework: Worksheet 29

Tuesday 10/6	**Today's Topic**: Unit 2 Exam – Basic Differentiation Rules

In-class examples: None

Homework: Exam. Due 10/7 – 9:00 am