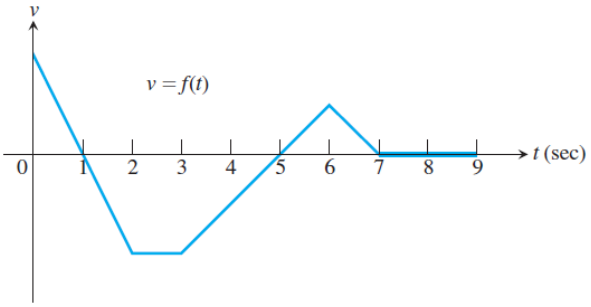
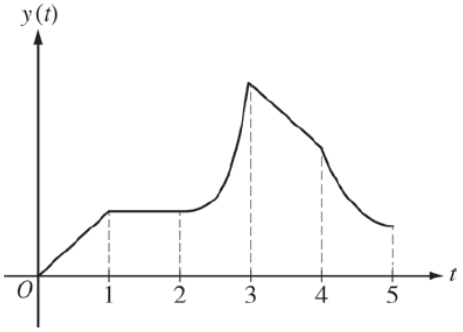
AP CALCULUS BC
Unit 4 Outline – Contextual Applications of the Derivative

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
9/18	**LINEAR APPROXIMATIONS** **LINEARIZATION** **TANGENT LINE APPROXIMATION**	**Ex. 1** Find the linearization of $f(x)=\sqrt{1+x}$ at $x=0$, and use it to approximate $\sqrt{1.02}$ without a calculator. Then use a calculator to determine the accuracy of the approximation. **Ex. 2** Find the linearization of $f(x)=\cos x$ at $x=\frac{\pi}{2}$, and use it to approximate $\cos 1.75$ without a calculator. Then use a calculator to determine the accuracy of the approximation.
AP MULTIPLE CHOICE For the function f, $f'(x)=2x+1$ and $f(1)=4$. What is the approximation for $f(1.2)$ found by using the line tangent to the graph of f at $x=1$? (A) 0.6 (B) 3.4 (C) 4.2 (D) 4.6 (E) 4.64		
HOMEWORK		Worksheet 22

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
9/19	**RATES OF CHANGE**	**Notes Handout**
HOMEWORK		Worksheet 23

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
9/20	STRAIGHT-LINE MOTION	**Ex. 1** A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t) = (t-2)^2(t-4)$ where s is measured in meters and t is measured in seconds. (a) Find the instantaneous velocity at any time t. (b) Find the acceleration of the particle at any time t. (c) When is the particle at rest? (d) At what value of t does the particle change direction? **Ex. 2** The accompanying figure shows the velocity $v = f(t)$ of a particle moving on a coordinate line.  (a) When does the particle move forward? Move backward? Speed up? Slow down? (b) When is the particle's acceleration positive? Negative? Zero? (c) When does the particle move at its greatest speed? (d) When does the particle stand still for more than an instant?

AP MULTIPLE CHOICE



A particle moves along the y-axis. The graph of the particle's position $y(t)$ at time t is shown above for $0 \leq t \leq 5$. For what values of t is the velocity of the particle negative and the acceleration positive?

(A) $0 < t < 1$ (B) $1 < t < 2$ (C) $2 < t < 3$ (D) $3 < t < 4$ (E) $4 < t < 5$

A particle moves along a line so that its velocity is given by $v(t) = -t^3 + 2t^2 + 2^{-t}$ for $t \geq 0$. For what values of t is the speed of the particle increasing?

(A) $(0, 0.177)$ and $(1.256, \infty)$

(B) $(0, 1.256)$ only

(C) $(0, 2.057)$ only

(D) $(0.177, 1.256)$ only

(E) $(0.177, 1.256)$ and $(2.057, \infty)$

HOMEWORK	Worksheet 24

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
9/23, 24, 25	**RELATED RATES**	**Notes Handout**

AP MULTIPLE CHOICE

The radius of a circle is increasing. At a certain instant, the rate of increase in the area of the circle is numerically equal to twice the rate of increase in its circumference. What is the radius of the circle at that instant?

(A) $\frac{1}{2}$ (B) 1 (C) $\sqrt{2}$ (D) 2 (E) 4

The volume of a certain cone for which the sum of its radius, r, and height is constant is given by $V = \frac{1}{3}\pi r^2(10 - r)$. The rate of change of the radius of the cone with respect to time is 6. In terms of r, what is the rate of change of the volume of the cone with respect to time?

(A) $-24\pi r$ (B) $6\pi r$ (C) $\frac{20}{3}\pi r - \pi r^2$ (D) $16\pi r - \frac{4}{3}\pi r^2$ (E) $40\pi r - 6\pi r^2$

The fuel consumption of a car, in miles per gallon (mpg), is modeled by $F(s) = 6e^{\left(\frac{s}{20} - \frac{s^2}{2400}\right)}$, where s is the speed of the car, in miles per hour. If the car is traveling at 50 miles per hour and its speed is changing at the rate of 20 miles/hour^2, what is the rate at which its fuel consumption is changing?

(A) 0.215 mpg per hour

(B) 4.299 mpg per hour

(C) 19.793 mpg per hour

(D) 25.793 mpg per hour

(E) 515.855 mpg per hour

A sphere is expanding in such a way that the area of any circular cross section through the sphere's center is increasing at a constant rate of $2\,\text{cm}^2/\text{sec}$. At the instant when the radius of the sphere is 4 centimeters, what is the rate of change of the sphere's volume? (The volume V of a sphere with radius r is given by $V = \frac{4}{3}\pi r^3$.)

(A) $8\,\text{cm}^3/\text{sec}$

(B) $16\,\text{cm}^3/\text{sec}$

(C) $8\pi\,\text{cm}^3/\text{sec}$

(D) $64\pi\,\text{cm}^3/\text{sec}$

(E) $128\pi\,\text{cm}^3/\text{sec}$

HOMEWORK	Worksheets 25 - 27

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
9/30	**L'HOPITAL'S RULE**	

AP MULTIPLE CHOICE

$\lim_{x\to 0}\dfrac{e^x-1}{x}$ is

(A) ∞ (B) $e-1$ (C) 1 (D) 0 (E) e^x

$\lim_{x\to 0}\dfrac{x^2}{1-\cos x}$ is

(A) -2 (B) 0 (C) 1 (D) 2 (E) nonexistent

$\lim_{x\to 1}\dfrac{x^2-1}{\sin(\pi x)}$ is

(A) -2 (B) $-\dfrac{2}{\pi}$ (C) 0 (D) $\dfrac{2}{\pi}$ (E) nonexistent

HOMEWORK	Worksheet 28

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/1	**REVIEW**	**None**
HOMEWORK		Worksheet 29

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/2	**UNIT 4 FRQ**	Rates of Change, Particle Motion
HOMEWORK		Worksheet 30

DATE	CONCEPT	IN-CLASS SAMPLE PROBLEMS
10/3	**UNIT 4 EXAM**	Rates of Change, Particle Motion
HOMEWORK		None